

## MINING

Mining refers to the process of exploitation of minerals from the earth's crust. The mining industry involves all activities related to the extraction, processing and trade in minerals. In the industrial sector, minerals are used as raw materials, as a source of power and contribute to the generation of capital when exported.

Minerals are classified into two categories: the metallic and the non-metallic minerals. The **metallic minerals** are the most important and valuable because they are hard and have a wide range of uses. These include iron ore, tin, copper, aluminium, chromium, gold, silver, platinum, uranium, manganese, cobalt etc. The **non-metallic minerals** are relatively soft and weaker such as salt, potash, nitrates, sulphur, asbestos, certain precious stones e.g. diamonds. Minerals fuels are non-metallic minerals (*derived from vegetation remains*). These include coal, oil and natural gas.

### Methods of mining

The methods used to remove mineral ores from the ground depend on the nature of mineral, the depth at which it occurs and its marketing value. The most common methods include:

- **Open cast mining**

This method is used when the mineral ore is near the surface. The top soil (over burden) is removed and the mineral ore is blasted using explosives. The ore is then crushed to reduce the size. It is then loaded into trucks and taken to the processing plants.

- **Shaft/ Adit/ underground mining**

This is used when the mineral ores lie deep below the surface (the over burden is too thick to be removed by mechanical shovels). Vertical shafts are dug into the ground to appropriate levels. From these, horizontal tunnels leading to the ore body are constructed. Supporters are provided from the roof to the floor of the tunnels. The ore is then blasted using explosives causing shattering. The ores are crushed and loaded on small wagons and taken to the vertical shaft, and lifted to the surface, and taken to processing plants.

- **Placer or Alluvial mining.**

This is used when minerals occur in alluvial deposits. In this method a steel dredge or a gravel pump is used to dig up the alluvial deposits (waterlogged alluvium). The alluvium is mixed with a great deal of water. The mixture is rotated and in the process the lighter particles (sand, mud, dust) are washed off, leaving the heavier ores (diamonds settled down).

- **Drilling methods such as for petroleum/oil.**

***Process of oil drilling***

The basic equipment for oil drilling is a derrick—which is a steel tower about 40m high. Exploration /prospecting/survey of the oil is done and installing of the derricks/oil rigs follows. The derrick carries a drill stem on which steel drilling pipes are screwed /attached, having a drilling bit. The drilling bit is used to drill into/cut through the rock strata/layers to reach the oil well below. Lubricating mud is pumped into drilling pipe to lubricate the bit and to bring up rock samples. Once the bit reaches the oil stratum/layer, crude oil rushes out by natural pressure or pumped out to the

surface using oil pumps if natural pressure is weak. The oil is then transported through pipes, fuel tankers, trucks to the refinery.

### **Factors limiting exploitation and use of tropical minerals**

- 1) ***The small size of some mineral deposits*** that is, very small quantities not economically viable to exploit. A small deposit which can run out in a few years is uneconomical to exploit/ to install expensive machinery such as iron ore in Zimbabwe, Kenya, CAR; and Gold in Uganda, Kenya, Zimbabwe and Liberia. This discourages many investors in the mining industry.
- 2) ***The low grade of some minerals/*** low value for example copper which loses almost over half of the ores to become viable for productive value; yet it is deeply underlain/ occurs in deep layers such as in Zambia, and DRC (Shaba province). Because a large percentage of the mineral ore becomes waste material, copper mining attracts less investment. In Tanzania the quality of diamonds vary and some are of low grade, hence more uneconomical to mine.
- 3) ***The great depth of the mineral ores.*** Most minerals exist at great depth underground and hence very expensive to exploit. They are subjected to a thick overlying burden (over burden) such as coal, diamonds, iron ore and copper. This increases the cost of exploitation since it requires sophisticated technology such as the shaft/underground mining method and involves a lot of risks.
- 4) ***There are many risks involved in the mining sector.*** The mining conditions are not appealing partly attributed to the deep overlying burden which can bury the miners/exploiters, high pollution levels involved (noise and air) which causes deadly diseases. All these scare away workers and investors from tropical mining.
- 5) ***Most tropical countries export their minerals as crude ores*** and this earns them less than if they had processed ores. As a result the high costs of production are not compensated by high value in terms of exported ores, which weakens and undermines tropical mining especially in tropical Africa. For example copper in democratic republic of Congo (DRC).
- 6) ***Remoteness of some mineral deposits, referring to the distance from the coast.*** The deposits occur in remote areas such as iron ore and coal in southern Tanzania, copper inland locked Zambia. Therefore the long distance travelled and the absence of viable transport infrastructure has limited mineral production and trade in tropical countries despite having enormous mineral potential. Also the dense tropical rain forests such as in Congo basin make the development of transport systems more difficult.
- 7) ***Low level of technology*** used in extracting the mineral resources especially the underground minerals. This is the case with Africa and Latin America. More the small operations make mineral exploitation using modern technology unprofitable and very expensive. Yet even most countries cannot afford purchasing the modern equipment.
- 8) ***Inadequate capital to invest in the mining sector.*** Capital is inadequate for economic exploitation of minerals such as bauxite which needs large amounts of electricity for the final production of aluminium itself (such as in Ghana, Guinea and Sierra Leone). Also the delayed exploitation of oil in Lake Albert in Uganda has been mainly due to inadequate capital. The purchase of mining equipment, building smelting/processing plants and associated infrastructure are all expensive.

- 9) **Limited skilled labour to work in the mining sector.** Tropical countries do not have many competent engineers, geologists, and other scientists to develop and manage mineral exploitation economically. This is also attributed to the poorly developed training in mineral exploitation and the general education system in tropical countries. This also explains why these countries continue relying on foreign expatriate personnel.
- 10) **Price fluctuations on the world market.** The prices of some tropical minerals have fluctuated more in the recent past, leading to uncertain incomes. For example the prices of copper declined more in the 1980s such that even earnings from it reduced tremendously such as for Zambia, and former Zaire causing unfavourable terms of trade, hence limiting further investment in mining.
- 11) **Limited market for tropical minerals.** Many other countries that would import tropical minerals have large deposits of their own minerals/Reserves with better mining cost reducing technology for example copper greatly exists in USA, USSR, Canada; yet coal occurs in USSR, USA, china, Germany; which further reduces the market for tropical minerals. Still some tropical minerals have low market value such as lead and zinc.
- 12) **Political instability in many tropical countries** which also limits the success of mining. Countries like DRC, Liberia, Sierra Leone, CAR, Angola, Venezuela, Zambia, Gabon, Nigeria, Venezuela etc have for a long time been locked up in wars and civil strifes which negatively affects the mining activities. The mineral wealth in Angola (e.g. diamonds and uranium, iron ore, copper and manganese) has not brought maximum benefit to the country because rebels have been selling the minerals cheaply to American and European companies in order to get many to buy arms.
- 13) **Unfavourable government policy towards the mining sector.** In many countries government efforts are directed to many other sectors and providing social services but limited investment done in the mining sector, after all some countries have less economic potential currently in terms of minerals or their known reserves. Some governments also discourage foreign investors through high taxes and failure to maintain transport and other infrastructure.
- 14) **Power and energy problems in many tropical countries.** The exploitation and processing of some minerals requires colossal/large amounts of electricity. However many potential power generation plants have not been established and the existing ones have low voltage; which further undermines the performance of the mining sector in tropical countries.
- 15) **Low level of research in the mining sector.** There is inadequate mineral exploration to discover new mineral potentials, partly attributed to inadequate funding and limited expert manpower. Therefore many minerals are not known to exist and thus low level of mineral development.
- 16) **Exhaustion of some mineral deposits** due to high rate of exploitation, and thus many mineral deposits are exhausted or threatening exhaustion. For example some of the Zambian copper deposits are already exhausted. The copper deposits in Kilembe in Uganda are also exhausted. This also discourages many investors in the mining sector.

## **MINING IN SOUTH AFRICA**

South Africa is gifted /blessed with plenty of mineral resources and the country has the most developed mining sector in Africa.

## Gold mining

South Africa has the world's largest known reserves of gold. Gold mining takes place on the Rand (Witwatersrand) covering parts of the Orange Free State and Transvaal. The main gold fields of the Rand include Johannesburg, Springs, Krugersdorp, Klerksdorp, Vierfontein, and Odendalsrus.

## Diamond mining

South Africa is also a major producer of diamonds. In South Africa diamond has the greatest deposits in **Kimberley** and **Hope town** in the Rand. Other mines include the Premier mine near Pretoria, Bultfontein, Jagersfontein, Koffiefontein, Rustenburg and Bloemfontein.

Most industries connected with diamonds are found in Johannesburg—with most of the diamond cutting factories plus diamond research centre.

**Note:** *Diamonds are formed beneath the ground by great heat of volcanic activity and occur in rocks called **kimberlite**.*

## Coal mining

South Africa has large reserves of coal and produces about 6% of the world's output. *Coal is also used to generate electricity alongside other sources of power*. Southern Transvaal is the leading coal producing state in South Africa. Huge deposits occur at Witbank, Vereeniging and Middleburg.

## Iron ore mining

The most important African iron ore producer is South Africa and the country has its own iron and steel industry. In South Africa, large deposits occur in Pretoria, Middleburg, Waterburg and northwestern Cape.

Other important minerals in South Africa include platinum (world's leading producer), tin, manganese, chromium, asbestos, copper, nickel, zinc, and limestone.

## Factors which have favoured the development of the mining industry in South Africa

- 1) **Presence of a wide range of minerals and large deposits**, which encourages investment in the mining sector due to being economically viable. The country has the largest known reserves of gold concentrated in the Witwatersrand. It has large reserves of coal such as in Middleburg and Vereeniging; and it is a major producer of diamonds such as in Kimberley. These large deposits have attracted government funding and various local and foreign mining companies.
- 2) **High quality/value of the minerals** produced such as gold and diamonds. Gold commands high demand since it is a very precious metal used as international currency and used for decoration. Diamonds are used in industry for cutting and polishing, and making jewellery. The high grade of most of South Africa's deposits attracts many companies /encourages mining investment.
- 3) **Presence of labour both skilled and unskilled employed in the mining sector**. Cheap labour to work in the mines is provided by the black local people and migrants from neighboring countries like

Lesotho, Namibia, Botswana, Mozambique and Malawi. South Africa pays better wages than other countries. The foreign companies brought in many skilled workers and trained local people to acquire the necessary skills such as geologists who carry out mineral exploration, mining engineers, and supervisors.

- 4) **Presence of adequate capital to invest in the mining sector** provided by the government, foreign and local companies. These are investing in the exploration/ survey, exploitation and processing of minerals such as coal, gold, diamonds and platinum. For example the Anglo-American corporation is engaged in gold mining. This promotes the growth of the mining sector.
- 5) **Availability of large quantities of power/energy supply** such as coal used for smelting and refining gold, platinum, and chromium. There is also hydro electricity generated at Vaal dam and Handrick Verwoed dam on River Orange. Uranium near Johannesburg generates nuclear power. This in turn attracts various mining companies.
- 6) **High level of technology used** partly due to foreign companies. This involves the use of earthmovers, caterpillars, bulldozers, and cranes. Most mines began as open cast mines but of today underground mining is also used by deep-level miners. There is also alluvial /placer mining such as for alluvial diamond deposits. Modern mineral processing technology is used and all this turn increases quality and quantity of mineral production.
- 7) **Presence of a large market both internally and internationally.** Gold as an international currency has a ready market especially in industrialized countries in Europe, Asia and North America. South Africa also exports mineral and mineral products to African countries. Besides the Rand is the major industrial region of South Africa and yet the minerals are concentrated there, hence offering immediate market. This promotes more investment in the mining sector.
- 8) **South Africa has the most developed transport system in Africa** and directly comparable with those in North America and Europe. This includes road and railway network such as the Cape—St. Lucia via Johannesburg and the Pretoria rand –Kimberley Railway lines. These facilitate the movement of mineral ores to processing centres, and minerals and mineral products to the export ports like Cape Town and Durban. This increases mining investment.
- 9) **Large water supply, from both underground and surface sources** such as Vaal and orange rivers; necessary for refining some minerals such as diamonds. The water is also used for domestic use in the labour camps. This also encourages further investment in the mining industry.
- 10) **The development of the industrial sector** such as in Witwatersrand using the minerals as raw materials. For example the iron and steel industries using iron ore as a raw material in Pretoria, Witbank and Vereeniging. Other industries are engineering and electronics. This enhances mineral exploitation and processing due to the available immediate market in the various industries.
- 11) **Favourable/supportive government policy towards the mining sector.** Due to apartheid in the past, South Africa was isolated by economic sanctions and this gave the country a chance to develop most sectors of the economy to promote self-reliance including the mining sector. The government has set up the necessary transport infrastructure, creation of markets and economic liberalization, which has allowed many private companies into the mining industry (*since the end of apartheid*).
- 12) **Increased research and discovery of more valuable mineral deposits in South Africa.** Research is undertaken by geologists, engineers in areas of mineral exploration, exploitation and processing. This also in turn promotes the quality and quantity of mineral production.

- 13) **Political stability of South Africa.** Since the end of apartheid the country has remained stable which has encouraged many local and foreign investors in mineral exploration, extraction and processing as well as encouraging trade in minerals and mineral products since security of investment is assured.

### **Contribution of mining to the economy of South Africa**

1. **Generation of foreign exchange** because South Africa is the world's leading producer of gold, the world's largest exporter of platinum, a major exporter of coal, diamond. All these minerals and mineral products are exported to Europe (UK, Germany, Belgium); North America, South America, Asia, and the rest of Africa. The foreign currency generated helps to import foreign goods not produced locally, and foreign technology.
2. **Promotion of industrial development** such as gold refining and diamond cutting industries in the Rand region. The large deposits of iron ore are responsible for iron and steel industries in Pretoria, Johannesburg, Witbank, and Vereeniging. These industries have led to development of secondary industries (such as electronics, machinery, jewelry) and provide jobs to many people.
3. **Generation of many employment opportunities** to many people at various stages such as mineral extraction, processing, refining, transportation, and exportation. Many people are employed by the gold mining, diamond mining, and coal mining companies. This improves the standards of living of the people such as through building better houses, accessing better education and health services.
4. **Source of power/ energy supply** such as the mining of coal in the Rand has supplied power for domestic and industrial use. Remember that South Africa is the leading producer of coal producer in Africa. This helps to supplement other sources of power like HEP and thermal power, hence contributing to the general development of the country.
5. **Promotion of urbanization/ development of urban centres** especially in the Rand such as Johannesburg, Pretoria, Germiston, springs, Witbank, and Kimberley. As population increases in these urban centres, a number of facilities come up such as banking, insurance, education, hospitals, recreation, entertainment, and research facilities.
6. **The mining sector facilitates capital accumulation** such as gold mining which boosts the GNP of South Africa. Also the strong linkage between mining and industry has increased the export earnings—hence raising valuable capital to invest in various sectors of the economy like industry, sugarcane growing and tourism.
7. **Generation of government revenue** from the taxation of gold, platinum, uranium, iron ore and coal mining companies. The government also taxes the incomes of workers employed in the mining sector and the related industry. The revenue realized is invested in various sectors like fisheries, manufacturing industry, and vine growing.
8. **Promotion of international relationship/cooperation between South Africa and other countries** such as the countries where the mining companies originate, countries importing the minerals and associated industrial products—and they include: UK, USA, Canada, Japan, other Asian countries, South America, and the Rest of Africa. This has increased trade and economic contacts with those countries—hence more capital inflow.

9. **Promoted development of transport infrastructure** for example today South Africa has the most advanced road and railway network in Africa comparable to that of Europe and North America. These routes were initially established to connect mining, processing centres and the export ports such as Cape town-Johannesburg—St.Lucia railway and Pretoria—Kimberley railway. These networks have not only supported the mining sector, but also other activities such as industry, farming, service sector.
10. **Diversification of the economy** due to the development of the mining sector and related industry which supplements on the number of economic activities. It has therefore reduced over dependence on few sectors like agriculture; thereby expanding the economic base and national income.
11. **Facilitation of technological development** and research in the country through the use of modern mining methods—like underground mining, and standardizing of the industrial processing technology to improve the quality of products like chemicals, electronics, jewelry, and diamonds.
12. **Promoted development of other sectors** like agriculture, trade and commerce, tourism—given the linkage with such sectors. For example, the mining sector provides market for the agricultural sector through buying food for the mining workers. This in turn increases the national income.

### **Negative effects/ short comings**

1. **Disfiguring of the landscape/ destruction of the landscape.** The abandoned mines, ditches/ quarries and heaps of soil have created an ugly landscape and large areas of wasteland such as soil heaps from the gold mine near Johannesburg.
2. **Mining leads to pollution of the environment, that is, air, water and noise pollution.** For example coal mining destroys underground water and lakes. In addition, the dust from the various mines pollutes the air hence causing deadly diseases.
3. **Mining accidents** are associated within the sector for example the sinking of soils, patches of soil covering miners, collapsing roofs—leading to loss of life.
4. **Neglect of the agricultural sector** due to the movement of able-bodied people from the rural areas to get better paying jobs in the mining sector. This undermines food production.
5. **Displacement of people** from areas where mineral deposits occur (*especially due to large open cast mining*). Many people lose their areas with less or no compensation.
6. **Emergence of ghost towns** where minerals have been exhausted and this has forced people to move to other areas. Modern planned settlements at high cost have been abandoned such as in Johannesburg.
7. **Urban-related problems** in the mining towns such as slum growth, high crime rate, and poor structures. It is very costly for government to eradicate such problems.
8. **Discovery of minerals increased foreign influence.** Earlier the British and the Boers after discovering minerals displaced the blacks from their land. Today there are more whites in South Africa engaged in the exploitation and trade in minerals.
9. **Profit repatriation by the foreign—owned companies** such as those involved in gold and coal mining. This reduces the rate of re-investment in the economy.

10. **Leads to regional imbalance in development** since the mining zones have experienced more progress in terms of infrastructure than other areas. This in turn has led to rural—urban migration, hence creating more problems in the urban areas.

### **Problems facing the mining sector in South Africa**

1. Shortage of labour to work in the mines and related industries, and this undermines production.
2. Shortage of water needed in processing of minerals especially in the Rand.
3. Price fluctuations of minerals on the world market leading to uncertain incomes.
4. Competition with other mineral producing countries like Ghana, DRC producing gold.
5. Long routes to the coast which increases the transport costs.
6. Labour unrest which often leads to strikes and hence affecting production. This is due to poor working conditions and racial segregation.
7. Accidents occur during mining leading to loss of life such as due to falling rocks.
8. Suffocation due to lack of fresh air and flooding of the mines.
9. High costs of mining due to increasing depth of the mines.
10. Exhaustion of some high grade mineral deposits due to over exploitation.

### **MINING IN NIGERIA**

Nigeria is the largest producer of oil south of the Sahara. Large deposits of petroleum /oil occur under sedimentary rocks of the Niger delta and the neighbouring coastal plains/ off shore in the ocean.

Commercial oil production started in 1956. The first commercial oil well was at Oloibiri west of Port Harcourt and soon after others around Port Harcourt started production. Other oil reserves are found at Ughelli in Bendel state. Refineries exist at Port Harcourt, Warri, and Kaduna.

In Nigeria many companies both domestic and foreign are engaged in the oil industry such as shell—BP, Gulf, Mobil, Texaco, Elf, Nigerian national oil corporation. Most foreign companies originate from Britain, USA, France, Italy, Japan, and Germany.

Apart from oil/ petroleum, Nigeria produces natural gas, a cheap clean industrial fuel (*exploited together with oil*). Other important minerals in Nigeria include Iron ore at Enugu and Itakpe near Lakoja, Coal mined at Lafia and Enugu supplying power, Tin in Bauchi on Jos plateau.

### ***A sketch map showing the distribution of minerals in Nigeria***

### **Factors which have favoured the development of the mining sector in Nigeria**

- 1) ***Presence of large reserves of minerals in the country*** for example large reserves of oil at Oloibiri, Port Harcourt and offshore deposits. Nigeria has got the largest oil reserves south of Sahara, making it economical to exploit the oil and this has encouraged many oil companies to invest in the oil industry.



- 2) **Presence of adequate capital to invest in the mining sector** provided by local and foreign companies such as shell BP, Texaco, Gulf, which were attracted by the large oil reserves in the country. Capital is also raised by the Nigerian national oil corporation. This has enabled the installation of oil derricks to drill the oil and building of oil refineries such as at Port Harcourt; hence expansion of the mining sector.
- 3) **Presence of skilled manpower to work in the mining sector.** Nigeria is one of the African countries with high functional literacy levels and has trained many people as engineers, technicians, geologists, and managers. Workers are trained on the job to acquire the skills in oil drilling and processing. The skilled workers are also brought in by the foreign companies from their home countries. This increases the quality and quantity of oil production.
- 4) **High level/improved technology employed in mining.** Since 1956 mining and processing has been progressing with advancing technology such as the drilling pipe technology attributed to the mining companies. Previously natural gas was simply lost but today it is extracted as oil is being refined. One method to increase production has been the construction and operation of offshore drilling rigs.
- 5) **Presence of a large market, both domestic and foreign.** Nigeria has a big population over 130 million providing a big home market for oil and oil products. Nigeria mainly exports oil to USA, United Kingdom, Italy, France, and the rest of Africa to be used in a number of ways such as making chemical products and in the transport sector. Given the high grade of oil, the country supplies about half of its oil to USA and most of the other half to Europe. This has encouraged investment in Nigerian oil mining.
- 6) **Efficient transport system** since Nigeria is not landlocked and is lucky to have oil reserves at the coast which minimizes the transport costs to export markets. There is also an extensive system of pipelines laid down to transport oil from the fields to oil collecting terminals such as the pipeline from Oloibiri to port Harcourt, pipelines to Escravos terminal, Forcados terminal, Brass terminal, and Bonny terminal. Port Harcourt handles most of Nigeria's oil exports while other facilities for export are at Bonny and Burutu.
- 7) **Large quantities of power** in form of hydro-electric power at Kainji dam on Niger River, oil and natural gas to support the mining industry such as oil drilling and refining. This promotes efficiency and hence large-scale oil mining.
- 8) **The setting up of various processing industries** such as the completion of the Port Harcourt refinery owned jointly by the Nigerian government and shell BP made it possible to process total output in part. Other oil refineries are at Warri, and Kaduna; to increase the quality of output, instead of exporting crude oil. In turn, this has increased the export earnings from oil mining.
- 9) **Positive/ supportive government policy towards the mining sector** such as the liberal policy since it has allowed many companies to invest in the mining sector. The government has encouraged many companies by granting them tax holidays and protecting them against competition. This in turn expands the mining sector.
- 10) **Nigeria is also strategically located reasonably close to the markets** in Western Europe, USA and South America. This enables easy access to the markets. Nigeria became a member of OPEC (Organization of petroleum exporting countries) in the late 1970s. Easy marketing encourages further investment in the mining sector.

- 11) Relative political stability.
- 12) Increased /intensive research in the mining sector.

## MINING IN GERMANY

Germany is a country greatly endowed with mineral resources and has the second largest coal reserves in Western Europe after UK and its rapid industrial development was greatly based on the exploitation of coal. Today however other forms of energy are taking over from coal.

The most important /largest coalfield is the Ruhr coalfield which accounts for  $\frac{3}{4}$  of Germany's output and about 90% of its reserves. The coalfield is divided into two; the exposed coalfields to the south in the Ruhr valley and the concealed coalfields in the north in areas of the Lippe valley and Emscher valley.

The exposed coalfields have the coal bearing rocks on the surface while the concealed coalfields have them buried underground. Open cast methods are used for exposed coal while Shaft or underground methods are used for concealed coal.

**Note:** The exposed coalfields are getting exhausted and work now is deep in the concealed coal fields which are difficult and expensive.

Other coalfields in Germany include Aachen coalfields (not very important today); and the Saar coalfields near the Germany—French border with good coking coal and easy to mine. There are also lignite coal deposits at Cologne and in Bavaria which are mined to provide fuel for thermal electricity generation.

There are **other important minerals** in Germany such as potash, salt, iron ore, phosphates, copper, lead and zinc. [*The presence of certain minerals in large quantities such as potash and salt led to the development of chemical industry, including fertilizers and pharmaceuticals*].

### Factors which favoured the development of coal mining in Germany

1. **Availability of large mineral deposits/ reserves** for example the country has the second largest reserves in Western Europe after UK which meant that mining was cost effective. The largest coalfield is the Ruhr region which accounts for about  $\frac{3}{4}$  of Germany's output. Other deposits are the Aachen and Saar coalfields. This has attracted large-scale investment in the coal mining industry.
2. **Presence of different types of coal** for example Anthracite coal containing a high percentage of carbon and burning with great heat—making it an important source of energy. Gas coal for domestic and industrial purposes. Coking coal especially valuable for the iron and steel industries and chemical industries. Mining was therefore necessary since the coal acted as a raw material and energy for industrial development.
3. **Some coal deposits are near the surface and thus easy to mine.** At the beginning mining was concentrated in the exposed coal fields of the south and these could be mined by open cast method

especially in the Ruhr valley. Still most of the deposits were in close proximity to one another, allowing convenient use of coal as fuel first to process the iron into steel and manufacture products from steel.

4. **Presence of other forms of energy** such as petroleum, natural gas and hydroelectric power has also supported mineral exploitation and processing. In the recent years, nuclear energy and hard coal which burn more cleanly than brown coal are gaining importance.
5. **Well developed and cheap transport system** provided by the Rhine River and its tributaries such as Ruhr, Lippe and Emscher. The Rhine water way is linked with a system of canals such as Dortmund Ems and Lippeseite canals, which improves its transportation capacity; to transport coal to industries and markets. The Ruhr region has railway and road networks to transport coal, iron ore and mineral products. This leads to expansion of the mining sector.
6. **Large sums of capital to invest in coal mining** which was first provided by the government but later private financiers joined, to provide the necessary capital for mineral exploration, extraction, setting up processing plants and related industries.
7. **Development in technology in the mining sector** such as open-cast mining for deposits near the surface. Large machines are used such as shovel wheels which can do a lot of work. There is intensive research in mining technology such as the use of cranes, and excavators to support exploitation. This increases the quality and quantity of mineral production.
8. **Presence of skilled labour employed in mining** because a body of skilled labour has been developed right from the time of the industrial revolution in mining sector such as geologists specializing in mineral exploration/research, mining engineers, machine operators, managers, and drivers. This has increased efficiency in the mining industry.
9. **Presence of large market for minerals and mineral products.** Coal is used in the coking of iron, as a catalyst in blast furnaces and as a source of power. Of all the coal produced in the Ruhr, 40% is used there, 30% to other Germany areas and 30% exported to Scandinavia, France, Belgium, Italy, Switzerland and The Netherlands. Germany's potash industry ranks as one of the largest exporters of potash based on fertilizers in the world.
10. **Political stability of the country** since the Second World War. Germany has remained a peaceful country providing the necessary conditions for the rehabilitation of the mines that were destroyed during the war in the Ruhr, Saar and Cologne areas. Political stability has increased the confidence of investors and hence enabled the establishment and maintenance of mineral processing plants.
11. **Positive /supportive government policy towards the mining sector** such as originally investing in the mining sector with powerful industries. Today the government has provided enabling policies and subsidies such that mining continues in the rather uneconomical concealed mines. This has attracted foreign investors from countries like USA and Britain.
12. **High level of research in the mining sector** which leads to the discovery of more mineral deposits, improve their quantity and quality. There is also research into mining technology and new uses of the minerals. This in turn expands the mining sector.

### ***Importance of coal mining in Germany***

1. **Promotion of industrialization** for example the iron and steel industries which use coal as a source of energy and as an ingredient in the refining process. Iron and steel producing areas include Hamburg, Bremen, Hannover, Wolfsburg, and Brunswick. Chemical industries use coal as a raw material centred at Bochum, Dortmund and Essen. This has increased national income.
2. **Has promoted urbanization in Germany.** Many towns started as mining areas but have grown into great cities such as Dortmund, Duisburg, Essen, and Bochum. The Ruhr conurbation has a number of towns which developed mainly due to the presence of coal which was used as power. Most of the industries of the Ruhr are linked together/ depend on each other. The concentration of population in the Ruhr region has attracted many urban facilities such as banking, insurance, and education facilities.
3. Generation of foreign exchange
4. Generation of many employment opportunities.
5. Promoted development of transport infrastructure.
6. Generation of government revenue.
7. Promotion of international relationships.
8. Diversification of the economy.
9. Modernization of other sectors of the economy.
10. Development of modern technology.

### **Negatives/ short comings**

1. Pollution of the environment.
2. Urban-related problems.
3. The closing of some mines due to exhaustion of coal is leading to the under utilization of infrastructure put in the mining areas. This is especially in areas of exposed coal which is now exhausted like in Essen.
4. The use of open cast methods in the Ruhr, Aachen and Saar mines has led to destruction of the landscape, which has affected the otherwise viable agricultural land.
5. etc

### **Problems facing the mining sector in Germany**

- 1) Exhaustion of coal in some areas because coal has been mined for many years especially in the exposed fields. These areas have redundant infrastructure.
- 2) Increasing costs of mining with increasing depth of the mines especially in the concealed coal deposits. It requires experts and a lot of facilities such as construction of shafts, lamps—hence costly.
- 3) The closing of mines has resulted into unemployment and pre-mature retirement of skilled manpower.

- 4) Coal is facing stiff competition from other sources of energy especially petroleum/ oil which is a less pollutant and today the Ruhr region receives a large quantity of petroleum moved in by pipeline and ocean-going vessels , which has seriously replaced coal as a major source of power.
- 5) Competition from other countries whose coal deposits are continuously being discovered and low cost producing countries such as Saudi Arabia, china, USSR, and Australia.
- 6) Decline in demand for coal in relation to other minerals due to improved technology which requires less inputs and costs. For example in the iron and steel industry the technological progress results into less and less coal demanded.
- 7) Price fluctuations on the world market.
- 8) The shared location of some mineral deposits such as coal with France.
- 9) The uneconomical deposits of some minerals in some areas.
- 10) Destruction of landscape and mining accidents.
- 11) Shortage of labour to work in mining activities.
- 12) Remoteness of some areas of mineral occurrence.

## MINING IN USA

USA is endowed/ blessed with a variety of minerals. The most important minerals are iron ore, coal, gold, copper, petroleum/ oil and natural gas. Others are aluminium, lead and zinc, manganese, cobalt, and silver

### IRON ORE

Iron ore is mined in four (4) major regions:

- **Lake Superior region**—the most important of which is the Mesabi Range. Other deposits occur in the vermillion Range, Cuyuna, Gogebic, Menominee and Marquette Range.
- **The northeastern region.** Mainly ores are mined in the Adirondacks region of Newyork and the Cornwall area of Pennsylvania. Here they have the advantage of location near the industrial cities of Newyork and Pittsburgh.
- **The southeastern region.** This region is centred at Birmingham –Alabama. It is favourably located near the coalfields of the southern Appalachians and serves the iron and steel industry at Birmingham.
- **The western region.** This includes many scattered fields in western USA in the states of Utah, Nevada, Wyoming, and California. The ores are transported to the steel works at San Francisco, Los Angeles, Puelo, Colorado and Provo, Utah.

### COAL MINING IN USA

USA is the world's leading coal producer and it became the leading producer in the 20<sup>th</sup> century. However, the USSR has the largest coal reserves in the world.

The major coal areas of USA are:

- **The Eastern province.** This is the most productive region and has the greatest reserves. This includes four leading coal states: Pennsylvania, West Virginia, Kentucky and Ohio.
- **The Interior province.** This is the 2<sup>nd</sup> major producing region and it covers the shores of Lake Huron, Indiana, Illinois, Iowa, Missouri, Kansas, Oklahoma, and Arkansas.
- **The Gulf province.** It is a minor coal region including Texas, Alabama and Arkansas.
- **The Rocky mountain province.** This is America's greatest coal reserve but yet little exploited due to inaccessibility and distance from major markets. The major deposits are located in Utah, Colorado, Wyoming, Montana, and New Mexico.
- **The Pacific province.** This includes small coal deposits close to the pacific coast. The fields include Washington, Oregon, California and Alaska.

### **Factors which have favoured the success of coal mining in USA**

- 1) **The existence of large coal deposits** spread over the Eastern, Interior, the Gulf, Rocky Mountains and the Pacific provinces. These large deposits have promoted exploitation and processing of coal for now over two (2) centuries. The remaining deposits will last for over several decades to support the industries in USA and the international market.
- 2) **Presence of high quality coal and of all types** such as anthracite, bituminous coal, lignite (brown) coal and graphite coal. Coking coal is a grade of bituminous coal used in the iron and steel smelting in blast furnaces. Anthracite coal is of the best quality usable for heating, boilers as well as in the manufacture of batteries. About 50% of the world's anthracite coal is found in USA and this has given USA dominance in its supply to countries like Canada, china, Russia, and India.
- 3) **The country's coal deposits are easy to mine and transport** because the coal is found in horizontal layers and many deposits are found near the surface. The extraction of coal is done at low cost sometimes-using open cast methods. Even in mountainous regions such as Appalachians, the coal seams/ layers are not very deep and thus easy to access and extract.
- 4) **Strong capital base to invest in mining** provided by rich coal mining companies and private individuals. The corporations which operate in the Eastern and Gulf provinces are some of the richest in the world of coal mining business. More so USA has a high GNP per capita therefore capital mobilized for the purchase of modern machinery, setting up processing industries, training manpower, and carrying out mining research.
- 5) **Influence of many large foreign companies** from Britain and Germany due to the liberal economy of the US. These have brought in more capital, high technology and find it easy to market the coal abroad using their international reputation. The companies include the Peagody coal company and Kennecott company from Britain. Such companies have contacts in Europe and Asia which guarantees market for US coal.
- 6) **Presence of a large market both domestic and abroad.** Within USA the end user sectors for coal include electric utilities, coastal shipping, transcontinental railways and residential facilities. US coal is also exported to Canada, Japan, Italy, Netherlands, France, china and southeast Asia ( like

Malaysia, Indonesia). The economies of the newly industrialized countries continue to provide a large market for US coal. This promotes investment in the mining sector.

- 7) **Presence of efficient transport systems in USA** such as the country's highway system which is integrated with the railway system. The railway system is connected to almost all ports enabling easy transportation of machinery, manpower, the coal and coal products. The railway system if further integrated with the Canadian and Mexican railway systems. For purposes of export the US depends on the Atlantic and Pacific Ocean routes, which implies lower transportation costs compared to other coal producing countries.
- 8) **Availability of skilled/ highly trained labour to support coal mining** such as geologists, managers, engineers, marketeers, and accountants. The migrant workers from South America, Asia and Africa are also trained to acquire the needed skills. The coming of the multinational companies has increased the skilled labour and thus high quantity and quality of production.
- 9) **Advancement in technology** which facilitates easy extraction and processing of the coal. The extraction technology includes open cast methods (for seams near the surface), underground/ shaft mining (for deeper coal seams), and slope mining. The technology further has enabled the Americans to manufacture a wide range of products from coal greater than other nations.
- 10) **The growth of the industrial sector** also explains the success of coal mining. Previously coal was a major source of power for many industries (such as chemical, engineering). Today coal is used in the smelting of iron and steel and used to make metallurgical coke used in the blast furnaces. Coal provides a number of raw materials for the chemical industry (such as the making of organic chemicals, plastics, detergents, disinfectants, synthetic fibres, explosives). This attracts more investment in coal mining.
- 11) **Political stability of the US for a long period** which has attracted foreign investors from Europe and Asia due to guaranteed security of investment. The financial, insurance and securities subsectors have been attracted to the US mining industry for a long time. This has boosted further the stock of capital invested in the coal mining industry.
- 12) **Availability of large quantities of power** required for Coal mining, processing and the making of coal-related products. This includes hydroelectric power and the leading dams are Hoover dam, Grand Coulee dam, Shasta dam, and the many dams in the Tennessee Valley Authority scheme. These together with thermal facilities produce large quantities of power to run the coalmines and processing factories.
- 13) **Favourable/ supportive government policy towards coal mining industry** such as creating a stable political and economic environment, encouraging local and foreign investors and financing large hydro electricity projects. There has also been economic liberalization policy aimed at boosting coal mining as well as giving preferential treatment to investors when securing loans.
- 14) **Intensive/ developed research in the mining sector** done by physicists, chemists, engineers, geologist—to explore the available quantity and quality of coal in a given area and extract it using the most appropriate technology. There is also research aimed at improving the mineral processing technology.

### ***Impact of coal mining on the economy of USA***

### ***Positive impact***

1. Promotion of industrial development for example iron and steel industry since it is used in smelting. Coal and oil have also led to the growth of chemical industries since they are used as raw materials to make various products like organic chemicals, plastics, detergents, perfumes, disinfectants, insecticides, fungicides, and pharmaceutical drugs.
2. Generation of employment opportunities to the people.
3. Generation of foreign exchange to USA.
4. Diversification of the economy of USA.
5. Mining has promoted the development of transport infrastructure.
6. Promotion of urban development.
7. It has led to further technological advancement.
8. Coal miners have acquired more skills due to constant training.
9. Generation of government revenue.
10. The country's international relations have been strengthened.
11. Promotion of research and scientific studies.

### ***Negative impact***

1. Exhaustion of minerals causes dereliction of the landscape.
2. The decline of mining and closure of mines is associated with problems of unemployment and declining industry.
3. Pollution and health hazards.
4. Mining accidents
5. Profits by the foreign owned companies
6. Displacement of people
7. Destruction of natural vegetation
8. Urban—related problems
9. Underdevelopment of some rural areas
10. Displacement of other economic activities like farming and industry and tourism.

### **Problems facing the mining sector in USA**

- 1) ***Exhaustion of some high-grade minerals in some areas*** because coal has been mined for many years. For example the exhaustion of coking coal/ high grade bituminous coal in the Appalachians. In addition, many old oil fields are being exhausted which has made USA a major importer of oil/ petroleum and hence greatly affected by oil price rises since the 1970s.
- 2) ***Increasing/high costs of mining with increasing depth*** of the mines especially in the concealed coal deposits. This requires experts and a lot of facilities such as construction of shafts, miners' lamps— hence costly/ very expensive.
- 3) ***The closure of some mines has resulted into unemployment*** and pre-mature retirement of skilled manpower. It has also resulted into redundant infrastructure and unproductive land in terms of other activities such as agriculture.



- 4) **Stiff competition between oil and coal as sources of energy.** Today oil is a major source of industrial power. Oil has largely replaced coal in the boilers and furnaces. For example the presence of major oil fields in the interior has negatively affected coal production and trade, since oil is mined more cheaply and is a more effluent fuel.

On the other hand, coal is very bulky, which makes it difficult and costly to transport than either liquid petroleum carried by pipelines or tankers or electricity which is simply transmitted by wires and has no bulk at all.

*Note: Oil has also become a raw material in a wide range of chemical industries and in fact dominates the chemical industry. It is used in making synthetic textiles, dyes, solvents, detergents, plastics which have a wide range of industrial and domestic uses. Synthetic rubber is also extracted from oil.*

- 5) **Competition from other mineral producing countries** whose deposits are continuously being discovered and which are low cost producing countries such as Saudi Arabia, china, USSR, and Australia which produce oil. Also USSR, china, UK, South Africa which produce coal. This in turn limits the export market of US minerals.
- 6) **Remoteness of some areas of mineral occurrence** for example in the Rocky Mountain region mining of oil is more difficult, more expensive and thus potential oil districts are inaccessible due to rugged terrain. There are high costs of transporting minerals from the interior to the coastal processing centres and export ports. The Alaskan region also has large reserves of oil and natural gas but it is expensive to produce and transport because of the cold tundra climate (the severe winter conditions) make mining difficult throughout the year.
- 7) **The shared location of some mineral deposits such as coal and iron ore** with Canada. For example iron ore mining in the Lake Superior region which at times causes conflicts as regards the control of certain deposits of minerals. This undermines the expansion of mining investment.
- 8) **The uneconomical deposits of some minerals** such as the many scattered fields of iron ore in the states of Utah, Nevada and California. The pacific province has very small deposits of coal only for local significance close to the pacific coast. North America in general is markedly lacking in tin deposits, has limited deposits of zinc, chromium, and diamonds. This makes it rather uneconomical to exploit such minerals, hence discouraging investors.
- 9) **Fluctuation of prices of some minerals on the world market** such as for coal, oil and copper. For example, copper prices fluctuated more in the 1970s and 1980s which also negatively affected US production by discouraging some potential investors.
- 10) **Destruction of the landscape and many mining accidents.** The exhaustion of some deposits has left a derelicted landscape—since mining operators are unwilling to spend money on rehabilitation, which will not give them direct financial return. This leads to waste of agricultural and industrial land; causes ugliness, health and accident hazards. Therefore, there is strong opposition from environmentalists on further expansion of mining.
- 11) **Pollution of the environment** for example by the oil industry through unintentional oil spillage from tankers and pipeline leaks as well as through dumping of oil processing waste. This negatively affects the habitats of birds and aquatic life. This also leads to strong opposition from the Authorities and especially environmentalists.

- 12) **Shortage of labour to work in mining activities** since many are attracted to other better paying and/ or less risky jobs in the country or outside. This limits the productivity of the mining sector.
- 13) **Congestion at the ports** which leads to delays in the exportation of the minerals and thus leading to inefficiency in the mining sector.

### **Guiding questions**

- 1) To what extent have natural resources influenced the development of the mining sector in either Ruhr region of Germany or Zambia?

Natural resources to the development of the mining sector

- Large deposits of minerals
- High grade of the minerals
- Relatively flat landscape
- Nearness of some ores to the surface
- Availability of land/ sparse population
- \*Aridity of the area—alternative land use
- \*Water supply

#### ***Other factors***

- Cheap labour and skilled labour
  - Developed transport system
  - Adequate capital
  - Etc
- 2) Account for the development of the mining sector in either Nigeria or USA.
  - 3) Assess the role of the mining industry in the economy of either Zambia or Germany.
  - 4) Examine the problems facing the mining sector in either Zambia/Ghana or USA
  - 5) Using specific examples assess the significance of mineral resources as a basis for industrial development in either a developed or a developing country.
  - 6) To what extent have mineral deposits led to the growth of towns in either republic of South Africa or France?
  - 7) Assess the impact of mining on the environment in USA.
  - 8) With reference to either DRC or Germany, discuss the problems facing the mining industry and suggest possible solutions to the problems.
  - 9) Assess the contribution of the mining industry to the development of either Greatlakes region of North America or the Witwatersrand (Rand) region of the republic of South Africa.