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ECONOMIC GEOGRAPHY AND LAB WORK

DEPARTMENT OF GEOGRAPHY
AND NATURAL RESOURCE MANAGEMENT
SCHOOL OF EARTH AND ENVIRONMENTAL SCIENCE
UTTARAKHAND OPEN UNIVERSITY
(Teenpani Bypass, Behind Transport Nagar, Haldwani (Nainital), Uttarakhand, India)

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ECONOMIC GEOGRAPHY AND LAB WORK

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BLOCK 1 : NATURE, SCOPE AND APPROACHES

UNIT 1 - MEANING AND SCOPE

1.1 OBJECTIVES

After reading this unit, you will be able to:

- Understand the meaning and definition of Economic Geography
- Learn about the nature of Economic Geography
- Gain knowledge about the scope & development of Economic geography

1.2 INTRODUCTION

Geography has evolved into a very diverse and adaptable subject, with a wide range of topics to study. Economic Geography's major goal, as stated, is to evaluate man's economic achievement in terms of production and consumption in relation to his surroundings. We must evaluate the functions that this branch of geography serves in order to determine its relative relevance.

In the light of new and extended views of geography, place names, natural environments, and the influence of natural environments on man's activity have become obsolete and undesirable beliefs.

Today's geography is the study of geographic differences on the earth's surface; as such, it is a spatial or areal science that deals with interactions among geographic variables. Economic geography is the most developed of the major branches of geography.

Although it is a branch of Human Geography, it now has its own status in geographical studies and deals with areal variations in man's economic activity on the earth's surface.

Among the numerous sciences of geography, economic geography has undergone significant changes in the last fifty years, resulting in a variety of specialized areas, such as agricultural, industrial, and transportation geography.

In this unit we will be talking about the meaning, definition, nature and scope of Economic geography. We would start with the basic understanding of the field of Economic geography including the definitions, nature and scope of the discipline.

1.3 MEANING OF ECONOMIC GEOGRAPHY

Human Geography has a subfield called Economic Geography. Economic geography is the study of how human economic activities – production, consumption, and exchange – vary across space, with a focus on resource endowments, international trade and commerce, population growth, settlements, development, interaction and interdependencies, and regional supply and demand. The study of man and his economic actions in a variety of conditions is known as economic geography. When it comes to the definition of geography, geographers have differing viewpoints.

- According to Hartshorn and Alexander: “Economic Geography is the study of the spatial variation on the earth’s surface of activities related to producing, exchanging and consuming goods and services. Whenever possible the goal is to develop generalizations and theories to account for these spatial variations."

- According to J. MacFarlane describes Economic Geography as the study of "influence exerted on the economic activity of man by his physical environment, and more specifically by the form and structure of the surface of the land, the climatic conditions which prevail upon it and the spatial relations in which its different regions stand to one another."
- According to Dudley Stamp, Economic Geography "involves consideration of the geographical and other factors which influence man's productivity, but only in limited depths, so far as they are connected with production and trade."
- Professor E. W. Zimmermann pointed out that, Economic Geography deals with the economic life of man with relation to environment.
- As early as in 1882, the German scholar, Gotz had defined economic geography as "a scientific investigation of the nature of world areas in their direct influence of goods".

1.4 NATURE OF ECONOMIC GEOGRAPHY

In the words of Hartshorn and Alexander: "**Economic Geography** is the study of the spatial variation on the earth's surface of activities related to producing, exchanging and consuming goods and services. Whenever possible the goal is to develop generalizations and theories to account for these spatial variations."

With the addition of the concept of "spatial variation" or "areal variation," the nature of economic geography has changed dramatically. In their book Economic Geography, Alexander and Gibson (1979) and Hartshorn and Alexander (1988) claim that "economic geography is the study of areal variation on the earth's surface in man's activities connected to generating, exchanging, and consuming wealth."

1.5 SCOPE OF ECONOMIC GEOGRAPHY

Economic geography was defined by the German scholar Gotz in 1882 as "a scientific analysis of the character of world territories in their direct influence on goods."Despite the fact that Gotz was the one who coined the term "economic geography," his influence was limited to Germany.

Because the abstract principles of the time were not developed, they could not be connected to economic geography. Economic geography owes its development as an academic topic to the British public's interest in business. It's worth noting that George Chisholm, the pioneer of contemporary economic geography, intended to instill a sense of intellectual curiosity in the study of geographic facts.

He believed that economic geography's fundamental purpose is to "create some plausible forecast of the future course of commercial development insofar as that is affected by geographical conditions."Chisholm, on the other hand, focused on commercial development and primarily addressed physical characteristics and climate in connection to products in his discussion of the issue.

Others began to think of economic geography in terms of productive vocations as a result of this emphasis on physical features and climate in connection to products. “Economic geography deals with productive activities and strives to explain why certain places are outstanding in the production and exportation of particular items while others are significant,” Jones and Darkenwald (1950) write.

On the other hand, according to Ellsworth Huntington (1940), economic geography encompasses all forms of materials, resources, activities, conventions, capabilities, and forms of aptitude that play a role in earning a livelihood.

In his book Fundamentals of Economic Geography, Bengston and Van-Royen (1957) stated:

Economic geography is the study of how various places of the world differ in terms of basic resources. It seeks to assess the impact of variances in the physical environment on the use of these resources.

It investigates the disparities in economic development between regions or countries around the world. It investigates transportation, trade routes, and trade as a result of these many developments, as well as how they are influenced by the physical environment.

Other definitions of economic geography include:

J. McFarlane: “Economic geography is the study of the influence of man's physical environment on his economic activities, particularly the form and structure of the land surface, the climatic conditions that prevail upon it, and the place relations in which its various regions stand to one another.”

R.E. Murphy: “Economic geography has to do with similarities and differences from place to place in the ways people make a living.”

R.N. Brown: “Economic geography is that aspect of the subject which deals with the influence of the environment – inorganic and organic – on the activities of man.”

E.B. Shaw: “Economic geography is concerned with problem of making a living, with world industries, with basic resources and industrial commodities.”

N.J.G. Pounds: “Economic geography is concerned with the distribution of man’s productive activities over the surface of the earth.”

As can be seen from the definitions above, economic geography is primarily concerned with man's productive activities and their interactions with the environment. Primary activities are those that receive simple commodities or raw materials from the soil, the sea, or the rocks. Secondary and tertiary activities are those that receive complex commodities or raw materials from the soil, the sea, or the rocks. Agriculture, forestry, and fishing are among them.

The secondary set of operations is the manufacturing, processing, or fabrication of these commodities in factories and workshops. Following manufacture, transportation services, as well as insurance, broker, and dealer services, are required. These services are referred to as tertiary activities. All of these human activities are tied to environmental circumstances in some way.

In their book Economic Geography (1998), Wheeler, Muller, Thrall, and Fik describe economic geography using two continuums: a human-physical continuum and a topical-regional continuum. As a result, economic geography, which focuses on human production, distribution, and consumption, naturally falls toward the human end of the scale. Climate, geography, soil, and hydrology will all play a role.

The second continuum provides a technique to analyzing geographic variation in human and physical factors, or the study of the economic geography of a region, a second region, a third region, and so on, until the entire planet has been covered. It also covers the principles governing the distribution of various economic activities.

1.6 DEVELOPMENT OF ECONOMIC GEOGRAPHY

Economic geography is concerned with the geographic distribution of economic activity as well as the variables and processes that influence them. The focus of economic geography has shifted over the last five decades, from description – gathering facts about production in various locations of the world – to interpretation, from environmental determinism to economic determinism.

Both of these shifts can be attributed to the incorporation of Neo-classical Economics into economic geography, which has resulted in key disciplines of study such as Industrial Location Theory and Regional Science, thanks to its mechanical assumptions about Economic Man and Optimal Location. A Behaviourial Approach, on the other hand, has lately been created with an emphasis on the decision-maker.

During the last three decades, economic geography has shifted its focus to:

i. The nature and causes of development and underdevelopment, emphasizing the interrelationships between the less and more developed worlds and putting the mode of production at the centre;

ii. The link between economic systems and geography, particularly in interpretations of capitalism's spatial impacts and role in the development of the world economy;

iii. The impact of technological advancements and the development of new industrial areas

iv. The use of discursive, qualitative, and realist explanations that acknowledge that each economic agglomeration and development is entrenched locally in its own socio-institutional environment;

v. The economic dimensions of class, race, and gender, emphasizing and at times criticizing how economic institutions rely on discrimination based on these three groups;

vi. The role of ‘non-economic' forces in the economic process, such as cultures, institutions, and social behaviors;

vii. New explanations for the location of economic activity have been proposed, based on economic man's assumptions and optimization;

viii. The introduction of the concept of the decision-maker and the satisfier in the behavioral approach has changed the ideas; and

iv. The concept of sustainable development in resource use etc.

All of these fields of study have led to the development of an economic geography philosophy as well as regional development and planning.

1.7 CONCLUSION

This unit defined economic geography as a vibrant, diversified, and contentious sub-discipline of geography that studies the economy using a geographical method. The chapter addressed the differences between orthodox economics and an economic-geographical approach to examining economies. The unit established the essential ideas of an economic-geographical approach, namely space, location, and scale, in order to highlight these disparities. Economic geography is well positioned to assist us appreciate and understand the current economic world in all of its complexity since it has these and other notions at its disposal.

1.8 SUMMARY

Economic geography is the study of where economic actions take place, how they are distributed, and how they are organized spatially around the world. It is a well-known branch in the discipline of geography. However, many economists have tackled the topic in ways that are more characteristic of the discipline of economics in recent decades.

Economic geography has taken a variety of approaches to a variety of topics, including but not limited to the location of industries, transportation, economic development, real estate, gentrification, ethnic economies, gendered economies, core periphery theory, the economics of urban form, the relationship between environment and economy, and globalization.

1.9 GLOSSARY

- **Economic-** relating to economics or the economy.
- **Production-** the action of making or manufacturing from components or raw materials, or the process of being so manufactured.
- **Consumption-**utilization
- **Dynamic-** characterized by constant change, activity, or progress."a dynamic economy"
- **Diverse-**various
- **Spatial organization-** as one of the basic themes of geography, focuses on how to recognize and organize geographic space in which human activities occur, giving rise to spatial structures.
- **Economic development-** is the creation of wealth from which community benefits are realized.
- **Economic activities-** are a process that, based on inputs, leads to the manufacture of a good or the provision of a service.

1.10 ANSWER TO CHECK YOUR PROGRESS

1- Write the purpose of Economic Geography.

1.11 REFERENCES

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1.12 SUGGESTED READINGS

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- Saxena, Shankar Sahay, Economic Geography.

1.13 TERMINAL QUESTIONS

1-Explain when and how did Economic geography begin?
2-Define Economic Geography and give definitions of Geographers.
3-Explain the nature of Economic Geography.
4-Write a note on the scope of Economic geography

UNIT 2 - ECONOMY: DEFINITION, CLASSIFIACTION, LOCAL AND SPATIAL ORGANIZATION

2.1 OBJECTIVES

After reading this unit you will be able to understand the definition, classification of economy and local and spatial organization. Economic geography is a dynamic subject. It is constantly developing. The discovery of new countries, the discovery of new resources and the development of new industrial centers have made economic geography very widespread. Therefore, we can say that economic geography is not a dead but a progressive science.

After reading this unit learners will able to understand the following benefits: (1) It gives us an idea of the state and details of the natural resources by which economic growth of a country can take place at the present time. In this age of today (while all the advanced nations are moving forward in the race for progress). It is very important to know that what are the areas those are getting the right amount of agricultural products, and minerals for the progress of a country. Information of the origin of these products can be found only from the study of economic geography. (2) By what means and for any purpose, the natural property (wild material, agricultural material and mineral material) found in a country can be used. For example, in any country, forest wealth is found only in those areas where there is sufficient heat and rainfall in most parts of the year. The raw materials and timber obtained from forests can be used only in industrial and commercial cities. Fishes can be caught in shallow reservoirs within the country or on shallow sea banks, which are very cut and torn. Similarly, plains with suitable, climatic climate (e.g., Canada, Australia, Argentina, Indus-Gangetic Plain, Yangtzeikyang and Hwanghao Territory) are more suitable for agricultural work. Lack of other minerals is found in the parts found in coal and mineral oil and hydroelectric power can be developed only in those areas where the surface is high and low and where there is enough rainfall and which are close to densely populated areas. Knowledge of all these things can only be learned from the study of economic geography. (3) By finding out which mineral substances are hidden in the womb of the earth and by knowing how these minerals can be helpful for the fulfillment of human needs, the study of economic geography indicates that In which places can a particular industry be established. For example, iron and steel industries are established near coal mines and cotton textile industries close to densely populated centers. Other industries are also established as close as possible to raw material or power resources. Thus the subject of economic geography is very useful for industrialists too. (4) From the study of economic geography, it can be known from where the raw materials, food items or instruments, etc. can be obtained to meet the needs of a country and how to deliver these goods to the consumption centers and will have to resort to various modes of transport. If India needs food grains for its population, then of course it can meet this by sourcing it from Argentina, Russia, Myanmar, Australia, USA and Canada, and is also beneficial for the traders. (5) How does the human community in different parts of the world meet its physical needs? How does his life, food, food and clothing? Or how has he used natural means to raise the standard of living? All these facts can be known from the study of economic geography. How did a particular country make so much economic progress? Or why any other country is so backward? This can also be known by the study of economic geography. In today's era, the flame of war between different countries is being created, to calm the world peace by working on the geographical background state behind the efforts made by scientists, politicians, economists and geographers. Also have all problems can be solved easily if economic geography is properly studied.

(6) In every country, the scholars need to make a systematic plan for the country, so that they get complete knowledge about the substances originating in different parts of the country. They can easily decide how best to use the country's natural wealth? Which industries - businesses should flourish in the country? How to increase agricultural production? How would overcome the problems of vacancy, etc. This can only be possible if the person studies economic geography. In today's era, it is essential for the students of commerce and economics to have a proper knowledge of economic resources because no country is self-sufficient in them. Economic development of neither the individual nor any nation is possible without the spirit of mutual cooperation. Now it is definitely believed that human needs are becoming so complex that it cannot remain alone, it needs the cooperation of another. This sentiment has given rise to international trade and that is why the whole world is now being considered as One World. Apparently, people engaged in all fields of livelihood (banker, businessman, insurance worker, seller, advertiser, industrialist, farmer, economist, sociologist) must have adequate knowledge of economic and commercial geography. In this regard prof. Davenham's statement is remarkable, "Benelux, NATO,United Nations (UNO), organized internationally with the help of members from a large number of countries that have become and are becoming internationally renowned organizations. These are different countries and communities. Are trying to bring unity and freedom, without which modern civilization cannot survive. This unity can come only

when the three pillars of geography are fully aware and these three pillars are respectively "inhabitants of the world, places where does they live and do the work that they do". Virtually every person needs to study economic-commercial geography not only to calm their knowledge but to understand the people of the world.

2.2 INTRODUCTION

No substance or thing can be called a resource unless it has partial or full capacity to meet human needs or to overcome difficulties. A substance or element is considered a resource at the same time it has the ability to provide human needs, achievement or benefit. Therefore, a close relationship between man's capacity and resources has been considered. Therefore, it is clear that we can treat any substance or element as a resource only if man of any country has the intellectual and cultural and material ability to work or gain from that thing or element. The nature of the resource is determined by the intellectual and cultural capacity of man. Human's physical and intellectual capacity, interest, organization of knowledge, economic progress, political stability, etc. are resources in themselves, because all these elements contribute to their need fulfillment and progress. Resources are the basis of both wealth and security and are the foundation of power and wealth. It is the deciding factor in the fate of man in both war and peace. Humans have to depend on their own or others' labor to make food, clothing and shelter to meet the basic needs that can make these things. These objects are either found on the earth's surface or in the earth's surface, or they are prepared for human consumption by removing them or by adding, modifying or finishing them. The word resource is synonymous with the English resource 'word' which is made up of two words: Re 'and' Source, whose meanings are 'Re'-yunah (Again) or long term and' Source 'means or device respectively. In other words, the resources available in nature on which a biological community can depend for a long period and have the capacity to replenish or rebuild are called resources. For example, air (sun) received from nature and light (sun) from the sun will continue to be found for a long period, while vegetation or forests can be produced. Therefore, it is clear that a resource is a substance, property or element found in nature that is capable of meeting human needs. Therefore, resource is such a natural and human resource, which we use to fulfill our needs. In other words, the progress, development and survival of human life depend on resources. Every natural resource is useful for human life, but its use is possible only by developing appropriate technologies. Land, water, air, solarium, forests and wildlife existed even before the origin of human life. It is clear that humans developed these resources to meet their needs. In a nutshell, one can say that the elements present on the earth which are capable of being accepted by humans are called resources. E. W. In the words of E.W. Zimmerman, resource refers to the achievement of an objective. This objective serves personal needs and social goals.

Any object or substance found on earth will be called a resource when it has the following properties: (i) object is human utility. (ii) It should be possible to transform it into a more valuable and useful item. (iii) having the ability to fulfill certain objectives. (iv)The human resources capable of exploiting these items should also be available. (v) Should also have the necessary capital for sustainable development in the form of resources.

2.3 DEFINITION OF ECONOMY

The definition of economic geography has been given by different scholars in different ways. Definitions of some leading scholars and thinkers are presented here:

According to Bangston and Von Royen "Economic Geography investigates the diversity in basic resources of the different parts of the world. It tries to evaluate the effect that differences in physical environment have upon the utilization of these resources. It studies differences in economic development in different regions of countries of the world. It also studies transportation, trade - routes and trade resulting from the differential development and as affected by the physical environment".

According to G. Chisholm "It (Economic Geography) embraces all geographical conditions affecting the production, transport and exchange of commodities. Its chief use is to enable us to form some reasonable estimate of the future course of commercial development so far as that is governed"

According to Prof. Shaw "Economic Geography is concerned with problems of making a living with world industries, with basic resources and industrial commodities." Shaw] Prof. Johns (Prof. CF Jones) and Darkenwald

According to Darkanwald "Economic Geography deals with the productive occupations and attempts to explain why certain regions are outstanding in the

production and exportation of various articles and why others are significant in the importation and utilization of these things.” Prof. John &Darkanwald)
Murphy (RE Murphy) has defined the definition of economic geography as: "[Economic Geography has to do with similarities and differences from place to place in the ways people make a living - R. E. Murphy, An Introduction to Geography.]”
According to Rudolf Wergens, " ['Economic Geography is a study of the interaction between (a) the earth space in its fulfillment and (b) economic man, with particular attention to explanation of the distribution of the pertinent consequences of such inter - action. -Rudolf Wetgens]

According to Golz, “Economic Geography makes a scientific investigation of nature of world areas in their direct influence on the production of goods.”

In the words of Huntington (E. Huntington), "The extent of the impact of geographical environment on human business, human efficiency and other aspects of human needs (e.g., arts, religion, administration, education and civilization) is studied in economic geography.

"Economic Geography is the study of the spatial variation on the earth's surface of activities related to producing, exchanging, and consuming goods and services. "-Hartshorn and Alexander

“Economic Geography is the study of areal variations on the earth's surface in man's activities related to producing, exchanging and consuming wealth.”-John W. Alexander

According to NG Pounds, Economic Geography is concerned with the distribution of man's productive activities over the surface of the earth. These activities are primary, secondary and tertiary. -NG Pounds.

Economic Geography has taken up the neglected aspects of man's economic affairs and deals in commodities, the places and conditions of their production , transportation and -GT Renner

This makes it clear that economic geography is a science related to livelihood modes and their problems, in which the basic resources of the ground and the related human actions are studied. There is a science related to the exploitation of natural resources, in which their production, transport, distribution and consumption are studied.

Humans have made the objective fulfillment the basis of development by utilizing the resources available in nature. Humans have been consuming them since ancient times. Gradually, by rapid exploitation, the need for sustainable or sustainable development was felt and at present, a plan was prepared to classify them for proportionate use. Resources are biological and abiotic, depending on origin. Depending on the purpose, resources can be divided into energy, raw materials and food items.

2.4 CLASSIFICATION OF ECONOMY

The classification of resources on various common grounds can be done in the following ways: **(1)** Generally, there are two types of resources: **(a)** natural resources **(b)** human resources.

(A) Natural resources: All substances are the product of natural resources of the earth. Since nature is the mother of these resources. Hence they are called natural resources.

(B) Human resources: Human resources are the most important besides natural resources, because without human labor, natural resources have no value. Humans change their environment and use the substances found in it for their needs. As a result of his hard work, agricultural commodities are produced somewhere in the world today, then development of mineral materials and manufacturing industry is possible somewhere. The use of natural resources found on earth requires human thought, its organization and labor. Natural resources are generally divided into two classes based on origin: (1) biological resources, (2) inorganic resources. (1) Biotic or Organic or Living Resources, under which natural things derived from trees and animals are included. Such as forests, pastures and grasslands, wild animals - fish, fish and other jibs found in the sea. Forests provide humans with a variety of commodities (fruits, betel nuts, herbs, leaves, bark, fibers, gum, resin, rubber, etc.) on which industries of the modern era have developed. Where natural grasslands are available, animal husbandry is done on a commercial scale and sheep, goats, four-footers are reared for milk, meat or wool. Many types of wild animals, lions, leopards, leopards, hyena, elephants, etc. are found in forests and grasslands, whose skins, hair, teeth, seag, meat, etc. are used in many works. Fishing in lakes, ponds and coastal areas provides humans with a food base.

(2) Abiotic or Inanimate or Non - Living Resources, under which the surface, rocks, air, water, minerals, fuels, metals, building stones, etc. are included. Humans have used them to make things or to obtain power. Air is not only equal to nectar for its survival, but air power and eyes are also obtained from it. Water is also used for power generation in addition to drinking or agriculture. The situation between these two resources is that of soil, without which neither trees - plants can flourish nor humans get nutritious material. Therefore, their importance in natural resources is also high. According to the purpose-based classification, there are three types of resources: 1 Energy resources 2. Raw materials 3. Food items (1) Energy resources - Energy resources include those resources which are used for power tools. For the development of Power is derived from many sources, they are divided into living and non-living resources. There are wood in the means of human and animal and inanimate power in the means of living power. Apart from these two classes, a third class has also been considered, under which comes coal, mineral oil, natural gas, alcohol, sun energy, tidal power and atomic power. These are called industrial power. It consists of 29% of coal, 39% of mineral oil (petroleum), 19% of natural gas and 2% of hydro power, atomic power and other geologic powers. In the present times, energy resources are being considered as the standard of development of any country. Both endowed and untraditional nature resources are found in energy resources. Non-renewable or renewable resources include coal, petroleum, and natural gas. Forests, hydroelectricity, wind energy, solar energy, geothermal energy and tidal energy etc. are considered in the category of renewable or non-renewable energy resources. Due to the increasing importance of energy resources, it is very important to develop the basic spirit of sustainable development of their lives.

2) Raw material is the mainstay of industrial development and it can be divided into the following classes:

(a) Minerals: The objects that are dug out of the earth's surface or its womb are called mineral substances. These include iron - minor, non-ferrous metals, coal, diamond, limestone, gold, silver, mica, sandstone and many other mineral substances. All these minerals are the raw materials of many industries, such as iron ore in the iron industry.

(b) Vegetation: Under vegetation, grass. They come from bushes to huge trees. These include wood, fibrous products, lap, rubber, oil, seeds, blisters, carcass, algae etc. The main and secondary products obtained from natural vegetation are the raw material in various industries. For example, soft pulp is made from soft wood and paper is prepared from the pulp.

(c) Animals: Animals such as - cow, ox, buffalo, sheep, goat, camel, yak, etc. are also kept in the raw material category. Milk, hides, samur, horn, wool, silk and bones derived from these animals are the raw materials of various industries. The raw material for the milk industry, woolen textile industry, leather industry, silk industry etc. is obtained from animals only.

(d) Product material: Under it as raw material in fiber (cotton, flax, jute), rubber, oilseed crops, (mustard, groundnut etc.) cotton textile industry, tire-tube industry, edible oil, industries etc. Used in (3) Since the age of food stuff, humans have been using various food items for their supply. Generally, foods are derived from three types of resources:

(a) Vegetation: The majority of human food is derived from vegetable products. These include condiments, fruits, leaves, mushrooms etc.

(b) Animals and animals: Animals - Since the time, humans are filling their stomachs with animals and animals. He has adopted occupations like animal husbandry, poultry, bees keeping, fisheries, etc.

(c) Minerals: Salt (salt) has a special place in human food which is obtained from mining and drying of seawater. The salt is mainly used in food items.
Classification based on sustainability of use - some resources used by humans are short-term and some resources remain forever. Thus, depending on the continuity or continuity of usage, we can divide resources into three classes:
(a) Renewable Resources: This class includes all those resources which could be reproduced. These resources can be made useful in the long run by adopting physical, mechanical and chemical technology. Therefore, those resources are inaccessible and their life is sustainable repetition. For example, they can be reproduced when a region of forests is cut. The number of wildlife can also be

increased. Other resources of this category include water, wind, solar energy, soil, agricultural crops, human resources etc.

(b) Non - Renewable Resources: In this class, there are resources which are not possible to be replenished once exploited. Their quantity is limited and the construction period is also long. These resources are destroyed once used and their reuse is not possible. Coal can be extracted only once from groundwater, whereas its construction takes millions of years. The same category includes petroleum, natural gas, copper, bauxite, uranium, thorium, etc. resources which are non-renewable.

(c) Recyclable Resources: There are some resources on earth that can be used again and again. Water resources can be varied in different forms at different times. Similarly, iron can also be used in various forms.

2.5 LOCAL ORGANIZATION

Different economic territories are interconnected by the regional functional organization and take the shape of an economic landscape. Sangam (Uniform) and Nodal - The interlinking of economic territories creates regional functional organization, according to A.K. Philbrick (1) Unit of Occupance to Economic Industry, (2) Focality), (3) Localization, (4) Inter connection, (1) Spatial Discontinuity and Continuity, (6) Central Organization and Parallel Relationship

Economic geography is the major branch of human geography that encompasses all the activities performed by humans. It is the cream that acts as a unit of the economic industry that depends on the focus of that industry and the leaders of that are determined by the local production industry which interconnects the human and its functions from the industries and rent clubs. All these industries are interlinked and transported to the centralorganization and through the economic activities of the region and import-export from the local area, which depends on the mutual coordination of the local organization.

Different distribution models and economic landscapes of newly introduced physique differ because they have different types of interconnection due to natural biological and cultural processes, like - each in agriculture industry excavation trade tertiary work etc. The world distribution model varies. Their interconnectedness is also different. All these works are found in most quantity in the world but there is regional difference in their interconnected form. Therefore, on the basis of economic element or element group, agriculture state, industrial region, etc. can be demarcated. As well as regional affiliation, economicregions can be demarcated on the basis of symmetry. In this way, the economic landscape and typological classification through economic regions and their proper analysis helps.

2.6 SPATIAL ORGANIZATION

Spatial functional interaction is a mutually functional interaction between different economic regions of the world. This type of interconnection is necessary for the development of economic regions. In the era of modern specialization and production on a large scale, any economic work affects the whole world and is itself influenced by other economic-socio-political conditions of the world. Therefore, no economic region can remain separate from other states. In fact, incentives for a particular type of production in a particular state and means of producing it can be obtained not only from a remote region directly from the same state and the goods produced can be consumed in the same way. This regional functional interaction is the basis of economic development. Territorial functional interaction is both transverse and perpendicular, that is, there is interaction between different economic regions of the same hierarchy level and there is a similar relationship between regions at different levels of the state hierarchy. The expression of regional organization of the economic system is through such infinite regional functional interaction. Although such interrelationships and the functional structural patterns resulting from them are often not in tangible form visible, they are important geographical elements. Edward L. According to Edward L. UIman, the study of world and regional interactions is the axis of geographical study. Their function of regional interaction is regional functional interaction in which many interconnected sequences of regional functional organization arranged in economic functional hierarchy in different industries ie regional structure of economic landscape, such as interconnection of real important human elements between different regions of the world. This developed functional hierarchy arises from the increasing volume and complexity of units of economic industry on a large to small scale, as well as the parallel relationships and functional interconnections of central organizations.

The following example will explain this concept of regional functional organization. An agricultural farm is a unit of economic industry. The Agricultural farm is spread around the farmstead and is related to it. A commodity manufacturing industry, which is a separate unit of economic industry, develops at a central place. Therefore, there is no direct connection between the factory of agricultural farm and the commodity manufacturing industry, but in fact both are interrelated with a city which is the center of the commodity manufacturing industry as well as the market and supply center for agriculture. This process is repeated at every level of the hierarchy of central and homogeneous regions and eventually the world class economic landscapes become interconnected, but the intensity of interconnecting in such a functional organization varies according to the complexity of the economic system. Can. Initial economic systems do not provide Surplus, so no means of transportation and trading centers are required and as a result regional functional organizations may be separated only at the lower levels of the territories. On the other hand, the regional functional organization in the industrial trade economy system develops to the world level. 6. Territorial - Regional economic development - The concept of regional economic development shows the practical aspect of economic geography. It was only in 1920 that Drayor described economic geography as a practical approach. The concept of regional economic development emphasizes proper utilization of resources and maximum production through regional economic integration. The basic objective of economic geography is to explain the variation in the level of economic development in different regions. This requires measurement and analysis of various aspects of economic development. According to Ullman, the basic objective of regional research in economic geography is to determine and explain the level of current economic development of a particular state. In this context, it is more important to discuss resource accessibility rarity and progress in cultural technical field than other states in a particular state. For regional economic development, the associated and balanced resource utilization of different regions is essential because regional functional interaction and regional functional organizations will be in proper form only. This is why regional planning of regional interconnected economic development is more important in economic geography.

2.7 CONCLUSION

The geographers under this chapter try to explain that economic geography studies the variations, oddities and variations due to such activities between regions on the surface from the multi-dimensional and hierarchical development of various economic activities of humans. Under it, the study of relations between developed and developing countries is given information about imports and exports. The field of human economic activities on the earth is very wide which includes primary secondary and tertiary production as well as economic classification and local field studies of resources and detailed study of them all through different categories of definitions. So that the study of the entire chapter is easily understood.

2.8 SUMMARY

Economic geography is a major branch of human geography under which the regional variations, characteristics, spatial patterns and interactions of human economic activities are studied on the ground floor. Human communities in different parts of the world to meet their physical needs Engages in various livelihoods (cutting wood, fishing, fishing, farming, farming, collecting food, mining, industry, running business, trading, transporting and doing jobs in various establishments etc. These economic efforts of humans have influence on the elements of topography, land texture, soil, climate, vegetation, mineral resources, geographical location, convenience of transportation etc. The main objective of economic geography is on human efforts (economic activities). To access, and analyze the environmental impacts.Economic geography is a dynamic subject. It is constantly developing. The discovery of new countries, the discovery of new resources and the development of new industrial centers have made economic geography very widespread. Therefore, we can say that economic geography is not a dead but a progressive science.
Human has made the use of the resources available in nature the purpose of development as the basis of development. Humans have been consuming them since ancient times. Gradually, by rapid exploitation, the need for sustainable or sustainable development was felt and at present, a plan was prepared to classify them for their proportionate use. Resources are biological and abiotic, depending on origin. Depending on the purpose, resources can be divided into energy, raw materials and food items:

2.9 GLOSSARY

- Local Organization: an organization those active – ties are limited to this state or to a specific geographical area within this state.
- Spatial Organization: Spatial Organization is the way a group or phenomenon is arranged on the surface of the Earth.
- Accessibility: The quality of being able to b reached or entered.
- Interconnected: Having all constituent parts linked or connected.
- Determine: ascertain or establish exactly by research or calculation.

2.10 ANSWER TO CHECK YOUR PROGRESS

Q1. Define economic geography according to Prof. Shaw?
Ans. "Economic geography is concerned with problems of making a living with world industries, with basic resources and industrial commodities"
Q2. Define local organization.
Ans. Local organization means an organization whose activities are limited to this state or to a specific geographical area within this state.
Q3. Define the spatial organization.
Ans. Spatial organization is the way a group or phenomenon is arranged on the surface of the earth. Geographers like to split things into functional regions, or areas defined by business and economic activities around a focal point or node.

2.11 REFERENCES

- Mamoriya, Chaturbhuj and Joshi, Ratan, Economic Geography.
- Sharma, Bhajanlal Rajkumar, Economic Geography.

2.12 SUGGESTED READINGS

- Saxena, Shankar Sahay, Economic Geography.

2.13 TERMINAL QUESTIONS

Q1. Write the definition of Economic Geography.
Ans. The definition of economic geography has been given by different scholars in different ways. Definitions of some leading scholars and thinkers are presented here:

According to Bangston and Von Royen, "'Economic Geography investigates the diversity in basic resources of the different parts of the world. It tries to evaluate the effect that differences in physical environment have upon the utilization of these resources. It studies differences in economic development in different regions of countries of the world. It also studies transportation, trade - routes and trade resulting from the differential development and as affected by the physical environment.

According to G. Chisholm"It (Economic Geography) embraces all geographical conditions affecting the production, transport and exchange of commodities. Its chief use is to enable us to form some reasonable estimate of the future course of commercial development so far as that is governed by

According to Prof. Shaw"Economic Geography is concerned with problems of making a living with world industries, with basic resources and industrial commodities." Shaw] Prof. Johns (Prof. CF Jones) and Darkenwald

According to Darkanwald" Economic Geography deals with the productive occupations and attempts to explain why certain regions are outstanding in the production and exportation of various articles and why others are significant in the importation and utilization of these things." –Prof. John &Darkanwald)

Q2. Present the classification of resources?

Ans. The classification of resources on various common grounds can be done in the following ways: (1) Generally, there are two types of resources: (a) natural resources (b) human resources.

(A) Natural resources: All substances are the product of natural resources of the earth. Since nature is the mother of these resources. Hence they are called natural resources. (B) Human resources - Human resources are the most important besides natural resources, because without human labor, natural resources have no value. Humans change their environment and use the substances found in it for their needs. As a result of his hard work, agricultural commodities are produced somewhere in the world today, then development of mineral materials and manufacturing industry is possible somewhere. The use of natural resources found on earth requires human thought, its organization and labor. Natural resources are generally divided into two classes based on origin: (1) biological resources, (2) inorganic resources. (1) Biotic or Organic or Living Resources, under which natural things derived from trees and animals are included. Such as forests, pastures and grasslands, wild animals - fish, fish and other jibs found in the sea. Forests provide humans with a variety of commodities (fruits, betel nuts, herbs, leaves, bark, fibers, gum, resin, rubber, etc.) on which industries of the modern era have developed. Where natural grasslands are available, animal husbandry is done on a commercial scale and sheep, goats, four-footers are reared for milk, meat or wool. Many types of wild animals, lions, leopards, leopards, hyena, elephants, etc. are found in forests and grasslands, whose skins, hair, teeth, seag, meat, etc. are used in many works. Fishing in lakes, ponds and coastal areas provides humans with a food base.

UNIT 3 - GEOGRAPHICAL BASES OF ECONOMIC ACTIVITIES: SYSTEMATIC AND SPATIAL

3.1 OBJECTIVES

After reading this unit you will be able to understand the geographical bases of economic activities. The expression of the form of a subject is expressed through its fundamental concepts. There are also some basic concepts in economic geography that express the central problems or goals of the subject, which the subject is trying to solve or achieve. Concepts are, therefore, indicative of the progress of any subject. Concept is different from theory or definition. Principles are the criteria that are valid for a particular situation and on the basis of which other relevant truths are explored. Definitions are called generalized statements incorporating more and more facts. A subject is studied according to its basic concepts. Discussion of one concept leads to the introduction of other corollaries and thus the study of that subject becomes more and more intensive. The basic concepts of economic geography reflect and create the nature of the subject itself in the form of a mutually coordinated and folded combination. Dr. Kashinath Singh and Dr. Jagdish Singh is presented A brief overview of the basic concepts of economic geography described It becomes imperative to do this to show the major sources of study progress of geography.

3.2 INTRODUCTION

Geography of economic activities deals with the location and organization of economic activities in space and accordingly is closely related with the organization of economic space. The primary sector of the economy extracts or harvests products from the earth such as raw materials and basic foods. Activities associated with primary economic activity include agriculture (both subsistence and commercial), mining, forestry, grazing, hunting and gathering, fishing, and quarrying.

3.3 GEOGRAPHICAL ECONOMIC ACTIVITIES

The following activities are studied under Geographical Economic Activities.

- The concept of economic landscapes.
- Economic landscape is not a static but dynamic element
- Existing economic landscape reflects the resource structure, economic processes and stage of economic development.
- Location and localization of economic activities.
- Spatial functional interaction.

- Regional economic development.

1. The concept of economic landscapes - The most basic concept of economic geography is that of economic landscape. The economic landscape is characterized by distinct economic characteristics of a particular region, that is, a regional economic personality. The overall nature of various elements, commodities, equipment, etc. related to various aspects of economic activities of any state, such as agriculture, industry, mining, trade, etc., emerge in the economic landscape. In this way, the landscape of the regional economy is represented in the economic landscape. The concept of economic landscape originated from the German word Landschaft. According to the German scholar Rudolf Wetgens, the ultimate goal of economic geography is to determine economic landscapes and its practical purpose is to achieve maximum efficiency in the use of nature by humans for economic purposes. Otrama also considered an interpretation of economic landscapes as the main objective of economic geography. Economic landscape shows the physical structure of a state's economic activity. Just as most of the human activities are economic, similarly in the cultural landscape, economic Landscapes are predominant. Various economic mechanisms are found in the economic landscape of a state, each of which has the primacy of a particular economic activity. As such, industrialized economic system states also exist. The importance of industry and trade is found in the economic landscape of the country, but in it agriculture, etc., other activities - economic landscape is not static but dynamic elements.
2. Economic landscape is not a static but dynamic element- in this concept, economic landscape on one side and man On the other hand, if it affects the immediate economic functions, then on the other hand, it gets affected and also changes. The existing economic landscape generally represents the compiled form of man's past economic work. Under this concept, every important economic progress and economic processes of different periods of human beings are marked to be marked. In some areas, the impression of economic work of this very ancient period is also visible. Therefore, to understand and explain the present form of an economic landscape, it is necessary to think about its systematic development. This discussion is actually related to the transformation process of the economic landscape. At any stage, this change process is incomplete. If

the analysis of the economic landscape is limited to contemporary conditions, then the analysis of the entire landscape will be incomplete. A discussion of the present form of an economic landscape gives an idea of a static landscape, but in fact the present form only presents an occasional picture, then the interaction and interaction of the then diverse elements is a byproduct. Remnants of past landscapes are also found in any existing economic landscape, with the help of which it is possible to properly analyze its dynamic nature. In a subsistence economy prime economic landscape, it is possible to undergo radical changes due to industrialization respectively. Based on this concept, Weber and other scholars have succeeded in establishing various industries in the economic system and formulating the principles of general economic development by adopting the Evolutionary approach.

3. Existing economic landscape; the resource structure, economic processes and the stage of economic development - Sorting method. Somewhere a particular economic element or method arises, just like the economic activity, there is rejuvenation in the economic landscape, which revives the process of economic development and the new development process is imprinted on the pre-existing economic landscape. The revival in the economic landscape is due to the arrival of new people in some part, the rise of new culture and the invention of new techniques of resource utilization. New technologies are sometimes invented in a revolutionary but sometimes revolutionary manner. Revolutionary changes in socio-economic environment and institutions can also lead to revival of the economic landscape. A similar resurgence has probably started in countries like China, India. In fact, the state of the economic landscape in any country can be determined after thorough study of the economic landscape of that country. The summary is that economic development is the result of resource use by human beings having technical knowledge. It explains the process and selective use of human resources under the periphery of the entire resource human culture in various regions and periods for interpreting the economic landscape.
4. Regional economic development: The concept of regional economic development reflects the practical aspect of economic geography. It was only in 1920 that Drayor described economic geography as a practical approach. The concept of regional economic development emphasizes proper utilization of resources and maximum production through regional

economic integration. The basic objective of economic geography is to explain the variation in the level of economic development in different regions. This requires measurement and analysis of various aspects of economic development. According to Prof. Ullman, the basic purpose of regional research in economic geography is to determine and explain the level of current economic development of a particular state. In this context, discussion of progress in resource accessibility - rarity and cultural - technical field is more important than other states in particular state. For regional economic development, the associated and balanced resource utilization of different states is essential as regional functional interaction and regional functional organizations will be in proper form only. This is why regional planning of regional interconnected economic development is more important in economic geography.

3.4 SYSTEMATIC ACTIVITIES

The analysis of the internal elements of the economic landscape requires the help of another basic concept. This concept is related to the status and placement of economic activity. The economic landscape is a set of several economic activities. That is why the concept of position and placement has the most importance in economic geography. The use of maps is essential for studying the status of various economic functions. Economic Work - Specific condition and placement conditions And the study of the elements attracts the most attention of economic geographers and they are trying to explain the status of the economic works, the placement and distribution model, and the rendering of general principles. For this, both regional and systematic approaches are used. This new element or method becomes chronologically most influential in its expansion area and the old elements and methods start disappearing, however remains of ancient elements and methods which bear witness to the nature of the past economic system. The present characteristics of an agricultural or industrial state develop from time to time. There is also the beginning, expansion, development, maturity and attainment of such regions in order. J. C. Beaver (J.C. Weaver) has used the trilogy of Structure, Process and Stage to explain the economic landscape. The structure includes the characteristics of the resource base. It consists of both natural and human resources. According to the stage of economic development, in various parts of the world, the young stage of economic development, the mature stage and the old stage are available. The economic landscapes of puberty are found in those parts where human resource use has started in large quantities only recently and resource use has been limited. Brazil and Min's Economic Landscapes in Latin America and Africa, Economy Similar to Youth, Economic Landscapes are found in countries like USA, Canada, Russia, Australia, New Zealand, etc. where economic growth has reached extremes. Older economic landscapes are found in Britain and some other countries in Europe, where the history of resource use is very old, but this does not mean that there is no possibility of economic progress in old age landscapes. Naturally stated earlier, the economic landscape is a composite form of regional affiliation with various economic elements of a particular state and their other natural human elements of that region. Synthesis is done in the geographical perspective of the independent subjective analysis of these various elements within the boundary of the economic region and thus it becomes easy to understand the true nature of the economic landscape.

3.5 SPATIAL ACTIVITIES

Spatial functional interaction is a mutually functional interaction between different economic regions of the world. This type of interconnection is necessary for the development of economic regions. In the era of modern specialization and production on a large scale, any economic work affects the whole world and is itself influenced by other economic-socio-political conditions of the world. Therefore, no economic region can remain separate from other states. In fact, incentives for a particular type of production in a particular state and means of producing it can be obtained not only from a remote region directly from the same state and the goods produced can be consumed in the same way. This regional functional interaction is the basis of economic development. Territorial functional interaction is both transverse and perpendicular, that is, there is interaction between different economic regions of the same hierarchy level and there is a similar relationship between regions at different levels of the state hierarchy. The expression of regional organization of the economic system is through such infinite regional functional interaction.
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economic functional hierarchy in different industries ie regional structure of economic landscape, such as interconnection of real important human elements between different regions of the world. This developed functional hierarchy arises from the increasing volume and complexity of units of economic industry on a large to small scale, as well as the parallel relationships and functional interconnections of central organizations.

The following example will explain this concept of regional functional organization. An agricultural farm is a unit of economic industry. The agricultural farm is spread around the farmstead and is related to it. A commodity manufacturing industry, which is a separate unit of economic industry, develops at a central place. Therefore, there is no direct connection between the factory of agricultural farm and the commodity manufacturing industry, but in fact both are interrelated with a city which is the center of the commodity manufacturing industry as well as the market and supply center for agriculture. This process is repeated at every level of the hierarchy of central and homogeneous regions and eventually the world class economic landscapes become interconnected, but the intensity of interconnecting in such a functional organization varies according to the complexity of the economic system. Can. Initial economic systems do not provide Surplus, so no means of transportation and trading centers are required and as a result regional functional organizations may be separated only at the lower levels of the territories. On the other hand, the regional functional organization in the industrial trade economy system develops to the world level. 6. Territorial - Regional economic development - The concept of regional economic development shows the practical aspect of economic geography. It was only in 1920 that Drayor described economic geography as a practical approach. The concept of regional economic development emphasizes proper utilization of resources and maximum production through regional economic integration. The basic objective of economic geography is to explain the variation in the level of economic development in different regions. This requires measurement and analysis of various aspects of economic development. According to Ullman, the basic objective of regional research in economic geography is to determine and explain the level of current economic development of a particular state. In this context, it is more important to discuss resource accessibility rarity and progress in cultural technical field than other states in a particular state. For regional economic development, the associated and balanced resource utilization of different regions is essential because regional functional interaction and regional functional organizations will be in proper form only. This is why regional planning of regional interconnected economic development is more important in economic geography.

3.6 CONCLUSION

A major branch of human geography is the study of the variation found in human economic activities from one place to another in the past. In other words, it deals with the distribution patterns of different types of economic activity, and the factors and processes that affect the regional differentiation of these models on the ground. Economic resources include natural resources of soil, water, bio-elements, minerals, energy etc.; Studies on economic activities and other economic aspects and organizations are included in hunting, fisheries, animal husbandry, forestry, agriculture, manufacturing industry, transport, communication, trade, commerce etc. Economic landscapes are always dynamic. Economic objectives are group of economic activities. The importance of the place increases wherever its center is found. Maps are of great importance in economic activities. Through the map, we get the information of any place very easily. Being dynamic, there is a difference in all its forms. Ultimately, the conclusion that economic geography cannot be conceived without economic activity. Therefore, all actions that a human being performs in harmony with nature are dynamic and continue to run parallel to man and nature.

3.7 SUMMARY

The expression of the form of a subject is expressed through its fundamental concepts. There are also some basic concepts in economic geography that express the central problems or goals of the subject, which the subject is trying to solve or achieve. Concepts are, therefore, indicative of the progress of any subject. Concept is different from theory or definition. Principles are the criteria that are valid for a particular situation and on the basis of which other relevant truths are explored. Definitions are called generalized statements incorporating more and more facts. A subject is studied according to its basic concepts. Discussion of one concept leads to the introduction of other corollaries and thus the study of that subject becomes more and more intensive. The basic concepts of economic geography display and form the subject itself as a form of mutually coordinated and folded combination. Dr.

Kashinath Singh and Dr. Jagdish Singh brief overview of the basic concepts of economic geography described is presented. It becomes imperative to do this to show the major sources of study progress of geography. The primary sector of the economy extracts or harvests products from the earth such as raw materials and basic foods. Activities associated with primary economic activity include agriculture (both subsistence and commercial), mining, forestry, grazing, hunting and gathering, fishing, and quarrying.

3.8 GLOSSARY

- Systematic: Done or acting according to a fixed plan or system ; methodical
- Activities: The condition in which things are happening or being done.
- Spatial: relating to or occupying space.
- Commercial: concerned with or engaged in commerce.
- Associated: (of the company) connected or amalgamated with another company or companies.

3.9 ANSWER TO CHECK YOUR PROGRESS

Q1. What are geographical economic activities?

Ans. A nation's economy can be divided into sectors to define the proportion of a population engaged in different activities. This categorization represents a continuum of distance from the natural environment. The continuum starts with primary economic activity, which concerns itself with the utilization of raw materials from the earth, such as agriculture and mining. From there, the distance from natural resources increases as sectors become more detached from the processing of raw material.

Q2. Define spatial activities?

Ans. Spatial intelligence, also known as visual spatial intelligence or spatial reasoning, is the ability to imagine or visualize in one's mind the positions of objects, their shapes, their spatial relations to one another and the movement they make to form new spatial relations.

3.10 REFFERENCES

- Mamoriya, Chaturbhuj and Joshi, Ratan, Economic Geography.
- Sharma, Bhajanlal Rajkumar, Economic Geography.

3.11 SUGGESTED READINGS

- Saxena, Shankar Sahay, Economic Geography.

3.12 TERMINAL QUESTIONS

Q1. Explain the geographical economic activities?

Ans. The following activities are studied under Geographical Economic Activities.

- The concept of economic landscapes.
- Economic landscape is not a static but dynamic element
- Existing economic landscape reflects the resource structure, economic processes and stage of economic development.
- Location and localization of economic activities.
- Spatial functional interaction.
- Regional economic development.

1. The concept of economic landscapes - The most basic concept of economic geography is that of economic landscape. The economic landscape is characterized by distinct economic characteristics of a particular region, that is, a regional economic personality. The overall nature of various elements, commodities, equipment, etc. related to various aspects of economic activities of any state, such as agriculture, industry, mining, trade, etc., emerge in the economic landscape. In this way, the landscape of the regional economy is represented in the economic landscape. The concept of economic landscape originated from the German word Landschaft. According to the German scholar Rudolf Wetgens, the ultimate goal of economic geography is to determine economic landscapes and its practical purpose is to achieve maximum efficiency in the use of nature by humans for economic purposes. Otrama also considers interpreting economic landscapes as the main objective of economic geography. Economic landscape shows the physical structure of a state's economic activity. Just as most of the human activities are economic, similarly in the cultural landscape, economic Landscapes are predominant. Various economic mechanisms are found in the economic landscape of a state, each of which has the primacy of a particular economic activity. As such, industrialized economic system states also exist. The importance of industry and trade is found in the economic landscape of the country, but in it agriculture, etc., other activities -

economic landscape is not static but dynamic elements

2. Economic landscape is not a static but aynamic element- in this concept, economic landscape on one side and man On the other hand, if it affects the immediate economic functions, then on the other hand, it gets affected and also changes. The existing economic landscape generally represents the compiled form of man's past economic work. Under this concept, every important economic progress and economic processes of different periods of human beings are marked to be marked. In some areas, the impression of economic work of this very ancient period is also visible. Therefore, to understand and explain the present form of an economic landscape, it is necessary to think about its systematic development. This discussion is actually related to the transformation process of the economic landscape. At any stage, this change process is incomplete. If the analysis of the economic landscape is limited to contemporary conditions, then the analysis of the entire landscape will be incomplete. A discussion of the present form of an economic landscape gives an idea of a static landscape, but in fact the present form only presents an occasional picture, then the interaction and interaction of the then diverse elements is a byproduct. Remnants of past landscapes are also found in any existing economic landscape, with the help of which it is possible to properly analyze its dynamic nature. In a subsistence economy prime economic landscape, it is possible to undergo radical changes due to industrialization respectively. Based on this concept, Weber and other scholars have succeeded in establishing various industries in the economic system and formulating the principles of general economic development by adopting the Evolutionary approach.
3. Existing economic landscape; the resource structure, economic processes and the stage of economic development:- Sorting method. Somewhere a particular economic element or method arises, just like the economic activity, there is a rejuvenation in the economic landscape, which revives the process of economic development and the new development process is imprinted on the pre-existing economic landscape. The revival in the economic landscape is due to the arrival of new people in some part, the rise of new culture and the invention of new techniques of resource utilization. New technologies are sometimes invented in a revolutionary but sometimes revolutionary manner. Revolutionary changes in socio-economic environment and institutions can also lead to revival of the

economic landscape. A similar resurgence has probably started in countries like China, India. In fact, the state of the economic landscape in any country can be determined after thorough study of the economic landscape of that country. The summary is that economic development is the result of resource use by human beings having technical knowledge. It explains the process and selective use of human resources under the periphery of the entire resource human culture in various regions and periods for interpreting the economic landscape.

4. Regional economic development: The concept of regional economic development reflects the practical aspect of economic geography. It was only in 1920 that Drayor described economic geography as a practical approach. The concept of regional economic development emphasizes proper utilization of resources and maximum production through regional economic integration. The basic objective of economic geography is to explain the variation in the level of economic development in different regions. This requires measurement and analysis of various aspects of economic development. According to Prof. Ullman, the basic purpose of regional research in economic geography is to determine and explain the level of current economic development of a particular state. In this context, discussion of progress in resource accessibility - rarity and cultural - technical field is more important than other states in particular state. For regional economic development, the associated and balanced resource utilization of different states is essential as regional functional interaction and regional functional organizations will be in proper form only. This is why regional planning of regional interconnected economic development is more important in economic geography.

UNIT 4 - SECTORS OF ECONOMY: AN INTRODUCTION

4.1 OBJECTIVES

After reading this unit you will be able to understand the Sectors of Economy. Economy is a social system of production, distribution and consumption. It is a moving picture of economics in a particular country or region. This picture is of a particular period. For example, if we say 'contemporary Indian economy' it means. A description of all the economic activities of India at the present time.

4.2 INTRODUCTION

The practical side of economics is economy. An economy is a system with which the resources available in the country are exploited and new resources are created. Through the economy, an effort is made to bridge the gap between unlimited need and limited resources so that the consumer is more satisfied, the producer gets more profit and the maximum social welfare for the society is ensured. Generally, to document the economic activities of the entire economy, it is divided into three sectors –

1- Primary Sector
2- Secondary Sector
3- Third or Service sector

4.3 SECTORS OF ECONOMY

Generally, to document the economic activities of the entire economy, it is divided into three sectors -

Primary sector:

Under this, accounting of the natural areas of the economy includes the following areas such as -

Agriculture, Forestry, Fishing (fishing),Mining (vertical excavation) and quarrying (inelastic excavation)

Secondary sector:

Under this sector, the production of manufactured goods of the economy is mainly accounting for -

Construction, where a permanent asset is to be built: e.g., House-Manufacturing where an item is produced: e.g., bread, etc.

Work related to electric gas and water supply etc.

Third or Service sector:

This sector provides its useful service to the primary and secondary sector of the economy.

Transport and Communications, Banking, Insurance, Storage business, Community service etc.

In addition, the economy is divided on many other grounds. It can be outlined as follows -

Item area:

The primary sector and the secondary sector are collectively called the commodity sector, which includes the production of physical goods.

Non item area:

The service sector of an economy is also called non-goods sector.

Organized sector:

Under this comes all those units, which regularly do accounting for their economic activities, about 9 percent of the Indian economy is from this sector.

Unorganized sector:

Under this come all the units which do not keep any accounts of their economic activities; Such as hawkers, khomache, retail vegetable shops, daily laborers etc. Its contribution to the Indian economy is around 91 percent.

4.3.1 Agriculture Sector:

Agriculture is the most important sector of Indian Economy. Indian Agriculture sector accounts for 18 per cent of India's gross domestic product (GDP) and provides employment to 50% of the countries workforce. India is the world's largest producer of pulses, rice, wheat, spices and spice products. India has many areas to choose for business such as dairy, meat, poultry, fisheries and food grains etc. India has emerged as the second largest producer of fruits and vegetables in the world [1]. According to the data provided by Department of Economics and Statistics (DES) the production of food grains for the year 2013-2014 is 264 million tons which is increased when compared to (2012-2013)

257 million tons. This is a good symptom for the Indian economy from the agriculture sector. India remains among main three as far as production of different agricultural things like paddy, wheat, pulses, groundnut, rapeseeds, natural products, vegetables, sugarcane, tea, jute, cotton, tobacco leaves and so on. On the other hand, on advertising front, Indian agribusiness is as yet confronting the issues, for example, low level of business sector reconciliation and integration, availability of dependable and convenient information needed by farmers on different issues in farming [2].Agriculture in Indian Economy Indian is an agriculture based country, where more than 50% of population is depend on agriculture. This structures the main source of income. The commitment of agribusiness in the national income in India is all the more, subsequently, it is said that agriculture in India is a backbone for Indian Economy. The contribution of agriculture in the initial two decades towards the total national output is between48% and 60%. In the year 2001-2002, this contribution declined to just around 26%. The aggregate Share of Agriculture and Allied Sectors, Including agribusiness, domesticated animals, and ranger service and fishery sub segments as far as rate of GDP is 13.9 percent during 2013-14 at 2004-05 prices. Agricultural exports constitute a fifth of the total exports of the country. In perspective of the overwhelming position of the Agricultural Sector, gathering and support of Agricultural Statistics expect incredible significance.

According to the fourth Advance Estimates of Production of food grains for 2013-14, aggregate food grain production is assessed to be264.77 million tons (MT).

Export of spices from India are relied upon to reach US$ 3 billion by 2016-17, on the back of imaginative promoting strategies, inventive bundling, quality in quality and an in number appropriation system.

The Indian flavors business is pegged at Rs 40,000 crore (US$ 6.42billion) every year, of which the marked portion represents 15% [3]. The National Food Security Mission (NFSM) was launched from Rabi, 2007-08. The fundamental targets of the National Food Security Mission (NFSM) is to expand production of rice, wheat, pulses and coarse cereals through region extension and efficiency upgrade in a supportable way in the recognized locale of the nation; restoring soil ripeness and profitability at the individual ranch level; and improving farm level economy (i.e. ranch benefits) to restore confidence amongst the farmers. The Mission met with a staggering achievement and accomplished the focused on extra generation of rice, wheat and heartbeats. The

Mission is being kept amid Twelfth Five Year Plan with new focuses of extra generation of sustenance grains of 25 million tons including 10 million tons of rice, 8 million tons of wheat, 4 million tons of pulses and 3 million tons of coarse cereals by the end of twelfth five year plan [4].
Training is an important procedure of capacity building of people as to enhance the execution. Consequently, training needs appraisal is imperative to the training process. It serves to recognize present issues and future difficulties to be met through training and improvement.
It is obliged to figure out the needs of individual trainee on which proficient skills ought to be assembled to do the relegated occupation in the associations [5].
The 6% of agricultural production is converted in to processed food, which is focused to achieve 20% in coming future. The business is work escalated and contributes around 50% for industrial production. Multi-National Food Companies have assumed a part of making business sector draw and rivalry. Selection of inventive and experimental bundling strategies by food industry has empowered the assembling of sheltered and quality sustenance [6].
Most of the Indians are directly or indirectly depending on the agriculture. Some are directly attached with the farming and some other people are involved in doing business with these goods. India has the capacity to produce the food grains which can make vast difference in Indian Economy. To achieve targeted mark by the government it needs to provide support in case of land, bank loans and other machineries to the small farmers along with the big farmers with this we can expect some improvement in Indian economy.

4.3.2 Industrial Sector:

An industrial park is an area of a city, state or other administrative geographical unit that is mostly used for industry. It consists of factories and other industrial buildings and often there is no provision of housing for the people that is the workers working here come from different residential areas to work here. Industrial areas are often located on the outskirts of cities. The secondary sector of the economy including industries that produce a finished, usable product or are involved in construction. This sector generally takes the output of the primary sector and manufactures finished goods or where they are suitable for use by other businesses, for export, or sale to domestic consumers. This sector is often divided into light industry and heavy industry. Many of these industries consume large quantities of energy and require factories and machinery to convert raw materials into goods and products. They also produce waste materials and waste heat that may cause environmental problems or cause pollution. The secondary sector supports both the primary and tertiary sector.

Some economists contrast wealth-producing sectors in an economy such as manufacturing with the service sector which tends to be wealth-consuming.[1] Examples of service may include retail, insurance, and government. These economists contend that an economy begins to decline as its wealth-producing sector shrinks.[2] Manufacturing is an important activity to promote economic growth and development. Nations that export manufactured products tend to generate higher marginal GDP growth which supports higher incomes and marginal tax revenue needed to fund the quality of life initiatives such as health care and infrastructure in the economy. The field is an important source for engineering job opportunities. Among developed countries, it is an important source of well-paying jobs for the middle class to facilitate greater social mobility for successive generations on the economy.

4.3.3 Service Sector:

The service sector is the third of the three economic sectors of the three-sector theory. Others are secondary sector (almost similar to manufacturing), and primary sector (raw material).

The service sector involves the production of services rather than end products. Services (also known as "intangible goods") include attention, advice, access, experience, and affective labor. The production of information has long been regarded as a service, but some economists now see it as the fourth sector, the quadrilateral sector.

The tertiary sector of the industry includes the provision of services to end-consumers, along with other businesses. Services may include transportation, distribution and sale of goods from producer to consumer, as can wholesale and retail sales, pest control, or recreation. Goods can transform in the service delivery process, as in the restaurant industry. However, the focus is on serving the customer rather than focusing on people and replacing physical goods.

4.4 CONCLUSION

Under Economic Zones, we select three groups. These three groups are related to each other in some way. For example, if animal husbandry is spoken, it will display the agricultural division. Similarly, if we talk about industries, then it will be associated with agriculture. Thus, as a third sector, we are connected to the job division with the first and second division. Let's study. The tertiary division is the backbone of the first and second part. But the backbone of the third division are also the primary and secondary areas. It can be said that we cannot separate these effects in any way. These Probates complement each other as well as provide a strong foundation to the economy of the country as these three divisions are capable of performing all kinds of tasks related to the Earth. Through this chapter, it is concluded that the primary and third sectors form a foundation for the economy of every possible country. He takes the country's economy forward, which takes that nation to a different position on the globe ... like India in the tea sector, the United States of America in the wheat sector, there are many such divisions Somehow strengthen the economy of the country.

4.5 SUMMARY

Economy is a social system of production, distribution and consumption. It is a moving picture of economics in a particular country or region. This picture is of a particular period. For example, if we say 'contemporary Indian economy' it means. A description of all the economic activities of India at the present time the practical side of economics is economy. An economy is a system with which the resources available in the country are exploited and new resources are created. Through the economy, an effort is made to bridge the gap between unlimited need and limited resources so that the consumer is more satisfied, the producer gets more profit and the maximum social welfare for the society is ensured. Generally, to document the economic activities of the entire economy.

4.6 GLOSSARY

- Sectors: An area or portion that is distinct from other.
- Industrial: relating to or characterized by industry.
- Exploited: Make full use of and derive benefit from (a resource)
- Production: the action of making or manufacturing from components or raw materials, or the process of being so manufactured.

4.7 ANSWER TO CHECK YOUR PROGRESS

Q1. How many sectors of economy?

Ans. Generally, to document the economic activities of the entire economy, it is divided into three sectors -

- Primary sector, Secondary sector, Third or service sector.

Q2. Define the industrial sector.

Ans. This sector generally takes the output of the primary sector and manufactures finished goods or where they are suitable for use by other businesses.

Q3. Define the service sector?

Ans. The service sector is the third of the three economic sectors of the three-sector theory. The others are the secondary sector, and the primary sector. The service sector consists of the production of services instead of end products.

4.8 REFERENCES

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- Sharma, Bhajanlal Rajkumar, Economic Geography.

4.9 SUGGESTED READINGS

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4.10 TERMINAL QUESTIONS

Q1. Explain the sectors of the economy?

Ans. Generally, to document the economic activities of the entire economy, it is divided into three sectors -

Primary sector:

Under this, accounting of the natural areas of the economy includes the following areas such as -

Agriculture, Forestry, Fishing (fishing),Mining (vertical excavation) and quarrying (inelastic excavation)

Secondary sector:

Under this sector, the production of manufactured goods of the economy is mainly accounting for -

Construction, where a permanent asset is to be built: e.g.,Bhavan-
Manufacturing where an item is produced: e.g., bread, etc.
Work related to electric gas and water supply etc.

Third or service sector:
This sector provides its useful service to the primary and secondary sector of the economy.
Transport and Communications, Banking, Insurance, storage, business, Community service, etc.
In addition, the economy is divided on many other grounds. It can be outlined as follows -

Item area:
The primary sector and the secondary sector are collectively called the commodity sector, which includes the production of physical goods.
Non item area:
The service sector of an economy is also called non-goods sector.
Organized sector:
Under this comes all those units, which regularly do accounting for their economic activities, about 9 percent of the Indian economy is from this sector.
Unorganized sector:
Under this come all the units which do not keep any accounts of their economic activities; Such as hawkers, khomache, retail vegetable shops, daily laborers etc. Its contribution to the Indian economy is around 91 percent.

Q2. Explain the service sector?
Ans. The service sector is the third of the three economic sectors of the three-sector theory. Others are secondary sector (almost similar to manufacturing), and primary sector (raw material).

The service sector involves the production of services rather than end products. Services (also known as "intangible goods") include attention, advice, access, experience, and affective labor. The production of information has long been regarded as a service, but some economists now see it as the fourth sector, the quadrilateral sector.

The tertiary sector of the industry includes the provision of services to end-consumers, along with other businesses. Services may include transportation, distribution and sale of goods from producer to consumer, as can wholesale and retail sales, pest control, or recreation. Goods can transform in the service delivery process, as in the restaurant industry. However, the focus is on serving the customer rather than focusing on people and replacing physical goods.

BLOCK 2 : PRIMARY ACTIVITIES

UNIT 5 - PRIMARY ACTIVITIES: CONCEPT, CLASSIFICATION AND IMPORTANCE

5.1 OBJECTIVES

The objectives of the study are given below:

- to know the importance of primary activities
- study of different type of primary activities found in World
- sub divided the primary activities on the basis of work of nature
- to study the different type of characteristics of the gathering activity
- to see the distribution pattern of primary activities
- to prepare a distribution pattern map of primary activities

5.2 INTRODUCTION

Human economic activities are adversely affected by the physical and social environment. These economic activities are the basis of economic development of any country. Physical environment includes geographical location, drainage system, land, soil type, natural vegetation and mineral resources etc. On the other hand social environment concern with the urbanization, industry, trade, population etc.It is well known that Physical and social condition are differ from place to place in the various parts of world. Sohuman economic activities are also differing from place to place.For example some areas are dominated by primary activities and others are dominated by secondary or tertiary activities etc.Human economic activities have been divided into five parts as give below:

PRIMARY ACTIVITIES

Primary activities are directly related with the obtaining product from nature. Activities such as hunting of animals, obtaining minerals from the earth crust, and gathering of products from plants are come under primary activities. The workersoccupiedthese economic activities are also known as red-collar workers.

SECONDARY ACTIVITIES

Secondary activitiesare related with the increasing and processing the utility of products of the primary activities such as production of sugar from sugarcane, production of textiles by processing fibers obtained from animals or plants, furniture from wood and production of steel goods by processing iron ore.Thus all manufacturing industries are secondary activities.These activities are highly developed in developed countries. The people occupied these activities are also known as blue-collar workers.

TERTIARY ACTIVITIES

These activities are related to the providing services. The examples of tertiary activities are trade and commerce, transportation, and communication.The workers engaged in these activities are also known as pink-collar workers.

QUATERNARY ACTIVITIES

These activities includes professional and administrative services such as education, development, information processing, teaching, entertainment services, health service and government services.The workers of these activities are often known as white- collar workers.

QUINARY ACTIVITIES

This activity includes researchers, planners, legal authorities and financial advisors. Sometimes these workers are called gold-collar workers.

5.3 MEANING OF PRIMARY ACTIVITIES

Primary activities include agriculture, mining, fishing, forestry and gathering.These activities are usually important in less developing countries of the world.It is the sector of an economy making direct use of natural resources. It the larger sector in developing countries.Primaryactivities canbe classified as give below;

- Gathering
- Agriculture
- Hunting
- Mining
- Fishing
- Forestry

Images of primary activities

5.4 CONCEPT OF PRIMARY ACTIVITIES

Primary activities or primary industry comprise all economic activities based on the axtraction or harvest of goods from the natural environment. It is vital not only for the economy but olso for the sustenance of the human race. One can even say that primary economic activities from the 'buitding block' of other economic activities. These activitiescontrast with the secondary activities that produseconsumar goods and the tertiary sector that offers servise. Most of the products extracted from the primary economic activities are used in other industries where theybecome factors of production. Primary activity includes those occupations which are closely related to man's natural environment. Gathering hunting, fishing, lumbering, animal rearing. Farming and mining are some of important examples of primary activities.

5.5 CLASSIFICATION AND IMPORTANCE OF PRIMARY ACTIVITIES

CLASSIFICATION OF PRIMARY ACTIVITIES: The classification of economic activities into primary, tertiary and secondary is useful on account of the information it providrs on how and where the people of a country ore employe. Primary activity includes thoueaccupations which are closely related to men's natural environment, gathering, hunting, fishing, lumbering, animal rearing. Primary and mining are some of important examples of primaryactivities.

IMPORTANCE OF PRIMARY ACTIVITIES: Primary activities means agricultural sector. In a country like india the main source of income even today is agriculture. The well being of other two sectors depands upon agriculture. Primary sector provides the base for the other sectors of the economythe primary activities fulfils the demand of row material needed by secondary activities for their operations.

Gathering: Gathering is one of the primary activities and is the oldest occupation of human being. Gathering is an occupation which includes the collection of different things from the forest resources. There are many parts in the world where man is dependent on this occupation. It is the simplest occupation of mankind. *Primitive gathering, the lowest order of economicactivities, is fading rapidly from the face of the earth, and is currently practiced y only a fewthousand people (John W. Alexander*

Fig. 1: World Gathering

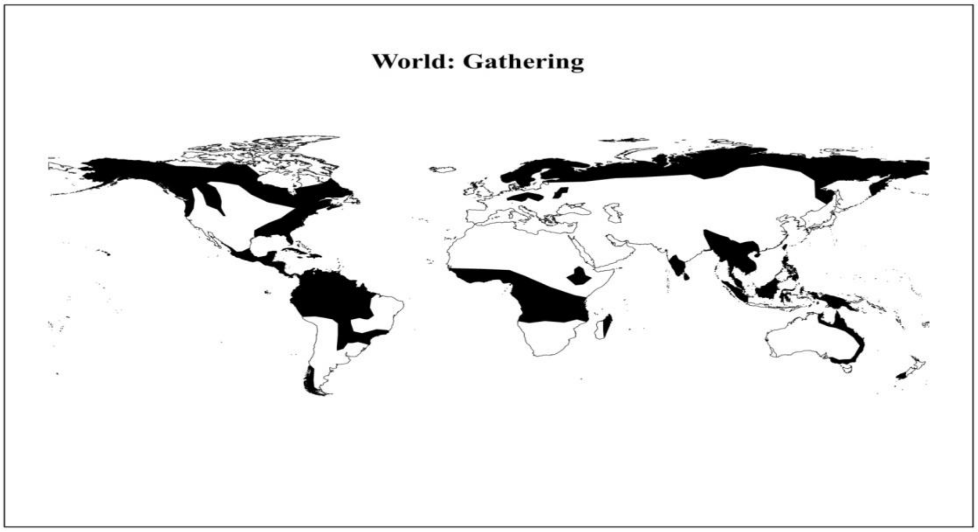

Image showing gathering

Types of gathering

Gathering may be divided into two parts:

A. **Subsistence gathering:**This is widely spread in the areas of Amazon, equatorial region, Kalahari deserts and mountain region of the world.Objectives of subsistence gathering aregathering of food products, grass for home, wood, leatheretc.

B. **Commercial gathering-**on the basis of forest characteristics it is classified into two parts:

Commercial gathering in Tropical forest:

Commercial gathering is widely spread in Tropical forest. These areas are known for evergreen hard wood forest. These are found in the areas of south and Middle America, middle Africa and south – East Asia (Fig. 1). The major products of Tropical forest are fruit, chickle, nuts, fibers', drugs, tanning materials and leaf etc.

- Fibers –fibersare obtained from plants growing in thesavannas and tropical forests. Some examples of fibers are a Toquillafiber which is gathered from toquillapalm in Ecuador, Panama and Colombia. Toquillafiber is used for making the well-known Panama hats.
- Gums and Resins- these are obtained from tropical forests.Lata, chickleare collected from tropical rainforests.
- Chickle-Chickleis used for making chewing gums.This product is obtained from the sap of the Zapote trees. These trees are mostly found in the tropical rain forests lies in Southern Mexico and British Honduras to Brazil.
- Rubber- This is an important activity.This is done in tropical forests of western Africa and southern America.
- Nuts and seeds- Nuts and seeds are obtained from the tropical rainforests. Variousspecies of the tropical rain forests produce nuts. Theseare used for food and a variety of other purpose by the natives. A number of types of nuts find a good export market too.It is well known that coconuts have been gathered for food and drink for a long time. On the other hand, several of the nuts give oils.
- Drugs- besides the nuts and seeds the forest also provideothersproducts used as drugs. Such as Camphor and quinine.
- Tanning materials – Forest alsoprovides tanning material. Mainly tanning is obtained form the bark and leaves of the mangrove trees.

Sub- tropical and temperate region

it is lies in Australia, Europe, Asiaandnorth America. Commercial gathering is less developed inSub- tropical and temperate region. Given below are the major product which gathered from these areas:

- **Tanning materials**- these are the most important products of gathering activity obtained fromSub- tropical and temperate region.Tanning industry has developed in many parts of the world and it is known as a simple industry. The major sources of tanning materials aremixed hardwood and coniferous forests of oak, hemlock and chestnut in eastern United States.
- **Cork-**Cork industry is also based forest gathering. This industry is highly developed in the Mediterranean region. It is obtained from the ark of oak.
- **Turpentine and resin**–these are obtained from another group of the products collected from the temperate and sub- tropical forests. The chief source of resin is pine forests from which turpentine is obtained.Key producers of turpentine and rosin are United States and France. While the pine forests of Himachal Pradesh and Uttaranchal states in India are the main sources of resins and turpentine.

HUNTING:

It is also the oldest occupation of human being like the gathering. It is the practice of killing or trapping animals. Hunting is done with primitive methods. The group cannot be too large, or can settlements normally be permanent It is most commonly done by humans for food, recreation, to remove predators that are dangerous to humans or domestic animals, or for trade. The figure 2 shows the hunting region of the world.

Image showing Hunting

Hunting regions of the world are:

The major Hunting regions of the world are the following given:

- Amerinds of Amazon
- pygmies of kango,
- Semang of Malaya,
- Papua people of New Guina,
- Punan of Borneo, bushman, Askimos etc.

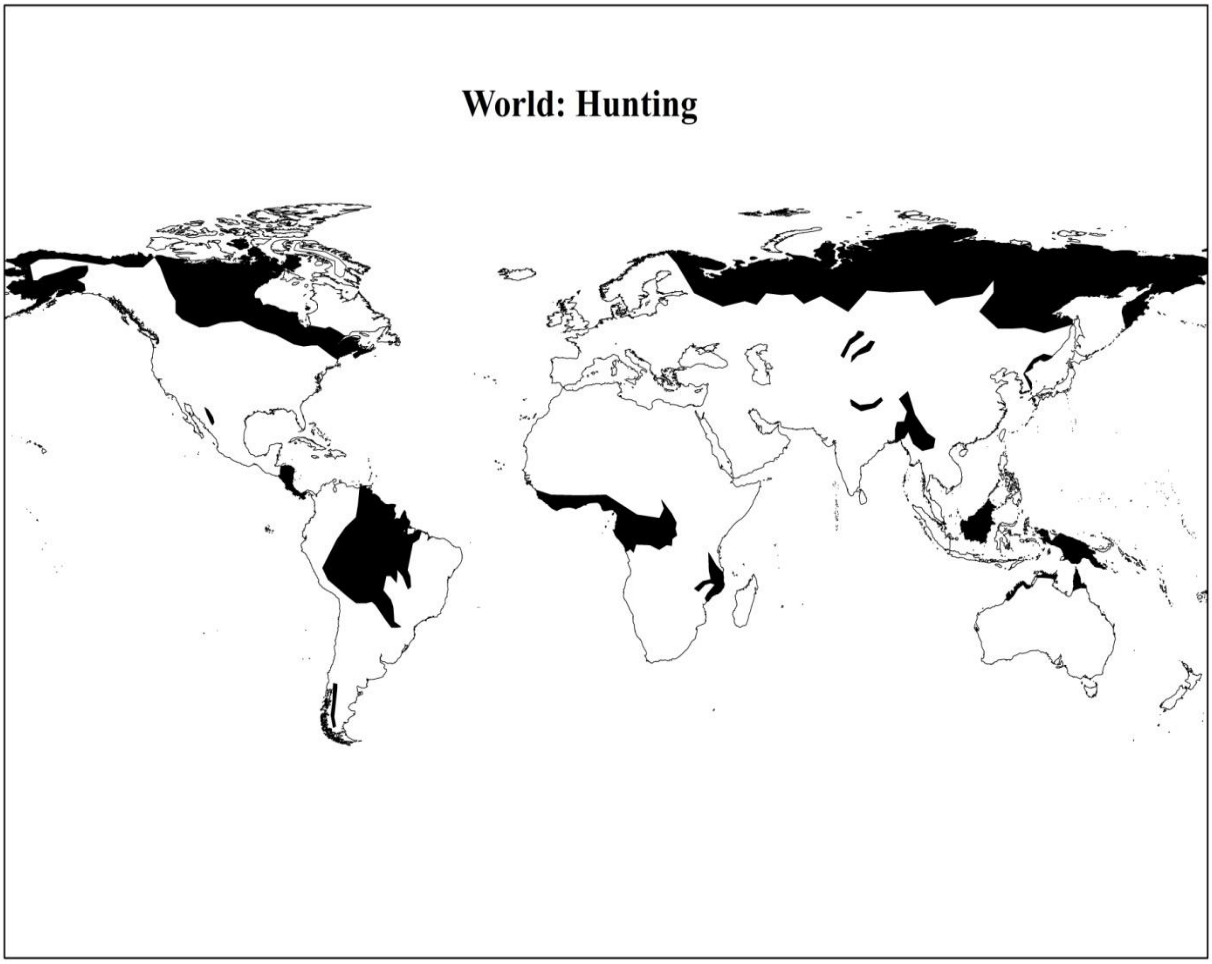

Fig. 2 Hunting regions of the world

LUMBERING

Lumbering or timer production is widely spread as gathering. In terms of economic point of view it is the most important forestry activity. This activity is done in many regions of the world.Coniferous, hardwood and mixed forests of the northern hemisphere are the chief areas of this activity. The major products of lumbering industry are industrial round wood and fuel wood Russia, China, Brazil, Canada, United States, India, Indonesia and Nigeria account 60 per cent of the total round wood production of the world (Fig. 3).

Worldwide, half of the wood consumption occurs in the form of fuel wood. Lumbering activity provides about 80 percent of the world's industrial wood in the mid-latitude regions. The leading producers of the industrial timber are United States, Russia and Canada. Less developed regions for lumbering activity are lies in tropical forests due to a variety of factors.The forest reserve is limited.In many parts of the world forest reserve show a declining trend. In disparity many Asian countries face a timer scarcity. Huge areas of Middle East, china, North America, and India have lost their tree cover.

Image showing lumbering activity

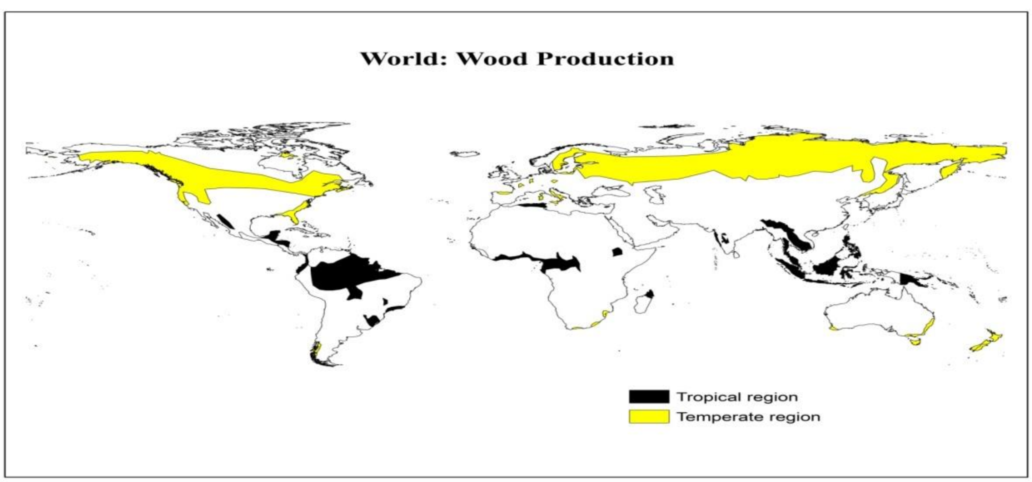

Fig. 3 World: Wood Production

Major Region of wood production in the world:

- **Russia-** First in the production of woodslies from Ural to Kamchatka.
- **USA-** 15 % production of world, chief area are great lake, rocky, Alaska, aplacian etc.
- **Canada** – 4.5 %, major area are found in Colombia, Ontario, north prairie area, these are famous for soft wood and also known as store house of soft wood.
- **European country**- 10 % of the world production, major regions areNarve to Russian forest belt, Sweden, FinlandFrance, Germany.
- **Asian country –** China, India (8% and 7.7%), Burma, Japan.
- **South America**-Major trees areCheed wood, pine, seeder
- **Australia** (S-E, TASMINAI)and New Zealand

Animal Grazing and Animal Rearing

This is also the one of the first primary activity of mankind.In this activity people make some investment to increase natural production. So this activity is different and more advanced than hunting and food gathering. Cultural changes are occurs in human societies due to Pastoral herding from the hunting activity and food gathering stage.Labor is the major investment of the people occupied this occupation. The animals reared in this occupation are very from place to place. Camel, Sheep, goats, reindeer, cattle, and yak are the chief animals of this activity.

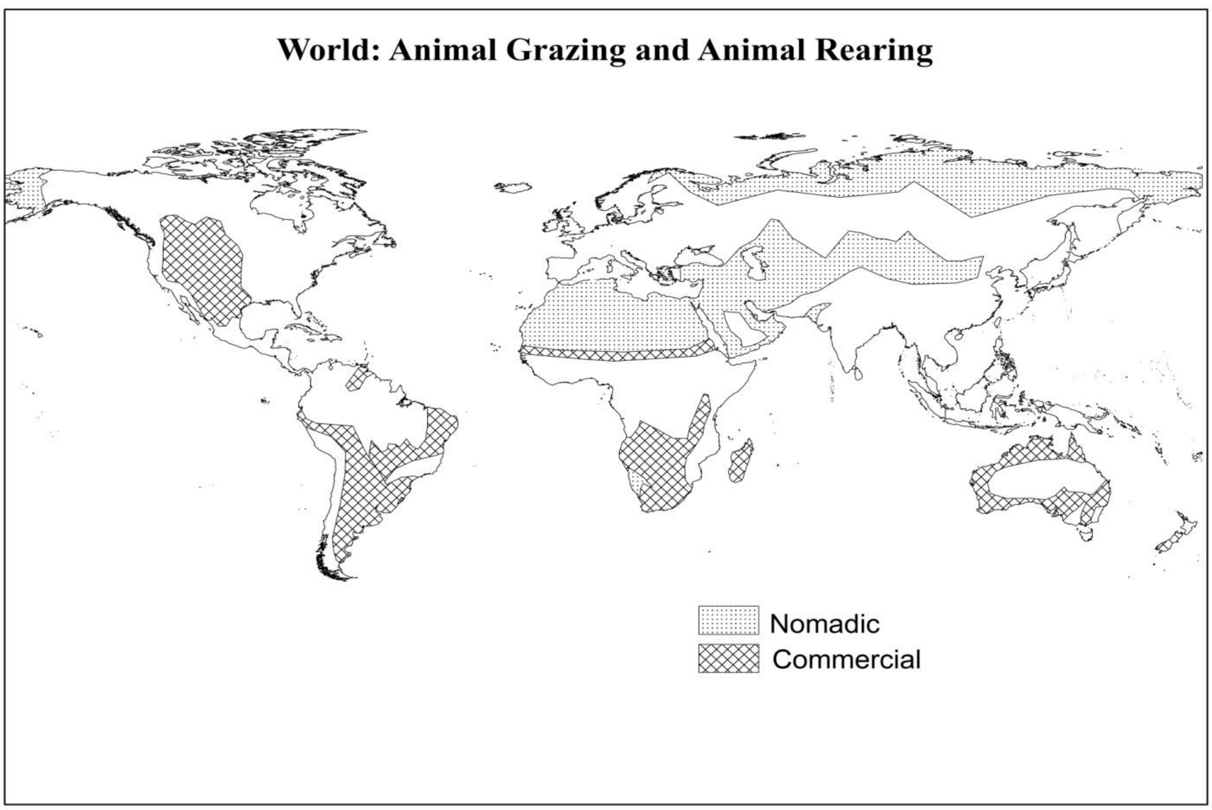

Fig. 4 World: Regions of Animal grazing and animal rearing

Animal grazing and animal rearing occupationmainly can e classified into two parts:

1. **nomadic herding**
2. **commercial grazing**

Nomadic herding

It is well known that natural pasture is the base of nomadic herding. It is a usual migratory undertaking. The characteristics of nomadic herding areas are less fertile soils and relatively dry land. Sahara desert, Iran, Saudi Arab, Eastern Africa, Iraq, China and Magnolia, South frontier of Tundra are the chief area of nomadic herding (Fig. 4).

Commercial grazing

In this activity large numbers of people are engaged worldwide. This activity is also called livestock ranching. Commercial grazing involves thecommercial rearing of livestock at huge cattle farms.The nature of workers engaged under this occupation is not nomadic. These cattle farms are settled and people engaged in this activity have settled homes.

Major regions:

Commercial grazing in Temperate grasslands:

1. **prairie grasslands**- West of USA, Plains of Canada and North of Mexico
2. **South America-** Argentina (Pampas), Parana and Uruguay (Sarpil land)
3. **Australia** –S-E and west (Downs)
4. **New Zealand**- cantaburry
5. **South- Africa**- veld

Commercial grazing in Tropical grasslands:

1. **Savanas of Africa**– 1/3 of Africa, from AtlanticOcean to via Sudan and high lands.
2. **The savannas of South America**- Orinoco river, compos of brazil, Chaco plateau
3. **Australia**

FISHERIES

As per FAO a fishery is typically defined in terms of the people involved, species or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities or a combination of the foregoing features. It may include the capture of wild fish. It also involves raising fish through fish farming or aquaculture. More than 500 million livelihoods of the people in developing countries depend on this primary activity. A present day overfishing is a problem.

It is reducing fish stocks and employment in many fishing grounds of the world. On the basis of nature of water fishing can be divided into two parts Fresh water and Sea water fisheries. Major Fisheries industries are lies in the middle of northern latitudes. The causes of development are physical and economic factor. Physical factor includes rough continental self, fishing bank, cold and warm current, cold climate and forest availability. On the other hand economic factor includes demand, shortage of food, transportation facilities, cold storage house and scientific development.

Fishig activity

Fishing activity

Principle fishing ground of the world

1. the north- west pacific fishing ground

Itis spread from baring sea to eastern China Sea (Fig.5). It is the biggest fishing ground of the world. In this region commercial fishing is best developed in Japan. The major factors behind this are organized industry with modern fishing methods. Cod, Halibut, Alaska, King crab and Salmon are the most important catch.

2. the north-west Atlantic fishing ground

This region is lies along the eastern coast of North America. Both Grand Bank and the Georges Bank arethe major fishing bank of this region. In this region the convergence of cold Labrador Current and warm Gulf Stream enhance productivity. Cod is the major fish while redfish, squid, flounder and halibut are also important.

3. the north-east Atlantic fishing ground

This fishing ground is spread from Icelandto Mediterraneancost. The major country of this region are the European countries mainly Norway, Denmark, Spain Iceland and the United Kingdom. Dogger bank is the most important area.

4. the north- east pacific fishing ground

It is lies between Alaska to Californiaalong the west coast of North America. It is the forth largestfishingground of the world. Other important fish are tuna, halibut and sardines.

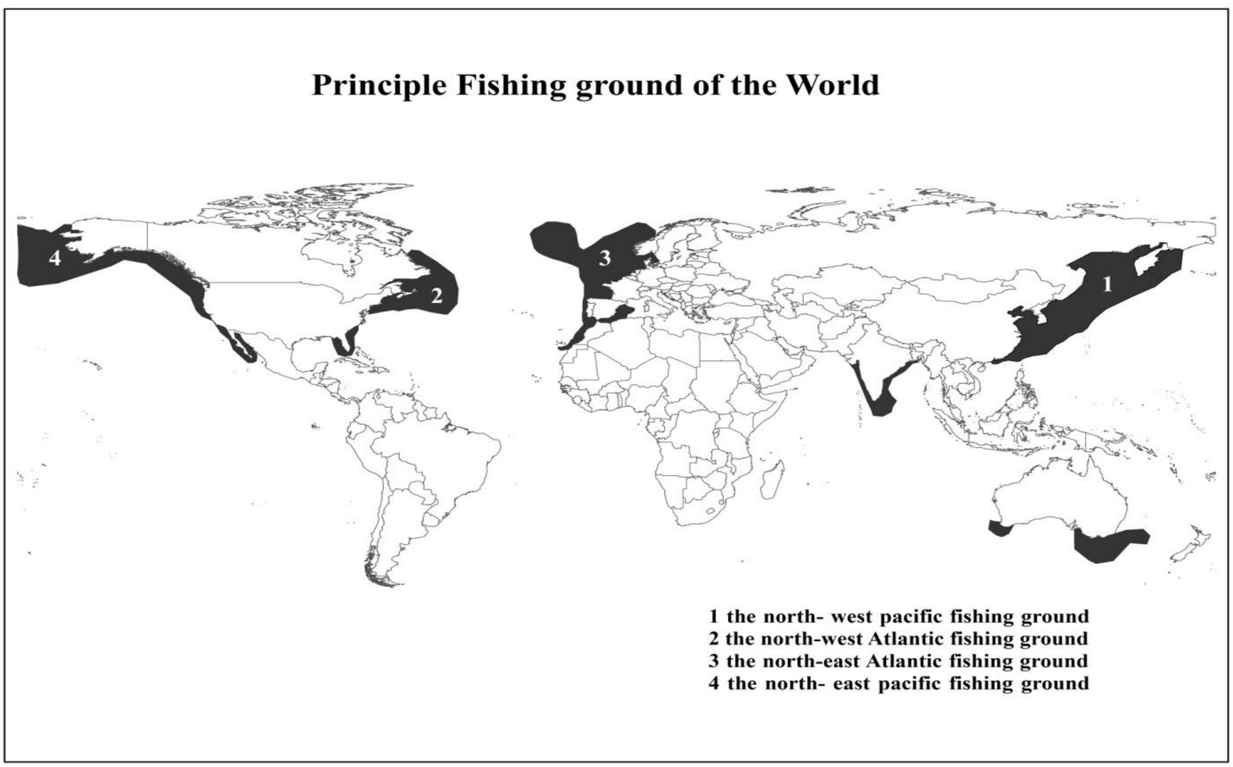

Fig. 5 major fishing ground of the world

Conservation of fishing

Following measures should e adopted in fishing conservation

- Finding of new fishing ground.
- Protection of water from oil and other type of pollution, water of fishing ground should be affluent free in order to conserve the fishes. Some restriction should be imposed on polluting water.
- Ban on rare fishes- many species of fishes are almost to an end. Hence to keep them alive a ban on fishing rare species of fishes should be stopped strictly.
- A certain quantity of catching fishing- in order to maintain the sustainability of marine resource like fish, a limit of quantity should be imposed by the management body.
- Small fishes should be banned- fishing of small fish should be banned for further preservation of fishes.

5.6 CONCLUSION

It is well known that economic activities are the basis of economic development of any country. These economic activities are also differing from place to place such as some areas are dominated by primary activities and others are dominated by secondary or tertiary activities etc. On the nature of work Human economic activities have been divided into five parts, primary activities are directly related with the obtaining product from nature, secondary activities are related with the increasing and processing the utility of products of the primary activities such as production of sugar from sugarcane, production of textiles by processing fibers obtained from animals or plants, furniture from wood and production of steel goods by processing iron ore, tertiary Activities are related to the providing services,Quaternary activities includes professional and administrative services such as education, development, information processing, teaching, entertainment services, health service and government services and Quinary Activities includes researchers, planners, legal authorities and financial advisors.

Gathering is one of the primary activities and is the oldest occupation of human being which includes the collection of different things from the forest resources. These are found in the areas of south and Middle America, middle Africa and south – East Asia. Hunting is also the primary activity and is the oldest occupation of human being like the gathering. It is the practice of killing or trapping animals. Lumbering or timer production is widely spread as gathering. Major Fisheries industries are lies in the middle of northern latitudes. the Principle fishing ground of the world are the north- west pacific fishing ground, the north-west Atlantic fishing ground, the north-east Atlantic fishing ground, and the north- east pacific fishing ground.

5.7 SUMMARY

The objectives of the study are to known importance of primary activities, study of different type of primary activities found in World; sub divided the primary activities on the basis of work of nature, to study the different type of characteristics of the gathering activity ad to see the distribution pattern of primary activities etc. It is well known that economic activities are the basis of economic development of any country. These economic activities are also differing from place to place such as some areas are dominated by primary activities and others are dominated by secondary or tertiary activities etc. Human economic activities are adversely affected by the physical and social environment. Primary activities are directly related with the obtaining product from nature. Activities such as hunting of animals, obtaining minerals from the earth crust, and gathering of products from plants are come under primary activities. Gathering is one of the primary activities and is the oldest occupation of human being. Gathering is an occupation which includes the collection of different things from the forest resources. Commercial gathering is widely spread in Tropical forest. These areas are known for evergreen hard wood forest. These are found in the areas of south and Middle America, middle Africa and south – East Asia.

Hunting is also the oldest occupation of human being like the gathering. It is the practice of killing or trapping animals. Hunting is done with primitive methods. The group cannot be too large, or can settlements normally be permanent. It is most commonly done by humans for food, recreation, to remove predators that are dangerous to humans or domestic animals, or for trade. Lumbering or timer production is widely spread as gathering. In terms of economic point of view it is the most important forestry activity. This activity is done in many regions of the world. Coniferous, hardwood and mixed forests of the northern hemisphere are the chief areas of this activity. Fish is a major source of protein for a large section of the population in many areas. Major Fisheries industries are lies in the middle of northern latitudes. The causes of development are physical and economic factor. Physical factor includes rough continental self, fishing bank, cold and warm current, cold climate and forest availability. On the other hand economic factor includes demand, shortage of food, transportation facilities, cold storage house and scientific development.the Principle fishing ground of the world are the north- west pacific fishing ground, the north-west Atlantic fishing ground, the north-east Atlantic fishing ground, and the north- east pacific fishing ground.

5.8 GLOSSARY

Critical appreciation of world agricultural system.

A grain civilization - A large, organized human society that relies on a large numberof its numbers producing food throughagriculture.

Agro Transport – Transport provides the essential link between agriculture producer and buyer.

Agricultural Marketimg – Covers the services involued in moving an agricultural product from the farm to the consumer.

Agricultural change – all the changes a farmer makes to existing farming practices.

Agrobiodiversity– The genetic resources for food and agriculture.

Fishing: Fishing is the activity of tring to catch fishtechniques for cating fish include hand gathering spearing, nothing, angling and trapping.

Coal mining: the process of extracting coal from the ground.

Row meterials: Substainces used in the primary production or manufacturing of goods.

Forest Products: The products include meterials derived from a forest for commercial use.

Nomadic herding: The wandering, but controlledmovement of livestock, solely dependent on natural forage – is the most extensive type of land use system.

Cattle rearing: cattle rearing deals with all the aspects of raising cows for beef or milk and can involve multiple tasks.

Wool industry: One of the primary natural textile fibers, the row material of the wool-processes and transforms various animals for marketing.

Meat industry: The meat industry processes and transforms various animals for marketing.

Hunting: The act of following and killing wild animals or birds as a sports or for food.

5.9 ANSWER TO CHECK YOUR PROGRESS

Q.1 What are primary activities?
Q.2 How many types of primary activities are found in the world?
Q.3 What are the importance of primary activities?
Q.4 Describes the distribution pattern of primary activities?
Q.5 What is the importance of commercial gathering?
Q.6 Describe the major fishing ground of the world?
Q.7 Describe the commercial grazing in Temperate grasslands?
Q.8 What are the different characteristics of Temperate grasslands?
Q.9 Define the Commercial gathering in Tropical forest.
Q.10 What are the rainfall characteristics of tropical forest?
Q.11 Define what is hunting?
Q.12 What are the Major Region of wood production in the world?
Q.13 Describe the important food gathering.
Q.14 Discus the Nomadic herding.
Q.15 Write short notes
(i) Turpentine and resin
(ii) Quinary Activities
(iii) the north- east pacific fishing ground
(iv) white- collar workers.
(v) gold-collar workers

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5.11 SUGGESTED READINGS

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5.12 TERMINAL QUESTIONS

Q.1 Present the classification of resources.
Q.2 What is resource? Explain the concept of resources.
Q.3 Describe natural resource?

UNIT 6 - PRIMARY ACTIVITY: PROBLEMS AND TREND OF MANAGEMENT WITH REFERENCE TO FORESTRY, FISHING AND LIVESTOCK FARMING

6.1 OBJECTIVES

The objectives of the study are given below:

- to know what are primary activities.
- to study the problems faced by the forestry.
- sub divided the primary activities on the basis of work of nature.
- to study the different type of characteristics of the gathering activity.
- to see the distribution pattern of primary activities.

6.2 INTRODUCTION

Human Economic activities are those which generate income. The development of any country is directly related to the economic activities. Economic activities have been classified into primary, secondary, tertiary, quaternary and Quinary activities. Primary activities are adversely affected by the physical environment. Primary activities include hunting of animals, agriculture, livestock farming, fishing, obtaining minerals, and gathering of products from forests.

Forestry is one of the part of primary activities it includes both the exploitation and use of forests. The forests are mainly classified into tropical and temperate. These are most exploited forests in the world. The major producers of hardwoods are Brazil, Colombia, the Democratic Republic of Congo and Indonesia. The forestry activities are determined by the distribution of forests while its distribution predominates by altitudes. The forestry activities are highly developed in temperate regions compares to tropical forest. The coniferous pine tree and the oaks are the chief trees which are found in temperate region and spreads in North America, Europe and Asia.

Fishing includes the capture of fish and other aquatic species. It is a traditional activity. The share of the Fishing in the total food of the world population is only 1 percent. Fish production contains high nutritional quality. Raising fish through fish farming or aquaculture are the forms of fishing. A current day over fishing is the worldwide problem. This activity provides employment to millions of people worldwide. Fishing may be divided into fresh water fishing and sea water fishing. Middle latitudes are the highly developed fishing regions of the world. The Principle fishing regions in the world are located in the north- west pacific, the north-west Atlantic, and the north-east Atlantic, and the north- east pacific (Fig.1).

Livestock breeding or farming involves the domestication of animals with an economic purpose. The characteristics of both livestock farming and agriculture are similar. This activity is practiced worldwide. Livestock farming is sub divided into commercial intensive and consumption or extensive. The highly technical form of livestock farming is commercial livestock farming. The basic purpose of comercial live stock farming is to increase the quality of the animals as well as related productions such as milk, meat. The major countries of the livestock farming are the United States, Switzerland, the Netherlands, Denmark, the United

Kingdom, Australia and Argentina. Livestock farming for personal consumption is also known as "backyard" farming.

Images of forestry, fishing and livestock management

6.3 PROBLEMS AND TREND OF MANAGEMENT IN PRIMARY ACTIVITIES (FORESTRY, FISHING AND LIVESTOCK FARMING)

Problems and trend of management in forest resources

Forest resource is very important. Peoples are dependent on these forest resources. Forest resources are rapidly declining as population is increasing. There is also a loss of biodiversity due to decline forest. Loosing forest these areas will be converted into the desert. So there comes a problem that how to manage these resource. Forest management involves the administrative, legal, social, economic, and technical measures drawn in the conservation and use of natural forest resources. Forest management also includes diverse human activities to protect forest ecosystem and its all functions.

The main objective of forest management is the production of wood product with sustainable forest management. The term sustainable forest management means the management of forests with three main principles of sustainable development ecological, economic and socio-cultural. Many policies and program are adopted in forest management by the developed and developing countries. Some of them are:

- **The Forest Resources Assessment 1980**

  The forest resources assessment 1980 known for the strict and controlled harvesting regulations, together with silvicultural treatments and safety against fires came into existence to assessment the proportion of tropical forest. It was under intensive forest management. During that time it was noticed that less than 5 % of tropical forest came under this definition. While in case of temperate forest of developed countries no attempt was made.

- **The Global synthesis (1990)**

  It was foundby the global synthesis (1990) that there is a decline trend in forest management in developing countries. On the other side improvement in forest management was founded in developed countries.

- **The forest principles (1992)**

  The United Nations conference on environment and development (UNCED) in Rio de Janeiro in 1992 adopted the forest principles. The basic motto behind forest principles was to understanding of sustainable forest management at that time.

- **Non- legally binding instrument**

  Similarly, Non- legally binding instrument was adopted in 2007 by the United Nations General Assembly on all types of forest. It was the first instrument of this type. A strong international commitment came in existence after this to promote implementation of sustainable forest management.

There is a direct impact of forest policies and institutional arrangement on forest management. Many countries of the world are following the trend to decentralize control over forest management. Privatization of forestry operations or forest land is a second trend in forest management.

A third trend is that involvement by large interest groups in forest management planning process should e ensured. For this purpose forest planning departments should develop the institutional capacity and ability to work with diverse groups. It is concluded that trend in forest policies and forest resources management shows a trend towards encouraging high participation of local peoples and other interested groups in forest management.

Some technical and international issues and trends in forest management

Many Latin American countries are considering the granting of wide areas of forest concessions such as Suriname considered granting (4.5 m ha) in 1994, on the other hand in Guyana granted a concession equivalent in size to half of Switzerland, Venezuela (about 3 million ha). Similarly, Belize considered granted 224 600 ha. It is found after granting the forest to many companies that the granting of forest concessions over huge areas may result in forest degradation. It may also impact the negatively to local people or indigenous people.

Clear - cutting in the forest areas is done for many reasons. The highly degraded forest areas are facing strong opposition from different environmental groups worldwide. There is a move away from large felling areas towards smaller areas in some countries like Canada. The discussion of the clear- cutting of forest outlined the complexities of the issues.

Image showing clear-cutting of forest

The most important of all forest management interventions is harvesting. Careless harvesting can destroy not the trees harvested along with this it can also damage the huge portion of the remaining trees. Careless harvesting increased the forest degradation and also caused negative environmental impact.

Images of forest harvesting

Images of forest management

Recent trends of management in fish production

In recent years fishing activities are rapidly increasing worldwide. The year 1994 shows the world fishing production about 109.6 million tonnes because of the fast increase in aquaculture production (especially in China). Total production of fish and selfish from capture fisheries and aquaculture was 109.6 million tonnes during 1994 which was 7 million tonnes more than the year 1993 (or increased by 7 per cent). The production of fish mostly increased from marine captures accounting to 4.9 million of the 7.3 million tonnes and below 0.5 million tonnes were produced from mariculture. Remaining 1.9 million tonnes were produced by inland aquaculture and 0.25 million tonnes came from higher inland capture fishery and were mainly from Asia.

The figures of 1995 shows the peak of total production reached to 112.3 million tonnes contributed by the figures of mariculture and inland aquaculture. Mariculture and inland aquaculture figure mainly showed an estimated increase that reached to 21.0 million tonnes from 18.6 million tonnes. In Asia, China contribution mostly increased the aquaculture production. The above details of production given represent the recent pattern of existing production through capture fisheries and aquaculture. The trend for demersal and pelagic species productions differ remarkablyfrom each other.

Globally, the production of pelagic fish showed an upward trend since 1950 and it continued even when the other five species like anchoveta, Atlantic herring, Japanese pilchard, South American pilchard and chub mackerel were apparently excluded.

Demersal fish obtained very high price and remained constant since 1970. The high price of demersal fish led in establishing new fisheries for established species.The predominance of Asia and carp species resulted in rapid growth of aquaculture production. Carp species in 1994 accounted half of the total volume of aquatic products. A report on 'Safety and health in the fishing industries' was prepared by International Labour Office for discussion in Tripartite Meeting held in Geneva in December 1999. Illustrated on the issues concerning of safety and health in fishing industry.

Problems faced by fishing activity

There are many problems which are faced by fishing activities worldwide. These problems are reduced the production level of fishing. Major challenges faced by fishing activities are:

- Inefficient fishing rules and regulations
- uncontrolled fishing capacity and efforts
- Over fishing

Overfishing is a way of depletion of fish resources which can occur in any size water bodies' like-.ponds, rivers, lakes or oceans. The overexploitation of fishes decreases the level of fish resources as well as result in resource depletion, low biomass level, reduces the biological growth rate and upset the marine ecosystem.

Overfishing sounds a profitable practice, but its impact is felt upon balance of life of oceans as well as on the social and economic well-being of the coastal communities whose way of life depends on fish.

Image showing overfishing of Cod Caught in a Net, Gulf of Maine

Image showing overfishing of Bluefin Tuna, Mediterranean

Management problems faced by fishing activity

The major Management problems faced by fishing activities are:

Inadequate fisheries regulations:

In case for high seas in many fishing regions and fisheriesthere is a lack of strong rules and regulations to limit fishing level.It reduced sustainablelevel of fisheries. Some international fishing regulations are limited to only the case for the high seas.

Lack of implementation/enforcement:

It is another management problem faced by fisheries.Although fisheries regulations are existbut there is a lack of implementation of regulations in many regions of the world. Many countries of the world have not ratified or implemented fisheries international regulations.

Lack of transparency and traceability:

There is no transparency and traceability in the activities of fishing and it is not known Whythe customs and retailers are caught legally when they export and import in their own country.

Failure to follow scientific advice:

It does effect the management of fishing when not following the scientific advices.There are number of fisheries management bodies that don’t adhere to the scientific advices and make the catches above the limit, for example Atlantic code and tuna fishes are caught above the mentioned limit.

Image of fishing activity

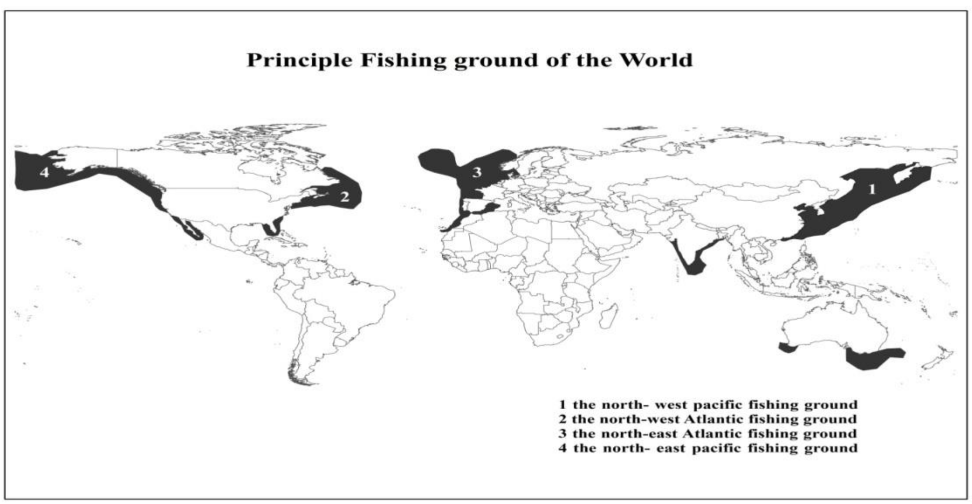


Fig.1

Conservation of fishing

- Discovery of new fishing ground,
- Protection of water from pollution, water of fishing ground should be affluent free in order to conserve the fishes. Some restriction should be imposed on polluting water.
- Ban on rare fishes- many species of fishes are almost to an end. Hence to keep them alive a ban on fishing rare species of fishes should be stopped strictly.
- A certain quantity of catching fishing- in order to maintain the sustainability of marine resource like fish, a limit of quantity should be imposed by the management body.
- Small fishes should be banned- fishing of small fish should be banned for further preservation of fishes.

Recent trends of management in Livestock

Livestock managers responsible for the running business of poultry farms, dairy farms, cattle ranches and other agribusinesses related to livestock. They have to keep financial records of the farm, supervise workers and ensure proper care and feeding of animals. In smaller farms, managers are also responsible to do some physical labor like assisting birth of animals or repairing machinery.

Livestock are the animals of domesticated raised in an agricultural setting to produce commodities such as food, fiber, and labor. The term is used to those domesticated animals raised for food such as cattle and goats. In recent years, some organizations are raised livestock to promote the survival of rare breeds. The breeding, maintenance, and slaughter of these animals are known as animal husbandry. It is a component of modern agriculture that has been practiced in many cultures since humanity's transition to farming from hunter-gatherer lifestyles.

During the history of animal husbandry, many secondary products have come up in an attempt to increase body utilization and reduce of waste. Animal offal and inedible parts are transformed into products such as pet food and fertilizer. Sometimessuch waste products were also fed to livestock.Though, intraspecies recycling creates a disease risk, threatening animal and even human health (bovine spongiform encephalopathy (BSE), scrapie, and prion).

Modern farming techniques seek to increase yield and improve of animal health with minimize involvement of human beings. Economics, quality, and consumer safety all these three thingsareplay main roles in how animals are raised.The use of hard and soft drugs and feed supplements may be regulated, or prohibited to ensure that yield is not increased at the expense of consumer health, safety or animal welfare. Practices arevarying all around the world, in the United States use of growth hormone is permitted, but not in stock to be sold in the European Union.Today, question has come for the improvement of animal health using modern farming techniques.Feeding corn to cattle, which have eaten grasses are less adapted to this change, the rumen pH becomes more acidic, leading to liver damage and other health problems.The US Food and Drug Administration allownonruminant animal proteins to be fed to cattle enclosed in feedlots. For example, feeding chicken manure and poultry meal to cattle, and beef or pork meat and bone meal to chickens are acceptable.

Possible modifiers of future livestock production and consumption trends

(a) Competition for resources

(i) Land

On the suitable land of the humid–sub humid zones, some rise in production is likely to occur where this is possiblethrough the use of improved pastures and effective management. In the more arid and semiarid areas, livestock are a key mechanism for managing risk.However increases of population are fragmenting rangelands in many places and making difficult for pastoralists to gain access to the feed and water resources that they have traditionally been able to access.In the future, grazing systems will increasingly provide ecosystem goods and services that are traded.But it is not clear, how future livestock production from these systems may be affected. The mixed crop–livestock systems will continue to be critical to future food securitybecause two-thirds of the global population live in these systems.

(ii) Water

Globally freshwater resources are relatively scarce. Freshwater resources are only 2.5 per cent of all water resources (MA 2005).Groundwater has also plays an important role in water supply. Between 1.5 and 3 billion people depend on groundwater for drinking, and in some regions water tables are declining unremittingly (Rodell et al. 2009). By 2025, 64 per cent of the world's population will live in water-stressed basins, compared with 38 per cent today (Rosegrant et al. 2002). Increasing numbers oflivestock in the future will clearly add to the demand for water, particularly in the production of livestock feed: one cubic metre of water can produce anything from about 0.5 kg of dry animal feed in North American grasslands to about 5 kg of feed in some tropical systems (Peden et al. 2007).

(b) Climate change

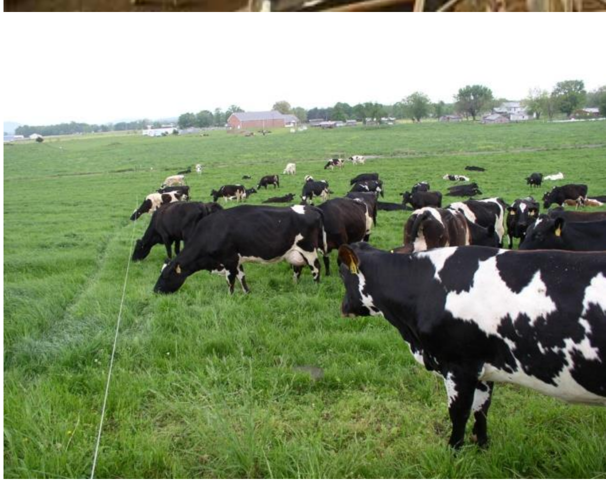
Climate change has effects on the global livestock sector. Increasing in the variability of climate will definitely increase livestock production risks as well as reduce the ability of farmers to manage these risks.Livestock food chains are the major contributors to greenhouse gas emissions, accounting for 18 per cent of total anthropogenic emissions.

(c) Socio-cultural modifiers

Social and cultural drivers of change are having profound effects on livestock systems in particular places. But it is often unclear how these drivers play out in relation to impacts on livestock and livestock systems. In human society livestock have multiple roles. They contribute significantly and directly to food security and to human health.For poor and under-nourished people particularly children, the addition of modest amounts of livestock products to their diets can have substantial benefits for physical and mental health (Neumann et al. 2003).

Increases demand for products of livestock wasmainly caused by human population growth, growth of income and urbanization. This will continue for the next three decades at least.Globally, increases in livestock productivity have beengenerallycause by animal science and technology, and scientific and technological developments in breeding, nutrition and animal health.These developments of technological will contribute to increasing potential production and further efficiency and genetic gains. In developed countries, demand for livestock products in the futurecan be greatlymoderated by socio-economic factors such as human health concerns and changing socio-cultural values.

In the future, livestock production is likely to be increasingly characterized by differences between developed and developing countries, and between highly intensive production systems on the one hand and smallholder and agropastoral systems on the other. How the various driving forces will play out in different regions of the world in the coming decades is highly uncertain.Can future demand for livestock products be met through sustainable intensification in a carbon-constrained economy? Increase of demand for livestock products willenhance to considerable competition for land between food and feed production.The increasing industrialization of livestock production may cause problems of pollution of air and water.The largest impacts of climate change have to seen in livestock and mixed systems in developing countries where people are already highly vulnerable.The need to adapt to climate change and to mitigate greenhouse emissions will definitely add to the costs of production in different places and the projectedbiofuels growth may have large additional impacts on competition for land and on food security.



Images of livestock management

6.4 CONCLUSION

Economic activities have been classified into primary, secondary, tertiary, quaternary and Quinary activities. Primary activities include hunting of animals, agriculture, livestock farming, fishing, obtaining minerals, and gathering of products from forests. Primary activities are adversely affected by the physical environment. Forest resource is very important and today this resource is rapidly declining as increasing population.So, there comes a problem that how to manage these resources. Management of Forest involves the administrative, legal, social, economic, and technical measures drawn in the conservation and use of natural forest resources. The main objective of forest management is the production of wood product with sustainable forest management.Many policies and program are adopted in forest management by the developed and developing countries.There are also many problems which are faced by fishing activities worldwide like inefficient fishing rules and regulations, uncontrolled fishing capacity and efforts and over fishing. These problems are reduced the production level of fishing. Fisheries regulations are exist but there is a lack of implementation of regulations in many regions of the world. Many countries of the world have not ratified or implemented fisheries international regulations.Commerciallivestockfarming is to increase the quality of the animals as well as related productions such as milk, meat.Increases demand for products of livestock was mainly caused by human population growth, growth of income and urbanization.In recent years, some organizations are raised livestock to promote the survival of rare breeds.

6.5 SUMMARY

The development of any region is directly related to the economic activities. Human Economic activities are those which generate income. Economic activities have been classified into primary, secondary, tertiary, quaternary and Quinary activities. Primary activities are adversely affected by the physical environment. Primary activities include hunting of animals, agriculture, livestock farming, fishing, obtaining minerals, and gathering of products from forests.

Forestry is one of the part of primary activities it includes both the exploitation and use of forests. The forestry activities are highly developed in temperate regions compares to tropical forest. The coniferous pine tree and the oaks are the chief trees which are found in temperate region and spreads in North America, Europe and Asia. The major producers of hardwoods are Brazil, Colombia, the Democratic Republic of Congo and Indonesia. In current day over fishing is the worldwide problem. Fishing includes the capture of fish and other aquatic species. It is a traditional activity. Middle latitudes are the highly developed fishing regions of the world. The Principle fishing regions in the world are located in the north- west pacific, the north-west Atlantic, and the north-east Atlantic, and the north- east pacific. Livestock breeding or farming involves the domestication of animals with an economic purpose. Livestock farming is sub divided into commercial intensive and consumption or extensive. Thehighlytechnicalform of livestockfarming is commercial livestock farming. Thebasicpurpose of commerciallivestockfarming is to increase the quality of the animals as well as related productions such as milk, meat. The major countries of the livestock farming are the United States, Switzerland, the Netherlands, Denmark, the United Kingdom, Australia and Argentina. Livestock farming forpersonal consumption is also known as “backyard” farming.

6.6 GLOSSARY

- Primary activities - Problems and trend of management with reference to forest, fish and livestock farming.
- Primary activity - collection or production of natural resources or row materials, such as coal, fish, wool wheat, rocks or minerals.
- Forest resources - forest provide clean water and air, timber for wood products, wildlife habitats, stable soil and recreational opportunities.
- Livestock farming - Livestock farming is simply the management and breeding of domestic, live stock or farm animals for purpose of obtaining many products.

6.7 ANSWER TO CHECK YOUR PROGRESS

Q.1 Describes what are primary activities?
Q.2 What do you understand by forestry?
Q.3 Why forestry activities are highly developed in temperate regions compares to tropical forest?
Q.4 How climatic conditions impact the Livestock farming?
Q.5 Describe the over fishing.
Q.6 What is commercial livestock farming?
Q.7 What do you understand by conservation of fishing?
Q.8 Define what is dairy farms?
Q.9 What are the principle fishing regions in the world?
Q.10 Discus the different characteristics of principle fishing regions.

Q. 11 Write short notes on:
(i) Clear – cutting
(ii) Livestock
(iii) Overfishing
(iv) Forestry

6.8 REFERENCES

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6.9 SUGGESTED READINGS

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2. Sharma, Bhajanlal Rajkumar, Economic Geography.

6.10 TERMINAL QUESTIONS

Q.1 What is the importance of forestry?
Q.2 What are management problems faced by fishing activity?

UNIT 7 - CRITICAL APPRECIATION OF WORLD AGRICULTURAL SYSTEM

7.1 OBJECTIVES

After reading this unit you will be able:

- to know the world agricultural system;
- to know what is Intensive agriculture;
- to know about characteristics of intensive agriculture and extensive agriculture;
- to know the importance of mixed farming and plantation agriculture.

7.2 INTRODUCTION

Agriculture is primary form of economic activity. It includes cultivation, livestock ranching, dairy farming, forestry, and irrigation etc. on the other hand it can be said that agriculture is a primary human activity including planned utilization of land or soil and water for growth of plants and animals to meet the basic needs of food and clothing. There are two factors which affect agriculture. One of them is physical factor which includes Soil (determines the production of crops through the fertility level), Relief (represent pattern of agriculture. The plain land is most appropriate) and Climate (determines the cultivation conditions of crop. The chief physical factor, both rainfall and temperature are most important). Second is human factor including Cost of land (if the land cost is more expensive then cultivator must farm intensively to make a profit), Market (the farm requires being close to its market or to ways of communication that allow the farmer to sell his goods), Government (plays the major role in crop cultivation with the help of grants, tax barriers and subsidies), and technology (it includes development of machinery, seeds and fertilizers).

On the basis of various components such as supply of land, moisture and water, cropping system and regional concentration global agricultural practices may be sub-divided into following types: On the basis of supply of land it may be sub-divided into Intensive agriculture and extensive agriculture. Likewise, on the basis of moisture and water it may be sub-divided into humid farming, irrigation farming and dry farming, similarly, on the basis of cropping system it may be sub-divided into Monoculture, duo culture, and oligoculture while on the basis of regional concentration may be sub-divided into monsoonal agriculture, Mediterranean agriculture, mixed agriculture, ad tropical and sub-tropical plantation agriculture .

7.3 CRITICAL APPRECIATION OF WORLD AGRICULTURE SYSTEM

The agriculture system is defined as a part of area or region with similar functional characteristic. It may be a single farm, or group of interrelated farm of crops having similarities of agricultural characteristics.

Agriculture requires anample land area in against of other economic activities such as manufacturing and service industries.

The first scientific attempt for the demarcation of world agricultural system was made by DerwentWhittlesey in his paper namely ‘Major agricultural regions of the earth’ in 1936 through the Annals of association of American geographers. Whittlesey demarcated the agricultural systems on the basis of following five characteristics of agriculture:

(i) The crop and livestock association.
(ii) The methods used to cultivate the crops and produce the stock.
(iii) The intensity of application to out-turn of the labour, capital and organization and out turn of product.
(iv) The disposal of products for consuming.
(v) The ensemble of structures utilized to house and to make easy the farming operations.

Whittlesey has recognized the following thirteen types of agricultural systems with the help of above indicators:

1. Nomadic herding
2. Livestock ranching
3. Shifting cultivation
4. Rudimentary tillage
5. Indensive tillage (with paddy dominance)
6. Indensive tillage (without paddy dominance)
7. Commercial plantation
8. Mediterranean agriculture
9. Commercial grain farming
10. Commercial livestock and crop farming
11. Subsistence crop and stock farming
12. Commercial dairy farming
13. Specialized horticulture.

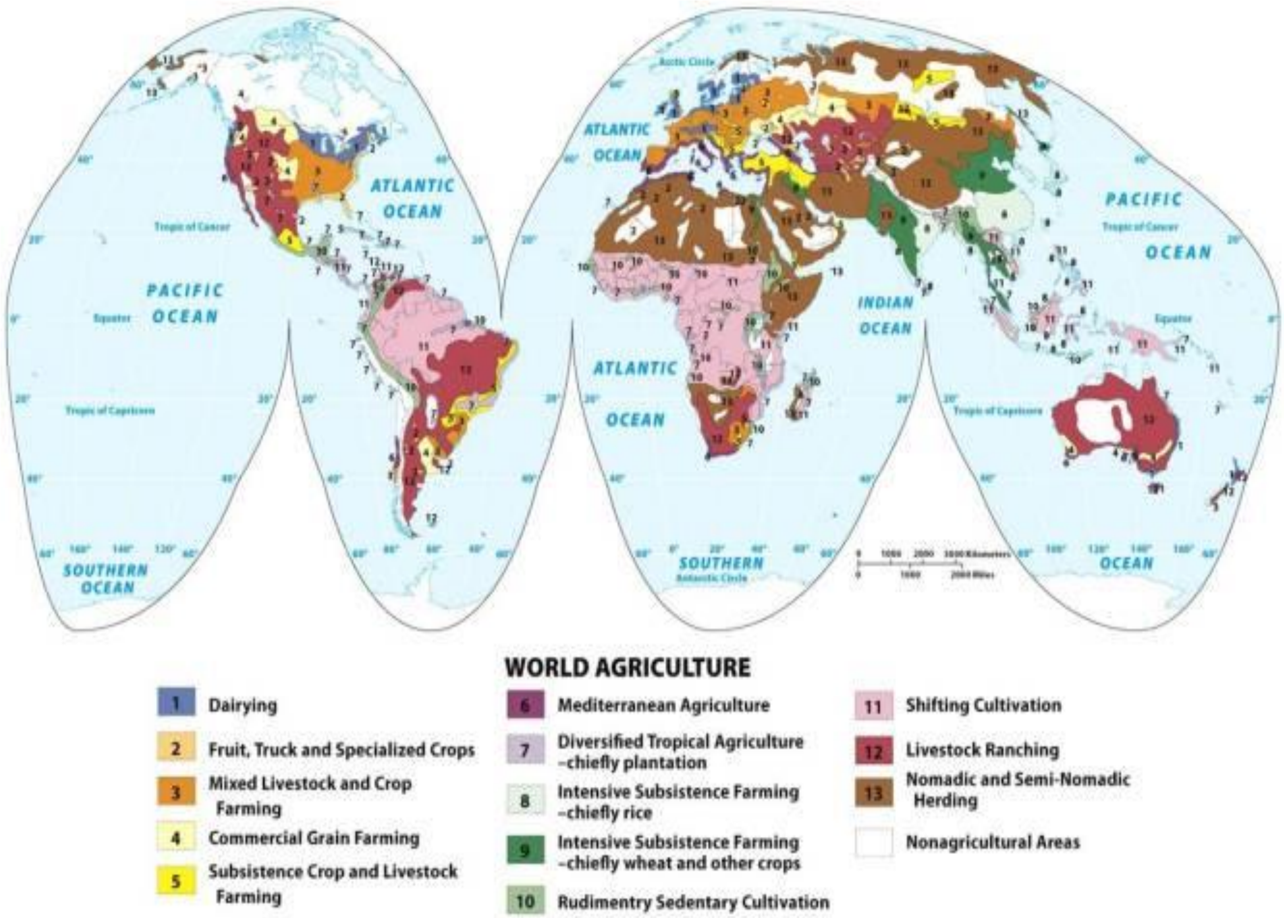

Figure 11.18

Source:https://www.google.co.in/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjB-bL_2pzUAhWKLY8KHQqPDgYQjRwIBw&url=https%3A%2F%2Fkashmirasacasestudyforaphg.wordpress.com%2Funit-5%2F&psig=AFQjCNEcH6ZyxFh19Vmm6Ktlb0mL-qcG7Q&ust=1496408685981049

7.4 INTENSIVE AGRICULTURE (MAJOR CROPS)

Most of intensive agriculture region are located in high population density region of world. Such as south-east Asian countries (India, Bangladesh, Thailand, Myanmer, China, Sri lanka, Indonesia, etc.)and western European countries (Netherland, Germany etc.).

It denotes to maximize use of per unit area of land. Intensive agriculture might be both labour-intensive and capital-intensive. The smallest part of the land is cultivated intenselydue to high pressure of population. Per capita productivity remains low but productivity per unit land always remains very high. Large proportions of the people are engaged in intensive agriculture.

The main characteristics of intensive agriculture aresmaller size of farm, high intensity of labourparticipation, high productivity, low per capita output, emphasis on cereal, dependence on climate,dependence on soil, low marketability, emphasis on multiple cropping, and lack of modern technology.

Image showing intensive agriculture

TYPES OF INTENSIVE AGRICULTURE

Intensive agriculture may be classified intotwo types.One is dominated by wet paddy and second is dominated by without wet paddy for examples wheat, pluses, maize, millets, barley etc.

Paddy (rice)

It is a tropical and sub-tropical crop. Rice is most important and principal crop of intensive agriculture.Its intensity is so high in some areas due to often cultivated twice or thrice a year.The favourable geographical conditions supports to rice cultivation are:

- Temperature: moderate to high temperature (20^0 -27^0 C) is ideal. The minimum temperature should not go below 15^0 C for rice cultivation.
- Rainfall: rice is a rain-loving plant which having requirement of rainfall 175-300cm annually. Water logging helps quick growth at initial period.
- Topography: uniform level surface is best for growing the rice.
- Soil: fertile riverine alluvial soils are suitable for rice cultivation.
- Cheap labour: huge quantity of labour is requiring for rice cultivation.

Image showing rice agriculture

Global production of rice

The S.E Asian countries produce 90% of global output. Like china, India, Bangladesh, Indonesia, Thailand, Myanmar etc.

China

China is the largest producer of rice in the world. Major producing regions of china are:
(i) Szechuan region: largest producing region of rice in china.
(ii) Lower Yangtze basin: it is an outstanding producer of high quality rice in china, due to fertile soil and high density of population.
(iii)South west region: this region is known for producing good quality of rice.
(iv)Kwantung region: in this area, rice produce with the help of irrigation facilities and low lying area.
(v) Szechuan- Hunan region: rice produces by wet farming.

India

India is the second largest rice-producing country in the world. Rice is the main food and cultivated in almost every states of India. Ganga- Brahmaputra valley contributes the largest amount of rice.In India, farm size and cultivation processes are generally small and uneconomic. As a result, the farmers are poor and the majority of them cannot afford to purchase modern agriculture techniques and instruments.

There are three types of sowing: first broadcast- is practiced in flood plain. Second drilling method is adopted by south Indians in upland area. Third is transplantation method.Major regions of rice are:
(i) North-eastern region: this area comprises Assam, west south Bihar and Orissa states. It has the maximum intensity of the rice cultivation. In this area, West Bengal is the largest producer of rice.
(ii) Southern rice region: this area comprises deltaic region of Godavari, Krishna, Kaveri and Tamprabarni and non-deltas areas of Tamil Nadu, Andhra Pradesh and Kerala.
(iii)Central region: this area covers Madhya Pradesh, part of Andhra Pradesh and Karnataka states.
(iv)Western region: it includes coastal zone of Maharashtra and Karnataka.
(v) Northern region: it covers north Bihar, U.P. Punjab and Haryana and J&K.

Indonesia

Indonesia is the third largest rice producer in the world followed by China and India. The main areas of the rice are situated in Java, Sumatra and Borneo.

Wheat

Wheat is the most important cereal crop of the world.Wheat is providing principal diet to Europe, America, Oceania and the African countries of the world. It is cultivated throughout the sub- tropical and temperate regions.

Image showing wheat crepe

Geographical conditions of wheat

Temperature: it requires 14^0-17^0 C temperature during sowing season and 18^o-22^oC in maturing.

Rainfall: wheat prefers low rainfall. 40-100 cm annual rainfall is ideal.

Frost-free day: at least 110 continuous frost free days are necessary.

Soil: fertile, slightly, acidic loam, sandy or silty loam soil is preferable

Types of wheat

There are three types of wheat: Autumn wheat (grows in milder climate), spring wheat(with stands harsh, extreme climate) and Winter wheat: rises in winter in warmer regions.

Production of wheat

Russian federation, U.S.A., China, India and Argentina together contribute more than 60% of global wheat production.

China

China is largest wheat producing country in the world. Its productivity is around 3700kg/ hectare, which is highly quite. Major regions of wheat of China are situated as given below:

(i) N.E. China: Beijing and Manchurian plain are fall in this region.
(ii) S.E. China: huge quantity of spring wheat produces in Hunan and Yangtze plain.
(iii) North China and kaoliang region: this region is well known for winter wheat. Hwang Ho valley is main region

U.S.A.

Wheat is grown in all the fifty states but intensity of cropping is more in the states of Dakota, Montana, Minnesota, Colorado and New Jersey. On the basis of seasonal variation, it is classified into four types: hard-spring, hard-winter,soft-winterand white winter wheat.The prairie region is suitable for spring-wheat cultivation. Hard –winter wheat is mostly consumed locally. It covers Utah, Colorado, Wyoming, Texas etc. It isa surplus wheat producing country in the world. Most of wheat is sent to international market for export purpose.

India

After green revolution, wheat production in India registered a huge improvement. Wheat is second most important crop in India after rice. The chief wheat production states are U.P., Punjab, Haryana, M.P., Rajasthan, Bihar, Maharashtra and Gujarat. There are two types of wheat winter wheat (is more popular in North India) while spring wheat (is cultivated in Western India). Productivity of wheat is highest in Punjab and Haryana while it is low in Bihar, Utter Pradesh and Madhya Pradesh.

Millets

It is considered as both food and fodder crop. It is a short growing season crop. Millet comprises Jowar, Bajra and Ragiof India and sorghum of Africa. Millets are certainly of lower nutritional value. So these are not very popular except in the poorer countries of Asia and Africa continents. The Indian sub-continent, as a whole, accounts for nearly 50% of world millet acreage. The U.S.A. is most important producer of sorghum.

7.5 EXTENSIVE AGRICULTURE (MAJOR CROPS)

It is practiced in low population density regions of U.S.A. Canada in North America, Argentina, Peru,etc. in South America, Russain federation in Eurasia, Australia, New Zealand etc. in Oceania. It is generally found in temperature and high latitudes.It is not labour-intensive but it is highly capital-intensive.

Characteristic of extensive agriculture are larger farm size, high intensity of capital, low intensity of labour, high per capita production,emphasis on mono-cropping, commercial approach, low production per unit of land,and dominance of machine. All processes of cultivation are done by machines due to dearth of human labour. Such as tractors, harvesters, winnowers and thrashers are utilized in cultivation process.

Maize

After wheat and rice, Maize is an important cereal crop of the world. It is extensively raised in N. America, Europe and Asia.

Geographical conditions

It is cultivated with the onset of monsoon and harvested in September – October. It requires temperature 15^0 – 30^0 C and 50-150 cms rainfall. Maize cultivation requires at least 150 frost free days and sub-tropical, and temperate red Podzol soil and Chernozem soil is suitable.

Economic conditions

Both labour and capital-intensive cultivation methods are utilized in maize cultivation to adjust to local conditions.

Image showing field of maize

World production of maize

U.S.A

U.S.A. is the chief producer country of maize in the world. It contributes about 42% of the global production. It covers about 30 million hectares of land in U.S.A. The U.S. corn (maize) production is extended in two parts: first, U.S.corn belt refer to Minnesota, Nebraska,Missouri and Illinois statesetc and other part is southern states like Georgia, Alabama etc.

Argentina

Argentina is a one ofthe main corn production countries. Most of the maize grown in the pampus grasslands.

China

It is amajor country of maize production in the world. Maize is grown almost in all parts of china. The main producing areas are Hopei, Yunan and Kirin.

Barley

Barley is a short growing season crop. it is very popular food crop in the world. It requires low temperature or short supply of moisture. The main characteristic of Barley isthat it is an important feedstuff.Barley is used in great quantities for making meals and manufacturing whisky and beer.Around Mediterranean Sea, Asia Minor, Central Asia, Australia and California are the major producing area of barley.

7.6 PLANTATION AGRICULTURE (MAJOR CROPS)

It is an export-oriented specialized agriculture. In this agriculture system emphasis is given to raise a single crop.Profit- maximization is the sole objective of this. It includes crop growing andprocessing, packaging, transporting and exporting of the product. It is founded in both side of the equator within tropical areas.this plantation agriculture involves coffee Plantation in brazil, Paraguay and Bolivia; sugar plantation in Cuba, Brazil, Peru, Puerto Rico and Philippines; coco farming in west indies, panama, Costa Rica; tea plantations in India, Sri Lanka, Indonesia; and rubber Plantation in Malaysia, Indonesia, Thailand, Sri Lanka, Cambodia, Myanmar and India etc.

The characteristic of plantation agriculture are monocropping pattern, labour- intensive agriculture, emphasis on large scale production, export to international market, Capital-intensive system, closely related with developing countries, occurrence of culture exchange, and associated with industries.

Tea

Tea is achieved from the leaves of broad-leaved evergreen shrub. It is broadly found in south Asia. On the basis of nature of processing, tea products may be classified into three type'sBlack tea, Green tea and Brick tea.

Image showing Tea field

Geographical conditions

Relief: Good drainage facility provides the optimum condition for tea cultivation. Tea estates in hilly regions are ideal.

Climate: it requiresheavy rainfall and temperature should be in between 15^0-27^0C

Soil: slightly, fertile, acidic and nitrogen - rich soil is ideal.

Labour: skilled and cheap labour is required to pluck of tea leaves.

Capital: tea plantation is a capital- intensive cultivation.

India and china are the undisputed leaders of tea production in the world. Both countries contribute over 50% of global production.

India

Tea plantation is one of the most important agro-economic activities. India is one of the largest exporters of tea in the international market. In India, tea plantation is started by then British colonial rulers in the Himalayan foothills in 1830.

Major regions are:

- The Brahmaputra: largest tea-producing region
- The Dooars: Noteble tea estates are Madarihat, Nagrakata, Kalchini etc.
- The Surma valley: Assam is an important tea producer district.
- The Darjeeling hills: best quality tea in world
- Nilgiri and Annamalai hills

China
China issecond largest tea producing country in the world.it has huge total production of tea but productivity is low only 700 kg./ hectare. Most of tea industries in china are located in S-Eastern part of the country.

Sri Lanka
It is most significant tea producing nation of the world. Tea plantation was established by the colonial British rulers. In Sri Lanka, most of tea gardens are located in the highlands of Kandy, Gale, Matara, Badulla and NuwaraElliya.

Sugarcane
Itis a grass species of tropical and sub-tropicalzone. It is an indigenous crop of India and China. It was introduced by the Portuguese colonialists in many countries of the world for example Brazil. After that, it spread over Cuba, Mexico and different European countries.
There are many uses of sugarcane such as Molasses and Sugar production, Fertilizer and Alcohol production, as a fuel,as fodder, Chemical and medicine production and Paper- board, paper and board –card production.Both Asia and S. America give over 80% of global production.

Image showing sugarcane field

Geographical conditions
Temperature: average annual temperature between 21^0 -27^0 C is ideal.
Rainfall: annual rainfall 100 -175 cm is perfect.

Soil: fertile, alkaline and well drained loamy soil is suitable. Black soil is best.
Relief: water logging is harmful and slight undulating relief is best.
Labour: it is labour-intensive agriculture.
Transportation: after harvesting, smoothly transportation is must for more output.

Global production of sugarcane

Brazil

It was introduced by Portuguese colonial rulers. This crop is growing in many parts but major regions are the minas Gerais; coastal areas of Peruambuco, Alagoas, Parahiba and Bahica; and coastal areas of Rio-de-Janeiro.In Brazil, the area under sugarcane cultivation is expanding and in future, sugarcane production may increase.

India

India isone of the most important sugarcane producers in the world. It has higher rank of sugarcane production in plain and delta regions. Area under-utilized is highest but output productivity is low.

Cuba

Cuba is known for sugarcane production and export. Economy of Cuba is dependent on sugarcane production. The sugarcane fields are located at Havana, Matanzas, Orienta, Cameguay, and Santa Clare. The productivity of Cuban sugarcane is one of the highest in the world.

7.7 MIXED AGRICULTURE

It is an admixture of cereal production and livestock ranching. The main objective of mixed agriculture is to reduce the menace of cultivation. It is widely spreading at a rapid pace to entire globe. It is entirely commercial system and less risky.
Generally, it is a transitional agricultural system involving cultivation and livestock ranching. Sometimes crops are cultivated to feed animals, sometimes for commercial sale and, sometimes, for consumption of cultivators themselves or to fulfill all of them. So, the aims are: Sustenance of animals, own consumption and commercial sale. Some cash crops such as wheat and soyabeenare cultivated for commercial sale to other countries.

Image showingmixed farming

Location

Geographically, it is located in two major regions of the world:

(a) U.S.A. region

This region includes the entire eastern part of U.S.A., particularly Georgia, Tennessee, Oklahoma, Kansas, Nebraska, Ohio, Indiana, in the western part; Oregon and California are not lagging far behind.

(b) Eurasia region

This region covers a huge area in between 40^0-65^0 N latitudes extending from Atlantic coast to pacific coast. Scandinavian countries, particularly Holland and Finland, are well – advanced in mixed farming. Ukraine, France and Italy are also highly developed in mixed farming.

(c) Other regions

It is now developing in expanded regions. Among these, Central Mexico, Uruguay, Southern Chile, Some parts of Argentina and South Africa are notable.

Characteristic of mixed agriculture are following:

- The main three aims of mixed agriculture are first feeding livestock, second own consumption and sale to market.
- It is also a transition agriculture system in between commercial and subsistence types of farming.
- Emphasis is given more on crop production rather than livestock ranching.
- Farm is utilized largely in 50-250 acres. In European countries, farm size is smaller compare than N. and S. America.
- Organic fertilizers are easily available from livestock and surplus of crops in farm.
- In this agriculture, labour demand remains uniform throughout the year.

7.8 CONCLUSION

Agriculture is a primary economic activity. It involves cultivation, livestock ranching, dairy farming, forestry, and irrigation etc. There are two factors which affect agriculture. One of them is physical factor and second is a human factor including Cost of land Market, Government and technology. On the basis of various components such as supply of land, moisture and water, cropping system and regional concentration global agricultural practices may be sub-divided into Intensive agriculture and extensive agriculture. The agriculture system is defined as a part of area or region with similar functional characteristic. It may be a single farm, or group of interrelated farm of crops having similarities of agricultural characteristics.

It has been found that intensive agriculture regions are located in high population density region of world including south-east Asian countries (India, Bangladesh, Thailand, Myanmer, China, Sri lanka, Indonesia, etc.) and western European countries (Netherland, Germany etc.). On the other hand extensive agriculture is practiced in low population density regions of U.S.A. Canada in North America, Argentina, Peru, etc. in South America, Russain federation in Eurasia, Australia, New Zealand etc. in Oceania. It is generally found in temperature and high latitudes. Likewise, plantation agriculture is an export-oriented specialized agriculture. Where emphasis is given to raise a single crop. It also includes crop growing and processing, packaging, transporting and exporting of the product. While, mixed agriculture is an admixture of cereal production and livestock ranching. The basic motto of mixed agriculture is to reduce the menace of cultivation. It is widely spreading at a rapid pace to entire globe. It is entirely commercial system and less risky.

7.9 SUMMARY

Agriculture is primary form of economic activity. It includes cultivation, livestock ranching, dairy farming, forestry, and irrigation etc. on the other hand it can be said that agriculture is a primary human activity including planned utilization of land or soil and water for growth of plants and animals to meet the basic needs of food and clothing. On the basis of various components such as supply of land, moisture and water, cropping system and regional concentration global agricultural practices may be sub-divided into following types: On the basis of supply of land it may be sub-divided into Intensive agriculture and extensive agriculture. The first scientific attempt for the demarcation of world agricultural system was made by DerwentWhittlesey in his paper namely ‘Major agricultural regions of the earth’ in 1936 through the Annals of association of American geographers.

Most of intensive agriculture region are located in high population density region of world. Such as south-east Asian countries (India, Bangladesh, Thailand, Myanmer, China, Sri lanka, Indonesia, etc.) and western European countries (Netherland, Germany etc.). The main characteristics of intensive agriculture are smaller size of farm, high intensity of labour participation, high productivity, low per capita output, emphasis on cereal, dependence on climate, dependence on soil, low marketability, emphasis on multiple cropping, and lack of modern technology. Characteristic of extensive agriculture are larger farm size, high intensity of capital, low intensity of labour, high per capita production, emphasis on mono-cropping, commercial approach, low production per unit of land, and dominance of machine. All processes of cultivation are done by machines due to dearth of human labour. Such as tractors, harvesters, winnowers and thrashers are utilized in cultivation process. The characteristic of plantation agriculture are monocropping pattern, labour- intensive agriculture, emphasis on large scale production, export to international market, Capital-intensive system, closely related with developing countries, occurrence of culture exchange, and associated with industries. It is founded in both side of the equator within tropical areas. this plantation agriculture involves coffee Plantation in brazil, Paraguay and Bolivia; sugar plantation in Cuba, Brazil, Peru, Puerto Rico and Philippines; coco farming in west indies, panama, Costa Rica; tea plantations in India, Sri Lanka, Indonesia; and rubber Plantation in Malaysia, Indonesia, Thailand, Sri Lanka, Cambodia, Myanmar and India etc.

Mixed agriculture is an admixture of cereal production and livestock ranching. The main objective of mixed agriculture is to reduce the menace of cultivation. It is widely spreading at a rapid pace to entire globe. It is entirely commercial system and less risky. The main three aims of mixed agriculture are first feeding livestock, second own consumption and sale to market. It is also a transition agriculture system in between commercial and subsistence types of farming. Emphasis is given more on crop production rather than livestock ranching. Farm is utilized largely in 50-250 acres. In European countries, farm size is smaller compare than N. and S. America.

7.10 GLOSSARY

- A grain civilization - A large, organized human society that reuse on a large number of its numbers producing food through agriculture.
- Agro- Transport - Transport provides the essential link between agriculture producer and buyer.
- Agricultural change - All the changes a farmer makes to existing farming practices.
- Agro biodiversity - The genetic resources for food and agriculture.

7.11 ANSWER TO CHECK YOUR PROGRESS

Q.1 Describes what is agriculture?

Q.2 What type of agriculture found in Indonesia and Myanmar?

Q.3 What is the difference between the intensive agriculture and extensive agriculture?

Q.4 How climatic conditions impact the agriculture?

Q.5 What is the importance of intensive agriculture?

Q.6 Describe the extensive agriculture?

Q.7 Describe the plantation agriculture.

Q.8 What are the different characteristics of Mixed agriculture?

Q. 9 What are the characteristics of extensive agriculture?
Q.10 Define what is agriculture system?
Q. 11 Describe the important food crops.
Q. 12 Write short notes on:
(i) mono cropping pattern
(ii) plantation agriculture
(iii) Mixed agriculture
(iv) Intensive agriculture in Asia
(v) mono-cropping

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7.14 TERMINAL QUESTIONS

Q. 1 Classify the intensive agriculture.
Q. 2 What are the geographical factor responsible for wheat production?
Q. 3 Discus the different characteristics of agriculture of plantation agriculture.

UNIT 8 - LAND-USE AND AGRICULTURAL MODELS: VON THUNEN AND WHITTLESEY

8.1 OBJECTIVES
8.2 INTRODUCTION
8.3 MEANING OF LAND USE
8.4 VON THUNEN'S MODEL OF AGRICULTURAL LAND USE
8.5 MODIFICATION OF VON THUNEN'S MODEL
8.6 WHITTLESEY'S MODEL OF AGRICULTURAL LAND USE
8.7 CONCLUSION
8.8 SUMMARY
8.9 GLOSSARY
8.10 ANSWER TO CHECK YOUR PROGRESS
8.11 REFERENCES
8.12 SUGGESTED READINGS
8.13 TERMINAL QUESTIONS

8.1 OBJECTIVES

After reading this unit learners will be able:

- To know about land use.
- To know about the geographic location and extent of the spatial unit under consideration.
- To know about the temporal aspects of various activities undertaken.
- To know about Different land use models and the necessity of their rise.
- To know about the Importance of the different land use models.

8.2 INTRODUCTION

The term 'land' has been given a special meaning. It does not mean soil, as in the ordinary speech, but it is used in a much wider sense.In the words of Marshall, land means:

"The materials and the forces which nature gives freely for man's aid, in land and water, in air and light and heat…"

Land stands for all natural resources which yield an income or which have exchange value.

"It represents those natural resources which are useful and scarce, actually or potentially."

In every stage of economic evolution, nature has been man's most useful ally. In the hunting and the fishing stage, nature supplied food freely and sustained human life. In the pastoral stage, but for land surface and the pastures and meadows, herds of cattle and sheep could not have been reared and kept.The utility of land is obvious in the agricultural stage for how else could man grow his crops without soil, air and sunshine? When the agricultural stage has given place to the industrial stage, land still remains essential.

Land is the chief agent in the production of wage goods, such as food-grains, cloth and sugar. Every commodity that we use can, directly or indirectly, be traced ultimately to land. Look in whatever direction we may, our debt to nature is deep and obvious. Our very existence would be impossible without it. In Marshall's words:

"Earth's surface is a primary condition of anything that a man can do, it gives him room for his action."

The quantity and quality of natural resources (including agricultural land) plays a vital role in the economic development of a country. Important natural resources are those of agricultural land, minerals and oil resources, water, forests, climate, etc.

8.3 MEANING OF LAND USE

Land use is the human use of land. Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods. It also has been defined as "the total of arrangements, activities, and inputs that people undertake in a certain land cover type."

"Land use is characterised by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it" **- (FAO/ UNEP, 1999) (LCCS).**

Any given area of land is usually used to satisfy multiple objectives or purposes. Land use information provides answers to one or more of the following questions concerning the current use of the land:

- What are the purpose of activities undertaken - e.g. the specific products and services, that are sought.
- Where are the geographic location and extent of the spatial unit under consideration?
- When are the temporal aspects of various activities undertaken - e.g. the sequence of carried out operations like planting, weeding, etc..
- How the technologies are employed - e.g. technological inputs/ materials such as fertilizer, irrigation, labor, etc.
- How much are the quantitative measures - e.g. areas, products.
- What are the reasons underlying the current land use – e.g. land tenure, labour costs, market conditions, etc.

Agricultural land-use data are important for many of the regional to global activities currently undertaken by FAO (e.g. the validation of agricultural land evaluation; the preparation of perspective studies on agricultural production and food security; early warning for food security; natural disaster relief operations; farming systems studies; policy formulation). Thus, knowledge of current land use (& land resources) is needed for formulating changes leading to sustainable use of the resources.

Check Your Progress I

Q.1 What do you understand by “Land Use”?

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8.4 VON THUNEN’S MODEL OF AGRICULTURAL LAND USE

The analysis of land use patterns has long been one of geography’s basic concerns. At first, it might appear as if agricultural land use is little affected by relative location, once the factor of a suitable market has been acknowledged. Indeed, the farmer does adapt his land use to site conditions, climate, land forms, and soils. The VonThunen model of agricultural land use was created by farmer and amateur economist J.H. VonThunen (1783-1850) in 1826 (but it wasn't translated into English until 1966).

This model is based on an econometric analysis of his estates in Mecklenburg, near Rostock in Germany. Most of the data used in explaining his theory were obtained by him through practical experience. He attempted to construct a theoretical model of land use pattern, giving a particular arrangement of towns and villages in a situation experienced in Mecklenburg.

The main aim of VonThunen's analysis was to show how and why agricultural land use varieswith the distance from a market.He had two basic concepts:

1. The intensity of production of a particular crop declines with the distance from the market. Intensity of production is a measure of the amount of inputs per unit area of land; for example, the greater the amount of money, labour and fertilisers, etc., that are used, the greater the intensity of agricultural production.
2. The type of land use will vary with the distance from the market.

The VonThunen's location theory or model states that if environmental variables are held constant, then the farm product that achieves the highest profit will outbid all other products in the competition for location.The competitive position of a crop or livestock activity (namely, how high the bidding needs go to secure a desirable site) will depend on the level of return anticipated from producing at the particular location. A product with a high expected return and therefore, high rent-paying ability will be able to outbid a product with a lower profit level and, therefore, a relatively modest rent-bid ceiling.

By carefully compiling economic data on different farming activities on his own large estate Tellow in north-eastern Germany, VonThunen was able to determine the relative rent-paying abilities of each major agricultural product. Of course, the technology and agricultural products he managed in the early 19th century were different from those of today.But, there are sufficient similarities to allow the analysis to be updated for our purpose. Moreover, his explanation was truly general, allowing his explanation approach to be applied to most contemporary agricultural situations.

Following VonThunen's reasoning, the ranking of agricultural activities on the basis of rent-paying ability in the decreasing order are as follows:

Hierarchy of Agricultural Crops:

1. Truck farming (fruits and vegetables).
2. Dairying
3. Mixed crop and livestock farming (Corn Belt agriculture).
4. Wheat farming.
5. Ranching (yearlings often sold to feedlots of mixed crop and livestock farming).

Assumptions in the Thunian Model:

VonThunen's model was created before industrialization and is based on the following limiting assumptions:

- There is an 'Isolated State' (as VonThunen called his model economy), consisting of 1 market city and its agricultural hinterland. The city is located centrally within the "Isolated State" which is self sufficient and has no external influences.
- The Isolated State is surrounded by an unoccupied wilderness.
- The land of the State is completely flat and has no rivers or mountains to interrupt the terrain. There is a homogeneous physical environment, including a uniform plain around the city. The soil quality and climate are consistent throughout the State.

- This city is the market for surplus products from the hinterland and receives products from no other areas.
- The hinterland ships its surpluses to no other market except the city.
- The hinterland is inhabited by farmers who wish to maximise their profits, and who adjust automatically to the market's demands.
- There is only one mode of transport – the horse and wagon (as this was 1826).
- Transportation costs are directly proportional to distance, and are borne entirely by the farmers, who ship all produce in a fresh state, directly to the central city.
- VonThunen's model examines the location of several crops in relation to the market. The location of crops, according to him, is determined by:
  - i. The market prices,
  - ii. Transport costs, and
  - iii. The yield per hectare.

  The transport cost varies with the bulk and the perishability of the product. The crop with the highest locational rent for the unit of land will always be grown, since, it gives the greatest returns and all farmers attempt to maximise their profit. Two crops may have the same production costs and yields but difference in transport costs (per ton/kilometre) and market prices influence the decision-making of the farmers. If commodity A is more costly to transport per ton/kilometre and it has a higher market price, A will be grown closer to the market than B (Figure 8.1)

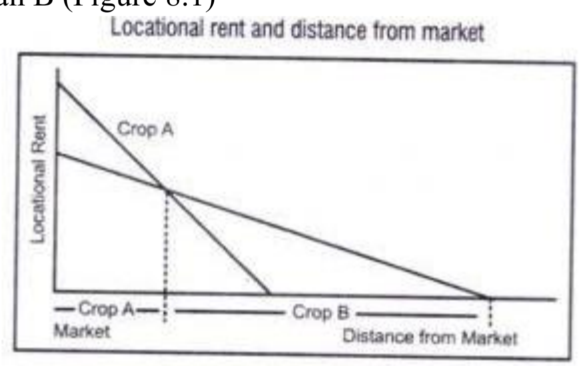

Figure 8.1

Locational Rent and Distance from Market:

The locational rent of A decreases more rapidly than that of B, because of A's higher transport costs. As the market price of A is greater than B, the total revenue is higher at the market for A than B.Thus, the market of the locational rent of A is greater than B, because production costs are the same and no transport costs are incurred. If the market price of B was greater than that of A, A would not be grown at all.

In his model,VonThunen has explained three stages of the growth of agricultural landscape in an isolated state as shown in Figure 8.2.The single urban centre and undifferentiated landscape of

VonThunen's model landscape is portrayed in Figure 8.2. For every farmer, regardless of the crop or type of livestock raised, the most desirable farming locations are situated as close as possible to the central market. The market is the destination for agricultural goods produced throughout the region.

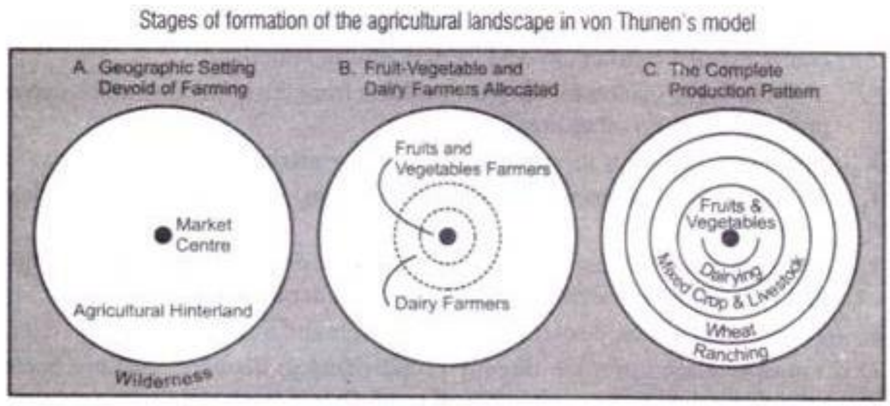

Figure 8.2

Stages of Formation of the Agricultural Landscape in VonThunen Model

Next, assume that all the land in the heretofore undifferentiated landscape is placed on the auction block at the same time. The myriad of vegetable, dairy, mixed crop and livestock, wheat, and cattle-ranch land users eagerly submit their rent-bids to the landowners. All these actors prefer to purchase the right to use farmland near the market.

However, vegetable farmers have a higher relative rent-paying ability near to the market than their competitors; hence, at the auction the vegetable farmers will outbid all the others. The vegetable producers will thereby acquire the right to farm the land adjacent to the market.Since, the undifferentiated landscape presents no advantages of being on a particular side of the market, the land users will distribute themselves circularly around the centre so as to minimise their distance to the town.

The bidding continues after vegetable farmers are accommodated. Since, dairy farmers rank next highest in rent-paying ability, they will successfully outbid the remaining contestants for locations in the next most accessible zone. Dairy farmers, too, arrange themselves in a circular fashion.There arises a definite formation of concentric rings of different land uses circumscribing the market (Figure 8.2-B). The remaining agricultural systems can be arranged concentrically around the market centre in the same fashion, according to their competitive economic positions. The completed pattern of production rings is shown in Figure 8.2-C.

On the basis of the above-mentioned assumptions, VonThunen constructed a general land use model; having a number of concentric zones around a market town (its three stages of growth have already been mentioned).The perishable, bulky and/or heavy products, according to this model, would be produced in the belts nearer to the town. The more distant belts would specialise in products which were less in weight and volume but fetched higher price in the market as they could afford to bear relatively higher transportation costs.

The final model was conceived as having specialised agricultural enterprises and crop-livestock combination. Each belt, according to VonThunen, specialises in the production of those agricultural commodities to which it was best suited (Figure 8.3).

It becomes clear from Figure 8.3 that the production of fresh milk (in the context of Europe) and vegetables was concentrated in *the Zone I* nearest to the city, because of the perishability of such products. In this zone, the fertility of land was maintained by means of manuring and, if necessary, additional manure was brought from the city and transported to short distances to the farm.

The Zone II was used for production of wood, a bulky product in great demand in the city as a fuel in the early part of the 19th century. He showed, on the basis of his empirical data, that forestry yielded a higher locational rent, since its bulkiness meant relatively higher transport cost.

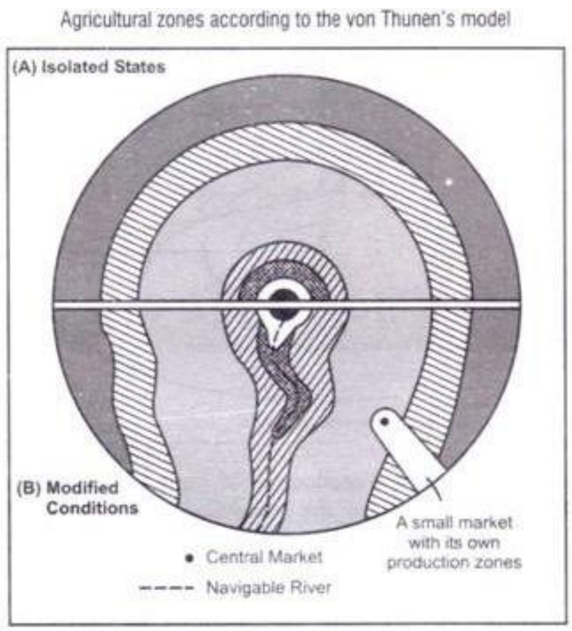

Figure 8.3

The Zone III represents crop farming where rye was an important market product, followed by other farming zones with a difference of the intensity of cultivation. As the distance from the market increased, so the intensity of rye production decreased with a consequent reduction in yields. There was no fallowing and manuring to maintain soil fertility.

In the next *Zone IV* the farming was less intensive. Farmers used a seven-year crop rotation in which rye occupied only one-seventh of the land. There was one year of rye, one of barley, one of oats, three of pastures and one of fallow.

The products sent to the market were rye, butter, cheese, and occasionally, live animals to be slaughtered in the city. These products did not perish so quickly as fresh milk and vegetables and could, therefore, be produced at a considerably greater distance from the market. In the most distant of the zones supplying rye to the city *Zone V*, farmers followed the three-field system.

This was a rotation system whereby one-third of the land was used for field crops, another one-third for pastures and the rest was left fallow. The farthest zone of all, i.e., *Zone VI* was the one of livestock farming. Because of the distance to the market, rye did not produce so high a rent as the production of butter, cheese or live animals (ranching). The rye produced in this zone was solely for the farm's own consumption. Only animal produce were marketed.

Bt this model was not the fairest as, when a small city with its own productive zones emerged, it would clash with the productive zones of the other major city as shown in Figure 8.3, hence the theory faced many critical remarks, which in turn led to its modification.

8.5 MODIFICATION OF VON THUNEN'S MODEL

The theory of agricultural location was presented by VonThunen in the early 19th century. Since then, several scholars including geographers have applied it in various parts of the world and have pointed out certain aspects which are not applicable in a way as pointed out by VonThunen. Many aspects of this model have changed due to development in agricultural system, transportation system and also due to other technological developments. There are also certain regional geo-economic factors which not only direct but determine the pattern of agricultural land use.

The main points raised by scholars regarding this theory are as follows:

1. The conditions described in this model, i.e., in an isolated state, are hardly available in any region of the world. There are internal variations in climatic and soil conditions. The VonThunen's assumptions that there are no spatial variations in soil types and climate are rare.
2. It is not necessary that all types of farming systems as described by VonThunen in his theory exist in all the regions. In many European countries location of types of farming in relation to market are no longer in existence.
3. The Thunen's measures of economic rent and intensity are difficult to test because of their complexity. The measurement of number of man-days worked in a year, cost of labour per hectare or cost of total inputs per hectare is not uniform in intensive and extensive types of farming. Similar is the case with the measures of intensity.

Edgar Dunn discovered certain lapses in the conceptual frames and calculations o the Thunian model. Location rent on the land is the difference between total revenues obtained from a land use and total costs per unit of land. Again, the total revenue is obtained as a product of land yield per unit and the prevalent market price obtained for the product. Further total cost incurred is the product of the yield per unit of land use and the per unit production cost, subtracting the market delivery cost.

Dunn produced a formula to express his idea:

$LR = E(P-a)-Efk$, where

E= yield (in weight or measure as bushel) or production per unit of land.

P= market price per unit of product (weight or bushel) of product.

a= production cost for each unit (weight, or bushel), *f*=freight rate per unit (weight, or bushel)/ mile/ distance.

4. VonThunen himself has admitted that with the change in location of transportation or market centre the pattern of land use will also change.
5. During the past 160 years, there have been sizeable changes in agricultural land use and the economy with which it interacts. The most important of the changes have been improvements in transportation technology; these improvements now permit a space-time convergence of distant places, thereby expanding the scale of possible economic organisation.In VonThunen's day, heavily loaded horse-drawn carts moved to market at the rate of about 1 mile an hour.
6. Environmental variables, as pointed out in connection with the physical limits model, are only a general locational constraint and play a passive role in shaping the distribution of modern commercial agriculture. In the human-technological context, the employment of artificial irrigation, chemical fertilisers, and the like, allows farmers to overcome most environmental barriers.
7. With changes in transportation conditions, the macro-Thunian system has also been modified since its emergence. A continuous process is involved that works to maximise locational utility. The situations discussed in Von Thunen's model were that of early 19th century era. The original Thunian model contained forestry (in its second ring) near to market, because heavy weight wood used for fuel and construction was expensive to transport. By the second half of the 19th century, cheaper rail transportation changed the entire pattern.

Demand for better access begets technological development, which results in transport innovation and culminates into change in pattern of agricultural land use.

8. Three kinds of economic empirical irregularities can be anticipated to influence the national Thunian pattern: transportation biases, distant concentrations of production that appear inconsistent with his model, and secondary markets.
9. The VonThunen model is also static and deterministic. Today, we know that economic growth and changes in demand will alter the spatial patterns of agricultural systems and land use, which in turn influence the rate of change. It might be possible to postulate a dynamic Von Thunen model that could be applied to the changing conditions.

But, the model, despite these possible manipulations, is really static, since, it represents a land use system at one point in time, VonThunen was not concerned with transitional changes, since, he and most of the direct extenders of his model assumed that any change in technology, demand, or transport cost would automatically be accompanied by an adjustment in the land use system.

The Thunian model was developed in the early 19th century, since then, conditions have entirely been changed. Therefore, it is not desirable to accept this model in its original form as observed by many scholars. But this model is still considered to be significant in many ways.

Finally, VonThunen incorporated two examples of modifying factors in his classic model. The effect can clearly be seen of a navigable river where transport was speedier and cost only one-tenth as much as on land, together with the effect of smaller city acting as a competing market centre. Even the inclusion of only two modifications produces a much more complex land use pattern.

When all the simplifying assumptions are relaxed, as in reality, a complex land use pattern would be expected. The catalytic factor in VonThunen's model was transport cost and the main assumption was the assumption of an 'isolated state'. In the modified VonThunen model, the influence of fertility, subsidiary town, information, etc., has been incorporated.

The concentric zones of the model get modified under the impact of various physical, socio-economic and cultural factors. The influence of availability of information also substantially modifies the concentric zone of agricultural land use.

Even though the Von Thunen model was created in a time before factories, highways, and even railroads, it is still an important model in geography. The Von Thunen model is an excellent illustration of the balance between land cost and transportation costs.

Today, the cost and technology of transportation has had a dramatic effect upon the agricultural land use patterns that one would expect by applying VonThunen's logic. Agricultural land use patterns that are evident surrounding market centres are thought to be historic remnants of a bygone era, or the result of administrative institutions whose existence brings about a usage to the historic patterns of land use. At the scale of the continent and the globe we now can observe VonThunen-like market forces and patterns of land use.

Relevance of Von Thunen Model and its Modification by other Researchers in their Work:

The Von Thunen logical framework has been important in the evolution of our thinking of how land values and land uses came about in the modern city. Indeed, Von Thunen's general theory of land values and land uses has been important in the evolution of thought.

All over the world, scholars have tested and applied the Von Thunen's theory of agricultural location. The greatest importance of the theory lies in this fact that it has given a new direction of thinking, resulting into the modified way of its application.

Von Thunen himself relaxed certain assumptions of his model. First, he introduced a canal along which transportation costs were lower than by horse and wagon. The effect was to create a series of wedge-shaped land use zones along the canal. Second, he introduced a second and smaller market, around which he postulated that a series of separate zones would be created.

Similarly, we could relax the assumptions by introducing yet another means of transport, such as a railroad or allow variation in the physical environment. The extent to which these relaxations affect the simple Von Thunen's model will depend on how they affect the simple conceptual framework put forward earlier.

Some researchers have used Von Thunen's model as a general framework for interpreting the spatial framework of the economy. Others have worked on a more direct basis. Thus, Von Thunen's model has been applied to the distribution of European agriculture in 1925.

Muller's interpretation of a normative macro-Thunian model for the United States, anchored by a megalopolis, is shown in Figure 8.4. Its utility for explaining the national pattern of agricultural production is demonstrated as follows:

The macro-Thunian model for normative United States

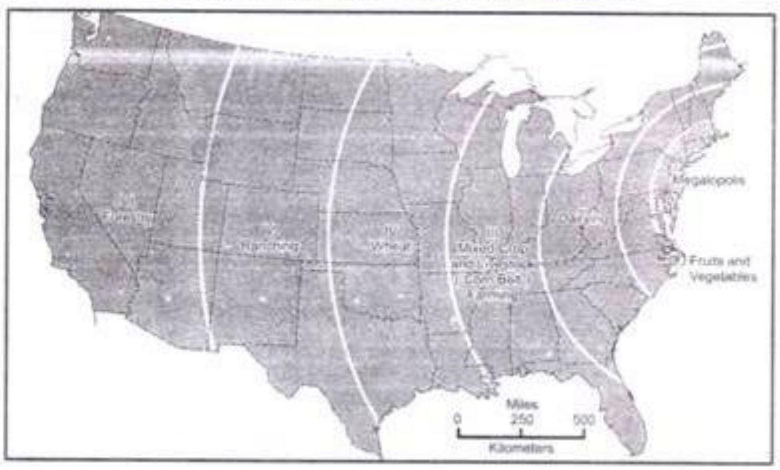

Figure 8.4

We begin again by relaxing the normative assumptions of the isolated state model, but this time with the realisation that empirical irregularities will be complex in the sophisticated economic space of the present-day continental United States.

However, because we are concerned only with the overall organisational framework of farming regions at a high level of spatial generalisation, the search is not complicated: if macro-Thunian processes have shaped the production pattern, then empirical response to them will be easily discernible.

The main task is to set up the investigation by cataloging physical-environmental and economic-empirical irregularities in order to derive an appropriate map of the expected real-world spatial pattern. Empirical evidence of Thunian spatial systems is also widespread beyond the United States. Figure 8.5-A shows the macro-scale pattern of agricultural intensity for the European continent, which is sharply focused on the conurbation ringing the southern margin of the North Sea, from London and Paris to Copenhagen. By combining the American and European patterns and proceeding to a yet greater level of spatial aggregation, one can even perceive (in Figure 8.5-B) a global-scale Thunian system focused on the "world metropolis" that borders the North Atlantic Ocean.

Large-scale Thunian system, showing macro-geographical patterns of agricultural intensity for Europe and in the world

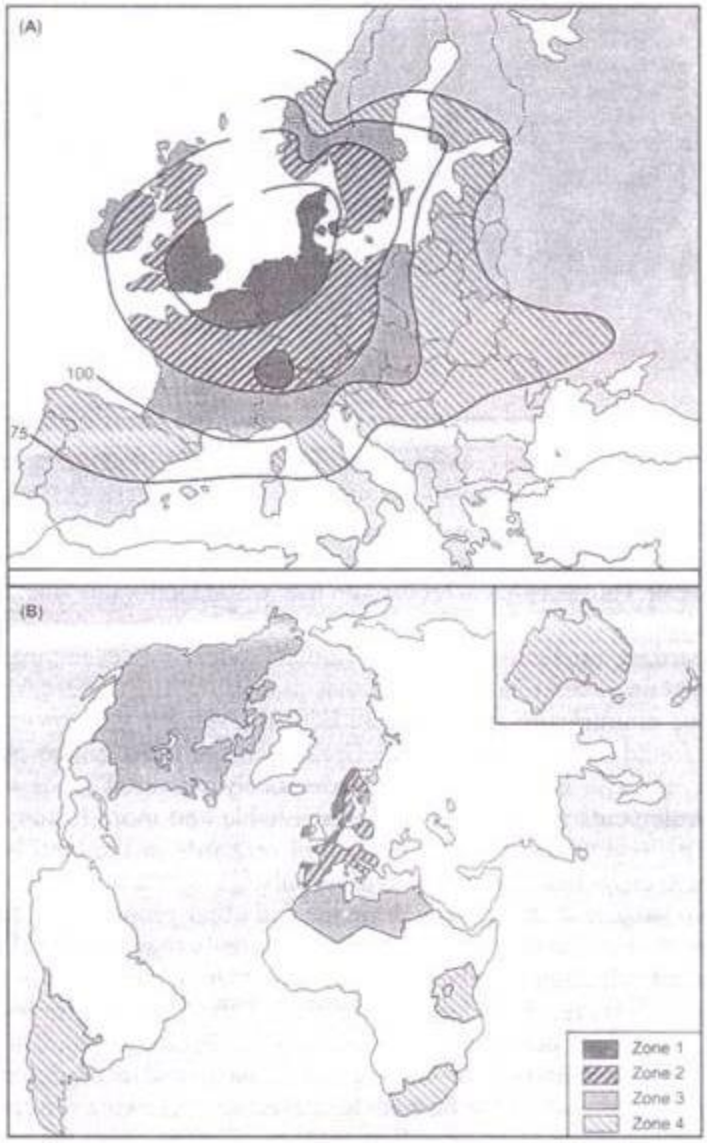

Figure 8.5

Regarding application of the Thunian model in developing countries M.H. Hussain (2010) has observed that in many of the underdeveloped and developing countries of the world, in both the villages and towns, cropping belts are found. In the villages of the Great Plains of India similar patterns can be observed.

The highly fertile and adequately manured lands around the village settlements are devoted to the perishable and more fertility requiring crops, e.g., vegetables, potatoes, oats and orchards in the land lying in the middle belt; crops like rice, wheat, barley, pulses, sugarcane, gram, maize, etc., are grown subject to the texture, drainage and other properties of the soils.In the outer fringes fodder crops and inferior cereals (bajra, millets) are sown. Alter the introduction of tube well irrigation in the great plains of India, this pattern has, however, been largely modified as the farmers with better inputs are able to produce perishable crops even in the distant fields from the settlements.

The consolidation of holdings in India has also modified the crop intensity rings as each of the farmers is interested in growing the commodities tor his family consumption as well as some marketable crops for earning cash to clear his arrears of land revenue and irrigation charges and to purchase the articles from the market for his family consumption.In some of the developing countries like India, Pakistan and Mexico the introduction of HYV (high yielding variety) has disturbed the application of VonThunen model.

The fast development of means of transportation has made it possible to transport the perishable goods at long distances in short period of time. Thus, the model advocated by VonThunen is no longer operative in its original form.

Thunian distance relationships can also be discerned at the national level in smaller developed countries such as Uruguay. Allowing for that nation's empirical irregularities, Ernst Griffin discovered that the expected Thunian pattern accorded nicely with the actual intensity of agricultural land use. Continuing down the level of generalisation continuum from mesoscale to microscale, Thunian influences are often observed to shape farming at the local level. Moreover, local agricultural productions in the less developed world, where technological conditions are more comparable to those of Von Thunen's days, May even exhibit spatial structures reminiscent of VonThunen's landscape.

Ronald Horvath found just such a pattern for the area surrounding Addis Ababa, Ethiopia. The particular significance of his discovery was an expanding transportation-oriented eucalyptus forestry zone in its classical inner position.

8.6 WHITTLESEY'S MODEL OF AGRICULTURAL LAND USE

Region and regionalism are one of the most critical and exercised phenomena in geographical literature in term of concept, methodology and application. Whittlesey stated that egional systems may be arrived at the aggregation of areal units or by subdivision regions. One of the most satisfactory classifications of agricultural regions in the world was proposed by Derwent Whittlesey in 1936. Whittlesey employed five criteria to classify agricultural regions n the world:

i. Crop and Livestock Combination
ii. Intensity of Land Use
iii. Processing and Marketing of Farm Produce
iv. Degree of Mechanisation
v. Types and associations of Buildings and other structure associated with Agriculture.

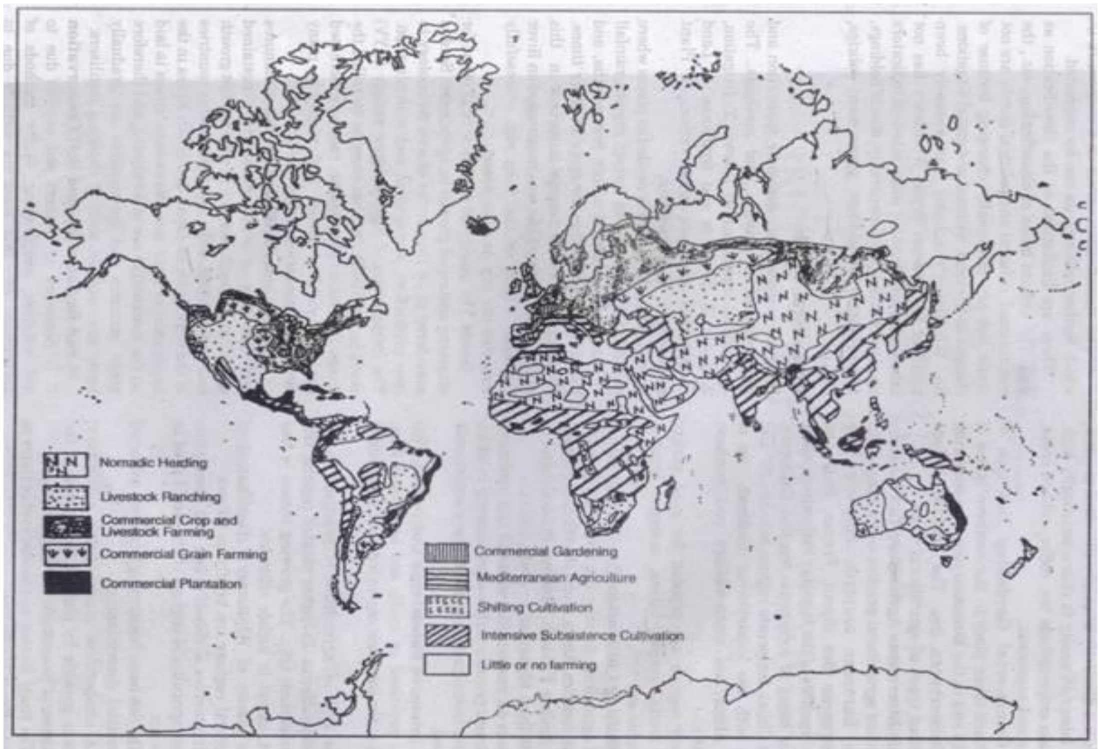

Figure 8.6

Whittlesey's Agricultural Regions

In 1936, Whittlesey identified 11 main agricultural regions, plus an area where agriculture was non-existent. Whittlesey's 11 regions are divided into 5 that are important in developing countries and 6 that are important in developed countries, which are based on the above determined criteria:

1. Nomadic Herding/Pastoral Nomadism:

Nomadic herding is practised in the drylands of Sahara, Saudi Arabia, Iraq, Iran, Afghanistan, Central Asia, Mongolia and China. Nomadic herding is also practised in south-west Africa, western Madagascar and along the southern boundary of the Tundra region in Eurasia where the Tungus rear reindeers.

This type of economic activity is characterised by a frequent change of habitation in search of fodder, fruits, nuts, edible roots, trading opportunities, etc. The migration may even be of 'seasonal' nature. For instance, the Tundras move northwards to mountains during summer and southwards to forests during winter. Similarly, the Gujjars of Jammu and Kashmir and Himachal Pradesh move to upper altitudes during summer and to the plains during winter.

2. Livestock Ranching:

Livestock ranching is undertaken in the vast prairies of western USA and western Canada, central Mexico, the belt from Venezuela to Argentina, the veld region of South Africa, temperate grasslands of Australia and New Zealand, and the region to the north of Caspian Sea.

In agricultural regions of this type, cattle rearing are done in relatively rainy parts, sheep are reared in less rainy parts and goats and camels are reared in low rainfall and warmer regions.

3. Commercial Dairy Farming:

Commercial dairy farming type is practised on the western shores of France, the UK and Ireland, the Great Lakes region and the north-west in the USA, south-eastern Australia and in New Zealand.These areas receive rainfall throughout the year and produce good quality, nourishing grass. Mainly cattle and poultry are reared. These regions are known for good quality milk products—cheese, butter etc., which are even exported.

4. Commercial Crop and Livestock Farming:

This type of agriculture is practised in temperate and dry continental climates of central European plains and to the east of the Urals up to Lake Baikal.

These areas are mostly influenced by the westerlies; hence, the rainfall is low in summers. Major crops grown are oats, barley, rye, flax, potatoes and other root crops, and wheat. Vineyards are also important.

5. Commercial Grain Farming:

This type of agricultural operations is undertaken in the Great Plains of North America, Uruguay, Argentina and the Eurasian Middle-East.

This type is distinguished from the type mentioned in item 4, mainly by the type of crop produced and the degree to which the crop enters commercial and international market.

6. Commercial Plantation:

This type of agricultural activity occurs in south-east Asia (Indonesia, Malaysia, the Philippines), Sri Lanka, West Africa, south and central USA, and Central America.This is a distinctly tropical cultivation practice, where labour intensity is characteristically high.

The main crops include tea, coffee, rubber, cocoa, coconut and sugarcane.

7. Commercial Gardening:

This type of agriculture takes place in the southern states of the USA and in the European countries bordering the Mediterranean Sea. The products include specialised types of agricultural crops.These farms grow the fruits and vegetables that are in demand in that country. Agriculture in this region is sometimes referred to as truck farming.

8. Mediterranean Agriculture:

This is a fairly widespread agricultural practice which takes place in the European countries bordering the Mediterranean Sea (Spain, France, Italy and former republics of the Yugoslav Federation), along western edges of continents (central California, central Chile), temperate regions between 30° and 40° in both the hemispheres (southern tip of South Africa and south-western and southern Australia).

These regions are reputed for good quality citrus fruits—grapes, olives, oranges, lemons, pineapples etc. .Horticulture - which is the growing of fruit, vegetables, and flowers - and tree crops form the commercial base of Mediterranean farming. Most crops in the Mediterranean lands are grown for human consumption rather than animal feed.

9. Shifting Cultivation:

This is a subsistence type of agriculture practised in forested highlands of South America, Africa, India (North-East, Orissa, Bihar, Andhra Pradesh, and Madhya Pradesh) and in the belt from Myanmar to south China.

This is an unscientific, wasteful and inefficient agricultural practice with low productivity in which primitive techniques and rudimentary implements are used.Once farmers use up all of the nutrients, they abandon the land. It is a form of subsistence farming. They clear land for farming, by slashing vegetation and burning debris. It is also called Slash & Burn cultivation.

10. Intensive Subsistence Cultivation, wet and rice dominant:

This type is practised in south and south-east Asia, mainly in the monsoon region with red and alluvial soil.

This type of agriculture is practised in all types of landforms. In higher rainfall regions, rice is an important crop. The growing season is free of frost, except in higher altitudes.It is the largest form of agriculture by workers. The term intensive implies that farmers must work intensively to subsist on a parcel of land.

11. Intensive Subsistence Cultivation, crops other than rice dominant:

This type is practised primarily by the large population concentrations of East Asia and South Asia, where rice growing is difficult. It involves the skilled use of crop rotation

Merits of Whittlesey’s Classification of Agricultural Regions:

1. It provides a classification and description of major agricultural regions of the world used in atlases etc.
2. The five basic functioning forms are subjected to statistical determination.
3. A comparative study of the agricultural regions is possible by plotting the system of the first degree of magnitude on a single map.
4. The study focuses on the observable items in the agricultural landscape.
5. The classification serves as a framework in which further refinements can be suggested.

Limitations ofWhittlesey’s Classification of Agricultural Regions:

There are limitations to the classification as well. The various bases of classification, viz., the institutional, cultural and political factors are not static but are continually changing because of changes in the local, national and global situations. So, Whittlesey’s scheme has recently been modified by Thoman Fryer. Whittlesey has not taken into consideration some relevant indicators like land tenancy, land ownership, size of holdings, fragmentation of holdings, government policies, etc.

Check Your Progress II

Q.1 What do you mean by an 'Isolated State'?

Q.2 Mention the main agricultural regions in which the world has been divided by Whittlesey.

8.7 CONCLUSION

Land has been one of the most important resources for the development of man throughout his ages. The usage of land for different purposes and the agriculture serve as the basic and main outcome of how we live today Later with time all these things got enhanced and modified. The global level regionalization has been attempted by the process of division. Whittlesey's world agriculture regions show their specific characteristics. Since agriculture regions are multiple-feature regions, they contain very diverse patterns of various agricultural characteristics which make each of them generally typically patterned so as to distinctify from others. These diverse criteria or features are naturally hardly spatially co-varying, and as a consequence, they have together intermediate limits. Hence such regions are based on convergence boundaries, and they are quite serviceable to study. Each depicts variety of agricultural trends and their spatial results.

8.8 SUMMARY

- Land use is characterised by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it.
- The Von Thunen's location theory or model states that if environmental variables are held constant, then the farm product that achieves the highest profit will outbid all other products in the competition for location.
- There is an 'Isolated State', consisting of 1 market city and its agricultural hinterland. The city is located centrally within the "Isolated State" which is self sufficient and has no external influences.
- Von Thunen's model examines the location of several crops in relation to the market. The location of crops, according to him, is determined by:

i. The market prices,

ii. Transport costs, and

iii. The yield per hectare.

- Whittlesey employed five criteria to classify agricultural regions n the world:

i. Crop and Livestock Combination

ii. Intensity of Land Use

iii. Processing and Marketing of Farm Produce

iv. Degree of Mechanisation

v. Types and associations of Buildings and other structure associated with Agriculture.

- In 1936, Whittlesey identified 11 main agricultural regions, plus an area where agriculture was non-existent.
- Whittlesey's 11 regions are divided into 5 that are important in developing countries and 6 that are important in developed countries.

8.9 GLOSSARY

- **Isolated State :** An area, consisting of 1 market city and its agricultural hinterland.
- **Amateur :** Especially fond of some particular thing
- **Wilderness :** Anunsettled and uncultivated tract of land left in its natural state.
- **Hinterland :** A rural territory or an undeveloped area
- **Empirical :** Based on proper observations and experiences

8.10 ANSWER TO CHECK YOUR PROGRESS

Check Your Progress I

Ans.1 Land use is characterised by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it.

Check Your Progress II

Ans.1 There is an 'Isolated State', consisting of 1 market city and its agricultural hinterland. The city is located centrally within the "Isolated State" which is self sufficient and has no external influences.

Ans.2 Refer section, 8.6

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2. *Agriculture regionalization,* **World and Agriculture Regions.**

8.12 SUGGESTED READINGS

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8.13 TERMINAL QUESTIONS

Q.1 Explain the zonal classification in Von Thunen's Model along with proper diagram.
Q.2 How the Von Thunen Model does affect the agriculture in India? Cite some examples.
Q.3 Explain the zonal classification of Whittlesey in detail.

BLOCK 3 : SECONDARY ACTIVITIES

UNIT 9 - SECONDARY ACTIVITIES: CONCEPTS, CLASSIFICATION AND IMPORTANCE

9.1 OBJECTIVES

After reading this unit learners will be able to understand the concepts, classification and importance of secondary activities. A secondary activity is a separate activity that produces products eventually for third parties and that is not a principal activity of the entity in question. The outputs of secondary activities are necessarily secondary products.

9.2 INTRODUCTION

Under these actions, the resources obtained from nature are not directly utilized, but they are cleaned, refined or transformed to make them usable. This increases their value. For example, making of steel machines or other items by dissolving iron, making flour or flour from wheat, cloth from cotton and wool, furniture from wood, paper, etc. The industries producing these goods are called secondary industries. All types of manufacturing industries come under them. Now Bagat agriculture and special advanced and completely new technology, intensive and mixed farming are also included in this.

9.3 MEANING OF SECONDARY ACTIVITIES

Secondary Activities Industries which are involved in making more valuable and useful goods from the products of primary activities such as agriculture, forestry, fishing and mining are called secondary activities. Manufacturing of cloth from cotton; sugar from sugarcane etc. are the examples of secondary activities. Secondary Production Related Occupations - Under these businesses, the natural resources are not directly utilized, but they are cleaned, refined or changed to make them usable. This increases their value. Such as making steel machines or other items by dissolving iron, making flour or flour from wheat, making cloth from cotton or wool or silk, making furniture from wood, making paper etc. The industries that manufacture these goods are called 'secondary occupations'. All types of manufacturing industries are included under them. A variety of secondary industries have been developed in all countries of the world. These industries are iron - steel, textile, chemical, rubber industry etc. These industries are developed to refine primary goods and make them more useful.

9.4 CONCEPTS OF SECONDARY ACTIVITIES

The occupations which produce finished goods by using the products of primary activities as raw materials are included in secondary activity. Manufacturing of cloth from cotton, sugar from sugarcane and steel from iron ore are important examples of secondary activities.
All these are secondary activities because the final product is to be produced not by nature but has to be made by men and therefore, some process of manufacturing is essential. Let us take an example of cloth. Though the primary product, i.e., cotton is produced by nature, but it cannot be used directly by us in this form. So to convert it into usable form some process of manufacturing is essential. This can be done in a factory or at home with simple toIndustries which are involved in making more valuable and useful goods from the products of primary activities such as agriculture, forestry, fishing and mining called secondary activities. Manufacturing of clothes from cotton and sugar from sugarcane, etc are the examples of secondary activities, they are called secondary activities because they process and manufacture the primary products into secondary products, thus they represent the secondary stage of activities.

9.5 CLASSIFICATION AND IMPORTANCE OF SECONDARY ACTIVITIES

The subject-area of economic geography is as broad as the expansion of human economic activities. Economic activities refer to those actions of human beings that increase the value or form of various goods and increase their ability to satisfy different needs of human beings. The increase in the value of goods comes from their Form, Place and Place Ownership. Three basic requirements of man have been considered, in the absence of which his life becomes difficult. Apart from air and water, these three essential requirements are - Food, Clothing and Shelter.

Basic need of human

Food	Clothing	Shelter
(To maintain the power to the body, grow and attain it)	(To protect the body from adverse climatic condition)	(to protect the body, rest , sleep and protection from enemies attack)

To fulfill these needs, humans have to depend on their own or others' labor. Human beings have to join other people who can manufacture or produce these items of need. These items are either found on the surface of the earth or in the earth itself or they are prepared for human consumption by removing them or adding, 0modifying or refining them. Just as wheat is used to make bread, wheat is produced by agriculture, it is converted into flour to make it useful. The manufacture of furniture is made from wood obtained from forests and wool sheep for woolen textiles and cast iron is used for tools.

The division of economic activities into primary, secondary and tertiary sector is useful from many perspectives.

(i) It shows the employment status: The classification of economic activities shows the employment status in various sectors. For example, in a developing country like India, most people are engaged in primary sector also known as agriculture and allied sector. On the other hand, in developed countries, such as the United States, most people are employed in the secondary and tertiary sectors.

(ii) For Government Planning: The classification of economic activities also helps the government to take steps so that more and more people are employed in non-agricultural sectors, especially in tertiary sector, as this sector helps in the development of primary and secondary sectors. is .

(iii) To know the contribution of the people: Economic activities carried out by different groups of people, their percentage and GDP. His contribution to G.D.P. Knowing the situation: We know the GDP and graph of these sectors and their share in percentage.

(iv) Share of sectors: Through classification we have also come to know about the share (percentage) in the employment sector. The classification also tells us the number of workers involved in different sectors (millions / millions).

(v) Knowledge of economic activities: The classification of the region informs us the economic activities carried out in the country.

9.6 CONCLUSION

The chapter on Secondary activities shows the concepts, classification and importance of economic activities. These economic activities have a direct impact on resources. This is the only resource that can be made usable. Such as cotton - cotton textiles, manufacture of items related to iron and steel, silk, wool, wood also we change the form of the products produced in the same way and make a new item. The subject area of secondary activities is wide because the complete form of the object under it is changed. Through these types of activities, the nature of the object and its cost vary. These activities of humans increase and work in harmony with the secondary group in three forms. These three activities are related to food, clothing and shelter and all three make a major contribution in furthering the secondary activities.

9.7 SUMMARY

A secondary activity is a separate activity that produces products eventually for third parties and that is not a principal activity of the entity in question. The outputs of secondary activities are necessarily secondary products. Under these actions, the resources obtained from nature are not directly utilized, but they are cleaned, refined or transformed to make them usable. This increases their value. For example, making steel machines or other items by dissolving iron, making flour or flour from wheat, cloth from cotton and wool, furniture from wood, paper etc. The industries producing these goods are called secondary industries. All types of manufacturing industries come under them. Now Bagat agriculture and special advanced and completely new technology, intensive and mixed farming are also included in this.

9.8 GLOSSARY

- Precede = Gerund or present participle: preceding to happen, come or go before somebody/ something
- Refined = Used about a substance that has been made pure by having other substances taken out of it.
- Occupation = A job profession: the way in which you spend your time
- Manufacturing = To make something in large quantities using machines.
- Form Change = The process of becoming or making something different.

9.9 ANSWER TO CHECK YOUR PROGRESS

Q1. Explain secondary activities?

Ans.A secondary activity is an activity performed by a unit addition to its principal activity. The result of a secondary activity is called secondary production.

Q2. Explain the concept of secondary activities?

Ans. Secondary activities are those activities which involve the manufacturing of finished goods by processing the raw materials that are found in the nature.

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9.11 SUGGESTED READINGS

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9.12 TERMINAL QUESTIONS

Q1. Do you believe that economic activities have the utility of division into primary, secondary and tertiary sector? Explain how?

Ans. The division of economic activities into primary, secondary and tertiary sector is useful from many perspectives. (i) It shows the employment status: The classification of economic activities shows the employment status in various sectors. For example, in a developing country like India, most people are engaged in primary sector also known as agriculture and allied sector. On the other hand, in developed countries, such as the United States, most people are employed in the secondary and tertiary sectors. (ii) For Government Planning: The classification of economic activities also helps the government to take steps so that more and more people are employed in non-agricultural sectors, especially in tertiary sector, as this sector helps in the development of primary and secondary sectors. is .(ii) To know the contribution of the people: Economic activities carried out by different groups of people, their percentage and GDP. His contribution to G.D.P. Knowing the situation: We know the GDP and graph of these sectors and their share in percentage. (iv)Share of sectors: Through classification we have also come to know about the share (percentage) in the employment sector. The classification also tells us the number of workers involved in different sectors (millions / millions). (v)

Knowledge of economic activities: The classification of the region informs us the economic activities carried out in the country.

Q2. What are secondary activities and why are they called secondary?
Ans. Industries which are involved in making more valuable and useful goods from the products of primary activities such as agriculture, forestry, fishing and mining are called secondary activities. Manufacturing of cloth from cotton; sugar from sugarcane etc. are the examples of secondary activities.
They are called secondary activities because they process and manufacture the primary products into secondary products, thus they represent the secondary stage of activities.

UNIT 10 - FACTORS OF INDUSTRIAL LOCATION; INDUSTRIAL LOCATION AND ECONOMIC GROWTH MODELS

10.1 OBJECTIVES

After reading this unit learners will be able :

1. To understand the meaning and concept of industrial location.
2. To analyze various viewpoint of scholars regarding industrial location.
3. To explain factors influencing the location of industries.
4. To expound the dynamics of location.

10.2 INTRODUCTION

A location theory is the systematic and rational analysis of spatial distribution of industries to find out the relative merits and demerits of any particular space over the others, for the construction pf manufacturing units and unit.

The distribution of industries of the world markedly varies from each other on the basis of raw materials, the process of manufacturing, the resultant products and even the markets. Therefore, it is quite natural that the locational preferences will also differ. So, this spatial difference of location needs careful study. The studies primarily concerned about the spatial variation of industrial locations are known as industrial location theory.

Any manufacturing process involves in the transformation of inputs, in one way or the other. Of course, the inputs like raw materials, energy, labour force are spatially distributed over different places. To mobilize all the inputs in a single place, we need excellent transport facilities. Other than production process, selling of the ‘output’ to the consumers in the market also require transportation to finished products. So, input mobilization, transformation process of input for manufacturing of output or finished products and selling of the products to the consumers are the major processes of manufacturing.

The manufacturing units get comparative advantage over one another, if the scale, technique and the location vary. The selection of industrial location is always controlled by the magnitude and cost of production. Beside these, the technologies adopted also control the wage rate of labours and quality of products.

10.3 FACTORS INFLUENCING INDUSTRIAL LOCATION

The relative advantage of one area over other, and the combined production cost difference between the places, is the essence of any locational study. The availability of raw material, cheap labour, transport cost and proximity to market makes the manufacturing cost differential between the places. If ‘profit maximization’ is the chief objective of entrepreneur, automatically ‘least cost’ location will be preferred for industrial location. The different locations have distinct geo-economic character. The factor governing the location of a industry fall into two broad group. These are: (1) Geographical Factor, (2) Socio-economic factor. It is indeed very difficult to discern the factors distinctly on which category they belong to, but broadly the subdivision are as follows:

1. Geographical Factor

a) Land
b) Climate
c) Water resource
d) Fuel

2. Socio-Economic Factor

a) Capital
b) Raw material
c) Labour
d) Transport facility
e) Demand
f) Market
g) Tax structure
h) Government patronage
i) Management
j) Other factor

1. Geographical Location

a) Availability of Land: Needless to say, that land is a prime requisite for any industrial establishment, whatever may be the process, technique or volume of the raw material or the product. Apart from the mere availability, quality of the land-form-undulating, even or steep slope-influences localization of the industry. The cost of land abruptly changes with the change of economic development of the area. It has been observed that extensive plain lands are generally inhabited by dense population. The urban centers generally develop on riverine plains, which on the other hand is also preferable for industrial location. Due to this conflict, cost of the land escalates rapidly.

b)

c) Climate: Even today, role of climate in the development of any industry has not been properly ascertained. The effect of climate on the growth of some particular industries cannot be ignored. In some instances, climate plays a vital role in development of the industry. The effect of climate was, perhaps, greatest in cotton textile industries in last centuries. The mild, humid climate of some places yielded comparative advantage over their competitors. Apart from textile, precision industries like electronics, watch, electrical, aviation apparatus and telecom instrument have also preferences on particular climate. Besides this, in general, mild climate increases productivity. After the introduction of artificial cooling system, however, effect of climate has been reduced.

d) Water Resource: Availability of water near industrial plants are pre-requisite for some particular industries like iron and steel, textile, card-board, cooper smelting and alumina reduction plant etc. besides manufacturing industries, thermal power stations, and, of course, hydel power plants require large amount of water. The recent trend of industrial location indicates strong influence of the proximity of water source. Apart from direct use of water to the plant, for drinking, drainage of industrial effluent, cooling purpose, water is regarded as one of the major ingredients for industrial growth.

e) Fuel: Fuel is one of the pre-requisites in manufacturing units. The conversion of fuel, either solid, liquid or gaseous, to kinetic energy is the basis for the transformation of raw material to the finished products.

2. Socio-economic Factor

a) Capital: The capital or investment is the basic requirement for the establishment of a manufacturing unit. The amount of financial investment discerns the magnitude or scale of the unit. In modern manufacturing world, not only the products but its marketing also needs tremendous capital investment. The role of financial institutions like bank and insurance are increasing day by day. The large industrial establishments require such a huge amount of money that capital accumulation from financial agencies, state government and even from people is a regular practice.

b) Raw Material: The proximity of the availability of raw materials is an important factor influencing the choice of location. There are certain industries in which the cost of raw material is the major component of cost of production of a product, e.g., sugar, cotton textiles, jute textiles, plantation industries, etc. On the other hand, in; some other industries it need not be high. Higher the proportion of raw material cost in total cost of production more shall be the weightage to this factor and vice versa. The nature of raw materials also determines the relative importance of this factor. There are certain raw materials, which are either bulky or perishable in nature or are heavy. Such raw materials cannot move long distances. PVC on the other hand can easily be transported over long distances. In the former situation, proximity to raw materials will be a critical factor, whereas in the latter it may not play an important role.

c) Demand: Demand cannot directly influence the location of the industry. In fact, demand of a particular commodity determines the very existence or survival of the industry. But in macro level demand of a region or a country attracts industries. Demand is, in reality, the reflection of market condition.

d) Labour Relations: With respect to labor there are two aspects. One is the easy availability of cheap low-wage labor. This factor alone was responsible to a great degree for early concentration of textile industry first in the Mumbai region and later in inland towns like

Ahmedabad, Sholapur, Nagpur and Kanpur. Similarly, the working of the iron and steel industry in Jamshedpur was very much facilitated by the supply of a fairly stable labor force. However, the efficacy of this one factor is getting fast eroded. Now with the development of the means of transportation and communication it is increasingly becoming possible to arrange increased supply of labor from any distant place. For example, development of call centers. Two, the labor relations play an important role in this decision. The regions, which are marked by the presence of strong trade unions are generally given a low priority. More important than the presence of strong trade unions is the attitude of the government towards the union activities. Where the governments have resorted to strong-arm tactics to keep a rein on militant unions, industry has tended to flourish in those regions. On the contrary, where the governments have been silent spectators towards the unlawful activities of the trade unions, flights of industry has not been unknown.

e) Transport Connectivity: Industrial location is also influenced by the factor that how well a particular site is connected with distant places by means of transportation and communication. Development of new made of communication have led to dispersion in some service industries. Transport connectivity influences both the availability of raw materials and servicing the distant markets for finished products. The increased flexibility and efficiency of modern forms of transport have enabled industries to exercise a freer choice in the matter of location than in the past.

f) Power Resources: Power is the most essential input to run the modem industry. No industry can do without the supply of regular good-quality energy. Therefore, those regions, which are endowed with regular supply of energy attract more industries than those regions which are bereft of this resource.

g) Access to Markets: The consumption centers are equally important determinants of the location of an industry. Here again, the relative importance of this factor depends on the nature of the product. The market for bulky and perishable products ought to be limited to a small geographical area. In such cases, industry would tend to cluster around the consumption centers. On the other hand, if the finished product.

h) can be easily transported over long distances there is no reason for industry to get concentrated at any individual place. Evolution of new markets is an important factor in the dispersal of industrial activity.

i) Infrastructure Services: Low prices and easy availability of developed land sites along with the existence of public utility services attract more industry; social amenities offered by particular areas as regards housing and medical facilities offer an attraction to industries. Further, when an industry concentrates itself' within a relatively small area, important advantages often accrue to it as a result of what have been called 'economies of concentration'. These consist mostly of external economies, which bind individual firms more closely.

j) Financial Services: The availability of reliable and cheap financial facilities and services has played an important part in the gone past in determining the location of industries. But with the growth of electronic means of transfer and communication this factor has lost its importance, except in those situations where the governments provide liberal credit facilities in order to attract industry to a particular area or a region.

k) Personal Factors: Entrepreneurs are known to have not always been guided by purely economic considerations in deciding location of their industrial enterprises. However, Personal preferences and prejudices of, these persons play an equally important role in deciding the location of industries.

10.4 THEORIES OF INDUSTRIAL LOCATION AND ECONOMIC GROWTH

From the later part of the 18th century, the western world had witnessed an unprecedently industrial growth. Numerous industries of various kind, scale and technique took birth. The spatial concentration of industries in urban centers and mining towns posed tremendous problems both to the entrepreneurs and the people. To earn maximum profit by reducing cost, growing urge surfaced to find out the least cost location of industries. The pioneer effort in this regard was made by Johan Von Thunen in the early part of the 19th century. The major objective of his theory was, however, to delineate the agricultural zones of different crops and demarcation of its limit and distance from the city core. In this theory, he attempted to discern the probable profit of cultivation of different crops according to the distance from the consumer. Through the theory primarily discussed agricultural activities, it had certain influence on the industrial theories devised in the subsequent periods.

Among, the different locational theories, because of simplicity, scientific approach and originality, the theory of Weber and Losch are more relevant than the other. There are two broad groups of theories of industrial location:

I. classical location theories and
II. more current suboptimal group of theories.

Early classical theories were more concerned with the nature of raw materials, other material inputs, 'markets, transport, overall location cost minimization and profit maximization, along the pathway of determinant optimum industrial location. In neoclassical situations, these factors underwent significant structural changes in content and emphasis. Gross raw materials are no longer used in crude raw form Whatever the farm, their total input quantity in manufacturing (excepting processing industries) has been drastically reduced, thanks to the technological upshot as well as consumers' taste for smaller size, less bulky, and lighter semi-durable products Market cycles, product cycles, new types of global 'brand' products and globalization effects have all led to the emergence of new types of location factors. As such, decision-making in industrial location factors has gone in more elastic and different sets of players and factors. The very thrust on rigidity on cost minimization and profit maximization or mass goods production scale has been of less importance, and has yielded important role to factors of international, regional and intra-national, scale. Human-technological-learning-upskilling, knowledge and management, and other nonmaterial factors have become very important. TNC-propelled up thrusts; squeezing distance-and-time factors through ICTs lean flexible production, reindustrialization and de-industrialization, and multimodal transport, and overall transport cost reduction are all the more complexly functioning factors. Lately, new behavioral and structural theories have become important Psychic income has been also replacing the neo-classical-thrust on the profit-maximizing 'economic man' New locational thrusts require salubrious, working environments for enriching 'good living' for their managerial personnel.

Classical location theories and sub-optional theories

Classical locational theories have been subcategorized into the following types:

I. Classical location theories

1. Weber's least-cost theory
2. Losch's revenue maximization theory
3. Hotelling model
4. Laundhardt-Palander construction of least-cost theory
5. Isard's substitution theory
6. Spatial margins to profitability
7. Central place theory, and
8. Greenhunt's general theory of location

II. Sub-optional theories

9. Behavioural theories
10. Structural theories

All these theories will be discussed in that order in the forthcoming pages.

WEBER'S THEORY OF LEAST-COST

Alfred Weber, a German location economist, pro-pounded his famous least cost theory of industrial location in 1909 in his German book uber den standort der Industrien, translated into English in 1929 as The Theory of the location of industries. Since then the work has been both highly commended and critically reviewed. His theory is much-more comprehensive and has been interpreted by different scholars. He was searching for a theory in relation to what causes an industry to relocate and move out from one place to another. He first analyzed the general regional factors of transport and labour costs, as primary factors, and the agglomeration costs as secondary factors influencing the optimal location of manufacturing industries. The primary causes stand for the regional distribution of industry (regional factors) and secondary causes lead to the relocation of industry. These two are the agglomerating and deagglomerating factors respectively.

Weber's main thrust was to analyze different cost- minimizing transport factors and processes and their impact on location. He offered certain assumptions like in other deductive models, and maintained the phrase 'other factors being equal' to give weight to his search. His assumptions were as follows:

1. Any country or area is typically uniform or isotropic, as Von Thunen stated earlier in 1826, in form, of climate, soils, technology, economic system and population distribution.
2. A single product is considered at a time and the product is dispatched to a single market. It differs thus from multi-product plants: This assumption he gave in order to stress on actual locations in space.
3. Raw materials occur unevenly in space at known and fixed places at a few locations, available at equal transportation cost throughout.
4. Markets are punctiform, known and fixed at specific places.
5. Labour is geographically fixed as it is supposed to be immobile by nature in general but abundantly available at particular wage level at specific places.
6. Transport costs are throughout equal as a function of linear distance and weight of the material transported and are assumed to be the chief location determinant. However, Weber allowed the scope for adjusting the additional costs in transport due to topography in terms of distance cost.
7. Other assumptions are that there is a) a perfect market competition, b) each enterprise would incur identical production cost, and c) there would be a uniform demand for a product at all markets, and hence uniform price.

Weber classified materials in terms of weight and availability and their relative importance in processing of products. He introduced and defined certain terms in his analysis:

1. **Ubiquities**: materials found theoretically everywhere in the area to be presumably equally available at the same price. They will not exert 'locational' pull.

2. **Localized materials**: to be found only in 'some' well-known geographical areas. They do exert locational pull according to their characteristics. These are of two types: (i) pure localized material which particularly by nature loses no weight in processing; Cotton wool in spinning or yarns in weaving are given as examples: (ii) gross localized materials which lose weight in processing and which differ in the proportion of loss depending on their characteristics. These are of two types (i) pure localized material which particularly by nature loses no weight in processing. Cotton wool in spinning or yarns in weaving are given as examples: (ii) gross localized materials which lose weight in processing and which differ in the proportion of loss

depending on their characteristics. Sugar beet as a raw material loses up to 7/8 ratio in processing sugar.

Manufacturing involves at least three stages in producing a marketable product:

1. Assembly or procurement costs of input or raw materials, labour, energy-etc.., known as transport costs;
2 Processing costs of raw materials into finished products of different types, and
3. Marketing or distributing costs\of finished products to the consuming points.

Transportation costs are naturally most important in assembly of raw materials, other inputs as well as marketing of finished products, depending on where the plant is located There are three types of locations, such as material site, market site or some intermediate or bulk-of-breakpoint in between. Transport costs depend also on the nature of the transported materials, raw or finished, value of the finished product, and volume of materials used.

Location weight: the total weight that is involved in movement per unit of product.

Material index (MI): an important component of Weber's theory. It measures the production of the weight of the localized materials which is retained in the weight of the finished product. MI x calculated as follows:

$$MI = \frac{\text{Weight of the localized materials in processing}}{\text{Weight of the finished product}}$$

MI is used to indicate whether the least-cost location is oriented toward the raw material site or market site. The basic MI. formulation states that: in case MI is less than 1, it favours market-site plant location; if more than 1, it tilts to the material site location; and if a plant uses only pure material as raw material it has an index of 1. Either of these two contrasting orientations develops a case of a variety of localized materials or types of finished product.

Plant location in case of use of localized and ubiquitous materials

Localized materials are important in plant location. In procuring ubiquitous materials, found everywhere, the cost is almost zero, and cost of only finished product matters. Market location for plants using ubiquitous materials is optimum (least cost) as the market itself consumes the final product locally without Incurring transport cost from the location of the factory.

It is clear, from the above table that manufacturing industry's locations vary widely from industry to industry in terms of types of raw materials used, including various combinations of pure and gross materials (not considering other costs). Some types of industry, particularly which use much higher quantity of localized gross (weight-losing) raw materials, in relation to the quantity' of products, have to be necessarily located at or near raw material sources. Transportation costs would increase if such raw material inputs are carried to a longer haul. This cost factor prevents any distant plant location for processing, as in mineral processing industry.

Location triangle

Weber demonstrated a series of 'location triangle' to find out and circumscribe an optimum plant of at least transport cost, as the most dominating locational factor.

1. If we examine transport cost assuming the existence of a single consumption centre or market and a single source of raw material, there can be three possible locational points with three different 'material types:

(i) In case of ubiquitous raw material, the lacation will 'be obviously at the 'market site. This is because, the raw material procurement cost in transport is zero, while the market is the ultimate sole consumer of the finished product.

(ii) If the pure raw material is involved, there are three location point possibilities: the market, or at the material source or at same intermediate site. Although Weber did not recognize the unnecessary cost on material handling (for unloading, re-loading) costs at set points, such a point is no longer much entertained. In case of gross (weight-losing) raw material, the material source will be the obvious location point, or any site close to it for such benefits as ample amount of water (for iron smelting), or for energy (aluminium plants consuming large electrical 'energy).

Location in case of one localized pure raw material

In case one localized pure raw material (RM) is used in manufacturing, and market (M) is located at another point where final product will be transported for use the total transportation cost would be equal all the way if production location occurs anywhere on the line Rm-M.

I. One localized pure raw material plus ubiquities: A plant using one pure raw material plus ubiquities will be best located at the market. Soft drink bottling industry plants are mostly located at market as the industry consumes water, an ubiquitous material, as the overwhelmingly largest content, and an infinitesimal amount of syrup to prepare the drink. Bottles used are purchased at the market itself, manufactured and sold by another enterprise. Moreover, today, drink' bottles are returnable to the industry through the market. In case of a plant utilizing ('a) more than one pure raw material or (b) more than the pure raw material plus more than one ubiquity, market happens to be the optional location point.

II. Weight losing two gross material using Industry: In case of a plant using two gross materials, e.g. flour and sugar in processing sweets for instance, market will be the optimum point; Market is the ultimate consumer of the product.

Single market, two gross materials

Weber assumed a location triangle with a single market (M) and two gross or weight-losing materials to be processed either together, at M1 or alternately at M2 or at the market M itself. Assumingly, either raw material loses 50 per cent of its weight in processing. The problem can be decided by calculating the transport costs. Tonne-mileage in terms of each plant located at any of these three equidistant points is assumed to be Rs 100 as per tonne mile. If M1 is selected as processing point, material, at M2 will cost Rs. 100 in tonne-mile up to M1 site. M1 material will be available assumingly at zero cost. As ach of the two materials lose 50% weight in processing, one-unit tonne will be the finished product to be transported to Mat the cost of Rs. 100 tonne-mile. The same cost will occur if processing is done at M2. Finished product will be costing Rs. 200 at the market if materials from Ml and M2 are transported. If market site (M) is the location point, again 2 tonnes of inputs (one ton each from M1 and M2) will cost Rs, 200 (Rs. 100 + Rs. 100), while finished one tonne product delivery cost will be zero for the market. Such plant can be located at any of the three points.

Intermediate point location within the location triangle. Weber did not visualize the cost implications of handling the material costs either for the raw materials or for the finished product costs involved in its delivery to consumption market. If P, an intermediate point location, is assumed to be the feasible optimum point for location of the industry, for the sake of the least transport cost point of views, the total cost of transferring the raw materials from either M1 and M2 as well as the finished product will be the least As explained in the above example, these transport costs are calculated by multiplying the weight of the raw materials from Ml and M2 as well as the finished product. As in the above, case, if the cost of transport in raw material transferring, is the same, and the finished product is one tonne in weight (as in case of a weight-losing manufacturing process, such as iron smelting, the least cost location will be closer to the raw material. This is because transport cost of the tonne of finished product will be less. However; in a weight gaining material, suppose one tonne of material is transferred from both M1 and M2, the finished product will be two tonnes. In such product, then P will be marketing two tonnes of finished material. In Weber's time raw material transport costs were much higher than in case of final product. As such, material site of industrial location was considered less costly. In modem times, low-grade iron ores (much weight-losing gross raw material) are palletized at the mine site itself to convert it into enriched pellets, which involve much less cost in transferring them to the iron and steel centre at much reduced cost. Freight rates have dynamically changed now much differently from Weber's time.

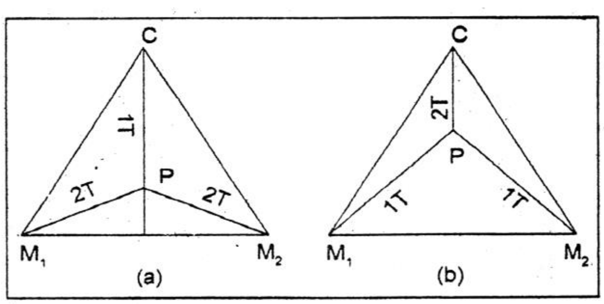

Figure 1: Weber's Location Triangles

Labour factor costs

Weber considered great role of labour cost in relation to industrial plant away from the point of the least transport cost. When industrialists would consider the disadvantage or possible savings in labour cost being greater (than any possible additional transport costs involved) they would be making a relocational move. Weber attempted to resolve this issue through developing isodapane technique.

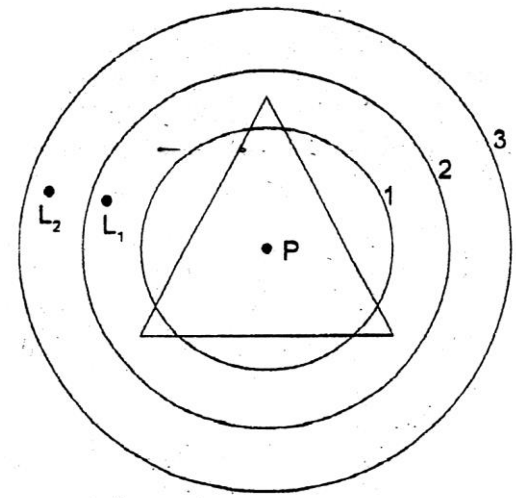

Figure 2: Labour and transport cost effect on industrial location

Isodapanes: In the original analytical measure, Weber derived the least cost model purely b considering' the first primary factor of transport, through transport cost minimization at the locational point. The isodapane is defined as a contour drawn through all the points with equal total transport costs, termed isotims (isovectures), with reference to the supply of each input at the location point, as well as the finished product. As such, the transportation of each item increases with each distance component or unit, from the minimum transport cost point. Then the total transport cost (a) for both assembling the inputs at the production location point, as well as (b) delivering the final product to the markets, is summed up. After this exercise, one is able to ideriti1y the feasible least-cost plant location. P is the originally considered least transport cost point. A series of isodapanes have been drawn per unit of production from P. In this exercise, L_1 and L_2 are found to be two labour points for cheap and abundant labour supply reducing costs by rupee 1 per unit of production. Each of these two points then looks to be alterative to the cost minimizing manufacturer who is likely to be considering whether it would be more rewarding or profitable by relocating the plant away from P and closer to-labour points. It is obvious that any alternative location points within Rs 1 isodapane would be saving more on labour cost to expend additional transport cost for each unit. As such, relocating the plant at or close to L1 would make sense in terms of more profit.

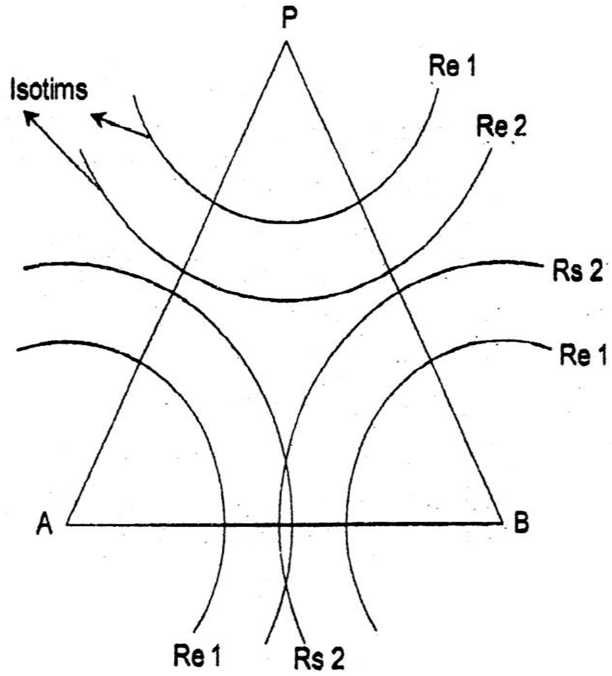

Figure 3: Isotims or lines of equal transport cost

It looks quite plausible to think that Weber was anticipating a situation emerging to cause progressive development in transport, technology and consequent increase in its efficiency, and thereby reducing transport
costs with time. This development would naturally lead to increasing distance between the transport isodapanes. In contrast, he also thought of increasing labour cost possibilities relative to other factor costs.

Economies of agglomeration: Agglomeration economies were visualized by Weber as the chief secondary factor. Industrialists do know the multiple advantages of agglomeration or clustering. Agglomeration occurs as a number of industrial enterprises with different industrial plants would mutually concur to locate and
operate at a clustered space point close by. However, clustering in space in and by itself would not allow any one enterprise to transfer any advantaged itself: it is necessary for at least two enterprises to act together. Agglomeration, economies are both external as well as internal, and exert significantly on the location of economic activity in space. Weber postulated the idea of critical isodapane of enterprises. He visualized agglomeration economies as to exert a strong deviational force on the minimum transport cost location in the same way as is exerted by cheap labour locations. However, in both cases, the pulls by locational deviation were visualized to depend op the location of the attracting force in relation to the critical isodapane it is in this way that the isodápanes of enterprises must intersect for the agglomeration to occur. If intersection does not occur, agglomeration will not arise. Every enterprise that agglomerates will be able not

only to reduce its total costs, but also gain extra advantage from sharing with other agglomerating firms. In A,B,C, and D are all least cost locations.

The effect of agglomeration on location costs, say by Rs. 5 per unit of production is felt if at least three of them (one of A,B,C, and D) concur to locate and operate in the same location. Furthermore, they must not enhance their transport costs over Rs. 5 per unit of production. In Fig. 3, the critical isodapane of 1.5 has been drawn round the plant location of each enterprise. In this diagram, A, C, and D have concurred to operate in the shaded space showing agglomerated space.

Geographic aspects of transport freight rate. Physical distance is an important geographic aspect considered in freight rates of transport. Weber stressed this as chief cost factor and noted that the least transport cost point happens to be the optimum location point of industries. To him, transport cost is a linear function of distance, and accordingly freight cost in creases with increasing distance according to unit weight of the, materials moved. That meant costs of different items varied exactly in proportion to distance. Now transport costs are only exceptionally proportional, to distance for several reasons that also vary according to the different modes of transport e.g. railways, truks, ‘airlines, waterway or pipeline, or multi-modal transport and their different charges. He also’ did not differentiate the costs charged for, raw materials or finished products moved as it prevails today. Hoover in ‘1948 stressed such lacunae in Weberian thesis since transport cost structures have now drastically changed since Weber’s time. Transfer of finished products cost is now more than that of raw materials. Finished product charges depend on such characteristics apart from weight or bulk, or their volume e.g. on their nature of inflammability, packaging type, risk of pilferage, insurance charges or value, etc. Other crucial factors for differential charges are due to the differences in (a) terminal or fixed costs, (b) variable (line-haul or-over-the-roa4)’ costs, and (c) the tapering and stepped-up costs with increasing distance. Terminal costs involve the original construction costs of transportation mode plus at the point facilities, and also material

handling costs, including equipments, storage, and paper billing to customers, and other secretarial and accounting charges. These terminal costs are by location fixed differently for each mode Also they are unrelated to the length of movement, and are spread over all short- journey or long-journey users. As such, they are termed unvarying-with-distance costs. These costs vary with the type of commodities moved. However, there are some notable points in terms of e4conomies of scale in. distance. This is because as the journey lengthens, the fixed cost per mile tends to decline accordingly. This aspect is caught in cost-tapering principle, which is involved in total transport costs.

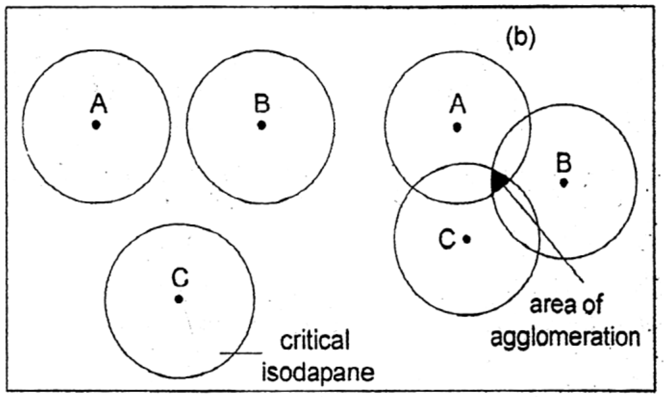

Figure 4: Weber's concept of agglomeration and its effect on industrial location

Varying (or line-haul) movement costs increases with the distance of movement. They are differently charged for specific users. Wages of loading and unloading, fuel, depreciation or wear-and tear costs of capital equipments, route maintenance, and tolls and taxes are involved, which all increase with moved distance. Total transport costs indicate the combined terminal costs plus varying costs. These are no longer linear functions. but curvilinear functions of distance. In fact, they are both curved and stepped and each step is exhibited in terms of regional distance unit zones. Rent curves become curvilinear and indicate that location rent decreases more rapidly close to market than over greater distances. It results into spreading the production zones 'into outer areas.' Moreover, freight rates are now universally charged according to distance zones as zonal structure of. freight rates.

Intermediate point location. Intermediate point location is not regarded as optimum location point, for plants, view of Weber's MI. Tapering costs of transportation with increasing distance renders it all the less likely. As this is because intermediate point will involve costs of two separate, of course shorter hauls, which are likely to exceed the transport cost of one long haul from either the material source site or the market as the location point of the plant. This is particularly because two distinct sets of terminal costs would be involved in short hauls instead of one as in long haul. A two-point plant location problem involving a tapered rate of transport structure. Curve XY shows the' cost in transporting raw material, while the other curve AB involves the cost of transporting the finished good. If one sums up the transport cost on each, of these two at every point between the material and the market site, clearly total cost would be more. This situation renders location at the intermediate paint out of question. It would decidedly incur higher cost than a location at either the market or the material source point because of the current tapering rate of haulage. Moreover, intermediate point location impels to pay two surrogate rates of transporting raw materials and finished products. Moreover, there is no advantage of tapering rates in this case. In recent years, however, some enterprises do prefer to locate plants at the intermediate points due to very economic and cheaper trucking costs on short hauls from point to point door in shorter time, although in small quantities. Such low amounts are good for some types of industries.

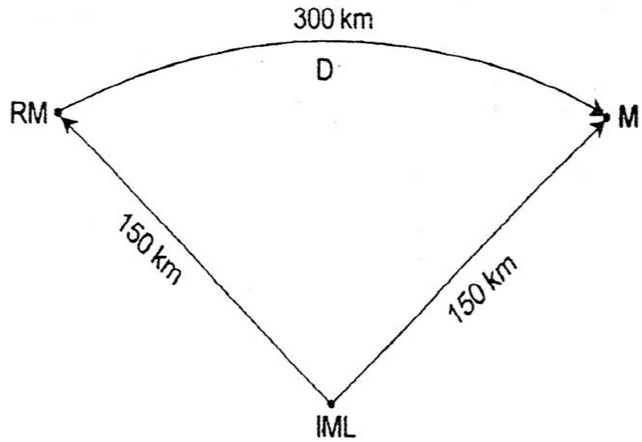

Figure 5: intermediate point manufacturing location and transport cost

There are also other situations which attract enterprises to locate at some intermediate point locations, such as for some transport and other non-transport advantages. Such intermediate points are of two types: one, break-of-bulk point and the other is crossing point of two different political boundaries. There is another variant due to granting of “in transit” privileges by transportation agencies, particularly the railways.

Break-of-bulk point location: Normally, the break-of-bulk point occurs where different transportation modes and route-systems converge. These points of convergence are intermediate transshipment points for products by unloading from one mode/route to loading for another mode/route. Clearly, additional trivial and handling costs involved in such transfers does minimize or even destroys altogether the long level tapering transport cost advantage. If enterprises locate manufacturing plants at the break-of-bulk point, they will be naturally losing these. extra cost advantages.

Criticism:

1. Weber's theory is a model hypothesis based on several premises. But in the complex manufacturing process, presence of all the desired conditions is not possible. Only in the exceptional cases all the premises may occur in a place. So, the theory is an exception rather than rule.

2. The difference of different economic systems has been ignored by Weber. The difference between the capitalistic and socialistic economy, institutional factors and entrepreneurial decision were not taken seriously.
3. Weber over emphasized on the role of transport cost. He considered transport cost is proportional with weight and distance. But, in reality, transport cost of raw material is cheaper than finished product. Transport rate is also not proportional with the distance. It has been estimated that with increasing distance transport cost reduces substantially. The advantage of the 'break of bulk' location was ignored.

4. In his agglomeration concept, Weber tried to establish that if industries concentrate in a region, it would get distinct advantages. But he failed to consider the space problem, energy crisis and problem of civic amenities.

5. The assumption of perfect competition in the concept of Weber is an ideal condition. In the long run it is very difficult to sustain perfect competition in the region.

6. Competition and price fluctuation in the economy is a natural phenomenon. Weber failed to recognize that.

AUGUST LOSCH PRINCIPLES OF PROFIT MAXIMIZATION:

August Losch, a German economist, published his theory of 'profit maximization' in the year 1954. The least cost location theory of Weber was wholly discarded by Losch. In fact, he suggested that, 'profit maximization' is the only objective of the entrepreneur, whether it is state or an individual. The major objective of the industry is, therefore to find out the place where maximum profits occurs.

Unlike Weber, who postulated his entire theory in an economic state of perfect composition, Losch, on the other hand, explained his theory with in the environment of monopolistic competition. According to Losch, industry will not necessarily be located within the least cost (transport cost and labour cost) location, rather it would locate in areas where maximum profit will occur. So, ignoring transport cost, labour cost and agglomeration cost, he emphasized more on the total production cost.

To get the maximum profit, as stated by Losch, total consumption is important. Higher the consumption rate, will greater will be the profit. In this case, he emphasized most on the price reduction of the commodity. Any decrease of price would automatically stimulate the volume of consumption. This can be understand by the following diagram.

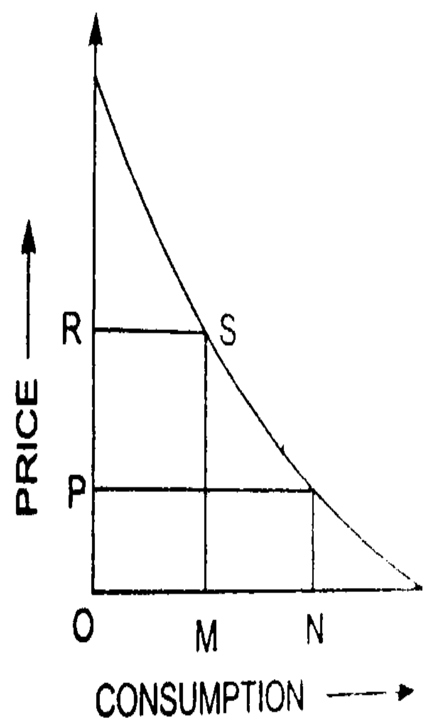

Figure 6

In this simple model, it is evident that when price of the commodity drops from R to P, the consumption increases from M to N. The theory of August Losch considered demand as a most important variable. The fundamental objective behind the theory was to find out the most profitable location for industrial establishment.

To determine the location of maximum profit, Losch said, *"the complexity stems from the fact that, there is more than one geographical point where the total demand of surrounding district is at a maximum,……we are thus reduced to determine separately for every one of a number of virtual factory location the total attainable demand, and for similar reasons the best volume of production as a function of factory price (market and cost analysis). The greatest* *profit attainable at each of these points can be determined from the cost and demand curves, and from this place of greatest money profits, the optimum location can be found".*

Losch argued that the most of the existing theories are all simplified and generalizations of the complex problem of industrial location. Like, Weber, he also considered certain assumptions for the success of his theory.

Assumptions:

Like Weber's theory, 'profit maximization' theory of Losch is not universally applicable. In the presence of certain optimum conditions, the maximum profit location may occur.

1. The area under consideration should be an extensive homogenous plane where raw materials are distributed evenly.
2. The 'transport cost' is uniform and directly proportional in all the directions.
3. The people inhabiting the region have a general homogeneity either in taste, knowledge and technical skill.
4. There is no economic discrimination among the people. The economic and career building oppurtunities are open and uniform to all individuals.
5. The population distribution is very even and the area is self-sufficient in agricultural production.

In the case of excess production of agriculture, the status quo of economy will be distorted. To achieve homogeneity of economy within the region, the theory required some more conditions. There are as follows:

1. The entire area should be equally served by the factories. No area should be exempted from the supply; therefore, no new firm would dare to venture in the area.
2. There must be conformity in the range and quantum of profit. In case of abnormal profit, new firms may try to establish their own plant.
3. The location must satisfy both producer and consumer. The profit of the firm and satisfaction of the consumer must be optimum through the location.
4. There must be provisions for consumers to get the products from other adjacent areas.
5. The number of consumers, producers and areas should be well defined and not very extensive. Only a limited number of producers within a small area will be able to overcome the complexities and satisfy completely and handful of consumers.

According to the Losch, to get the desired result from the location and sustained growth of the industry, these conditions are pre-requisites.

Theory: The major objective of the location theory is to attain equilibrium in the producing area and the products and the ability of the producers. If a single entrepreneur enters in the production process, within a vast area, the distribution cost will be very high. But when several small producers are engaged in the production process in separate regions, the distribution cost will come down and due to increasing competition, efficiency of the products and cost of production will be lower. The profit will increase sustainability. Due to increasing competition, the area served by individual manufacturing units will be reduced. In the reduced area, several producing units will remain adjacent with each other, without leaving any area unreserved. So, in this particular situation, a hexagonal area would serve the purpose.

To establish his theoretical model of the theory, August Losch proposed three distinct phase of development. The phases are as follows.

I. In this first phase Losch observed that if sufficient and symmetrical demand of the products in the market, the market conditions may be explained by a demand cone. The following diagram illustrate that the effective demand of the particular products will exactly same to the volume of the cone. In the figure below, P is producer, and demand curve is lying on QF. P or price line, controlled jointly by transport cost and distance. The price increased from P to F. along the Y axis or PQ demand of quantity is measured between PF and QF. When PF is taken as a measure of distance and is rotated about P, the circular area is formed, bounded by the focus F, where the price becomes too high. Total sales are given by the volume of the cone produced by the rotation of PQF. From the figure, it is clear that, away from center, with increasing distance, demand of the quantity drops drastically.

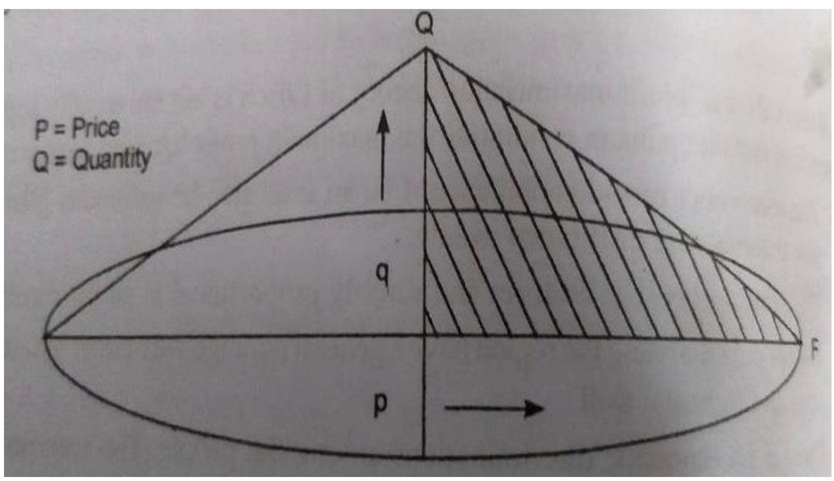

Figure 7

II. In the second phase, within the vast rounded area, several factories will concentrate. The virgin, extensive market area will automatically give a lucrative operational area, but despite the growing competition among the firms to capture larger share of consumer and larger market area, there should be some void in the boundary zones. Like intra-molecular space, a certain amount of region will remain unreserved or poorly served. Though the mal-distribution of firms may result in shrinking of area in some instances, some other regions will be devoid of any industry. The circular pattern of industrial hinterland in phase two will ultimately decide the future of the industry in that region.

III. In the third phase of industrial location witness the narrowing of the intermediate space between two markets. The area falls vacant between the different market areas become the target of new enterprises. As new firms set up within the vacuum, the hinterlands of earlier industries become reduced. The reduction of the market area results in rapid disruption of the early circular pattern. Gradually, the market area of the industries attains a hexagonal shape. According to Losch, when any area possesses several hexagons, lying upon each other and surrounding a particular center, metropolitan city will grow. In other words, it may be said that around the nucleus of a city, numerous hexagons or market areas of different commodity will grow. So, in this fashion, industries would concentrate within a region, each having different products. so, almost all types of materials including raw materials should be available on that point. Hence, any new industry would get its required raw material within near distance. Obviously, the total transport cost in that place will be minimum. In this way, 'equilibrium condition' as stated by Losch may be attained.

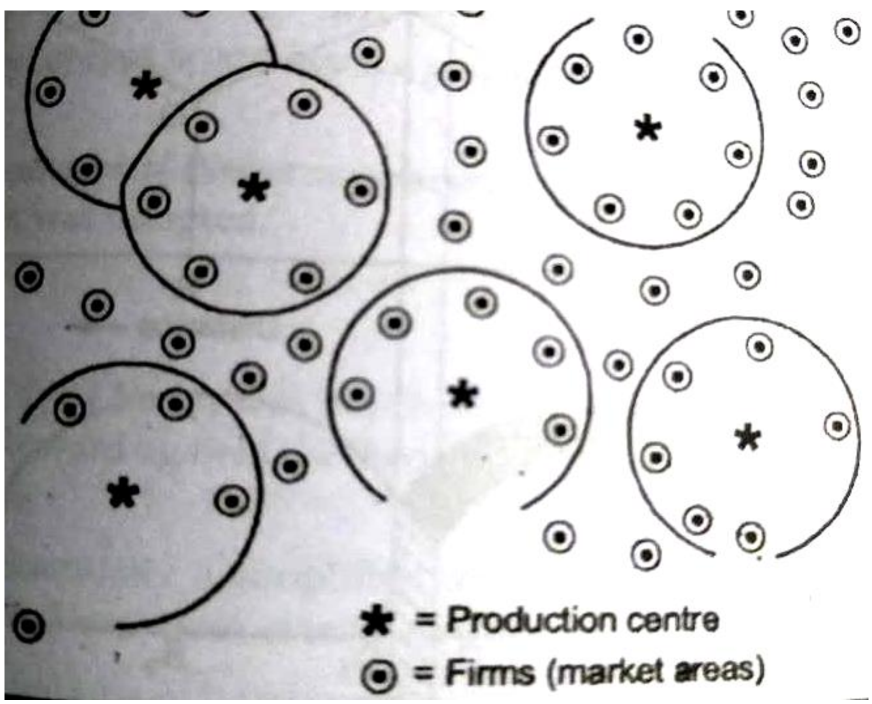

Figure 8: Second Stage of theory of Profit Maximization

Losch however, himself hinted about the deviation of his theory in some special conditions. According to his conception, when price of the commodity of a particular firm increases demand of product decreases considerably. Naturally, due to higher price, the company loses some of its market area. Automatically, that area is encroached by the adjacent firm. In this fashion, market area of a unit changes continuously. This incident was explained by the figure given by Losch below. In figure, as stated by Losch, A and B are two producing centers, with total production cost of P and Q. Their respective market boundaries are CPD_1 and EQD_1. At the product cost of M_1, their production touches the optimum level and equilibrium is attained. But when production cost at A increase from P_1 to P_2, the equilibrium condition is disrupted. The product of A becomes less attractive then before, so market boundaries also reduces from CP_1D to $C_1P_2D_2$.

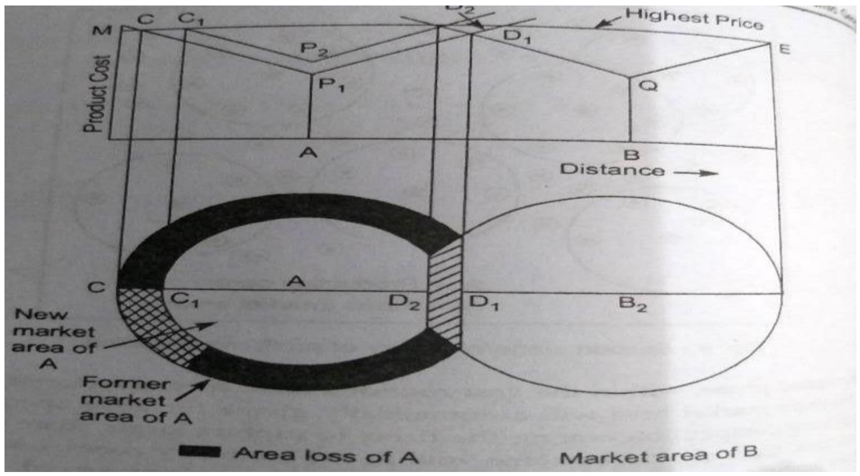

Figure 9

Merits:

1. Losch tried to restore an order in the former chaotic classification of industrial location.
2. He was the first person to consider the influence of the magnitude of demand on industrial location.
3. Losch rightly emphasizes upon the role of competition as an important determinants of location analysis.
4. The calculation adopted by Losch were simple and easily applicable to any place.
5. The theory has also a philosophical contribution on the motive of entrepreneur's role.
6. His equilibrium concept is perhaps the greatest contribution among the location theories developed later on.
7. The least cost concept of Weber was nullified by Losch and instead more precise profit maximization concept was adopted.

Demerits: Of course, the theory of Losch was not entirely flawless. Numerous criticisms from different quarters were put forward against the theory on various grounds. The major points the theory are as follows.

1. This theory is essentially a simplified model or theorizing of an ideal condition. In reality, only in a rare occasion, these events may occur.

2. The assumed condition of homogenous plain region, equal distribution of raw materials and uniform transport rates never occur in the real world. Therefore, Losch's theory, as said by some critics, is nothing but only intellectual exercise.
3. Losch even assumed the cultural homogeneity and uniform taste of the people within the region. This is nothing but absurdity.
4. He ignored the variation of technological development of different regions. The difference of technical know-how many offset the theoretical model.
5. Political decisions play an important role in the industrial location. Losch ignored it.
6. The variation of the cost of raw materials and labour wage rates were not given proper weightage in the theory.
7. Losch categorically separated the role and effect of agriculture and industry. But this difference is somehow arbitrary in nature.
8. The abstract and optimum situation demanded by the theory may be available in agriculture but not in the complex production process of modern manufacturing industries. Thus, Losch theory is more practical in agriculture, rather than in industry.

Other Theories Of Location:

As earlier stated, Alfred Weber's pioneer work evoked tremendous work in the area of the theory of industrial location. Besides Sargant Florence's comprehensive thesis on the subject, equally enlightening contributions have been made by other economists.

We make a brief review of these contributions here.

1) Among the modern theorists, E.M. Hoover occupies an important place. He has suggested certain improvements over Weber's theory by taking into consideration the characteristics of modern transport media. Transport agencies according to Hoover today incur high terminal cost for loading and unloading merchandise, preparing bills of loading and invoices etc. at either end of the journey, and these are independent of the distance travelled. Further, the transport cost curves also has greater degree of curvature now because of high fixed charges for equipment and maintenance and the greater efficiency in the use of vehicles and equipment on long hauls than short one. Industries, therefore, tend to concentrate at the terminal points of railways, water routes and other transport centers.

2) Leon Moses added dimension to the location theory. In his view the problem of optimum output, optimum combinations of inputs and optimum location are inseparable and, therefore, these should be solved simultaneously. The least cost site in his view cannot be determined before considering how least unit costs may be affected by large-scale economies and other variables in the production process.

3) The size of sales territories has been considered as one of the important factors affecting location in some of the recent theories. The spatial distribution of demand and the market area approaches developed respectively by Greenhut and Fretter point towards the unrealistic treatment of demand by Weber in his theory. Buyers' choices are given important place in new approach. In an economy, it a buyer has a choice between two competing sellers he will

patronize one that is closer to him. The producers' services, therefore, depend upon his locating near as many prospective customers as possible. The success of the firms' location choice, according to these theorists, is measured in terms of the size of the sales territories it monopolizes since the latter is directly related to the volume of sales. Each producer, therefore, tries to gain some cost advantage over his competitors that will enable him to enlarge his own sales territories at the expense of others. The market area approach has been useful to study industries where products are standard and transport costs are sufficiently high to represent a substantial part of the delivery prices (first due to Hotelling).

4) Some theorists have criticized both the least cost approach of Weber and the market area approach of Greenhut and Fretter on the ground that human factors are ignored while dealing with the causes of location. The entrepreneurial decisions, they contend, are sometimes consciously or unconsciously colored by personal attachment to one or another social, cultural or ethnic groups. An industry may not be located at a place, which may be the best for it. The average firm can survive even without its not having the best location in economic sense.

10.5 METHODS OF MEASURING THE SPATIAL DISTRIBUTION OF MANUFACTURING

Sargant Florence, a critic of Alfred Weber's theory of location, has developed an entirely different approach to industrial location. In his view, the relation of industries to a geographical area is not that important as the relation of the industry to the distribution of occupied population as a whole. Florence has worked out statistical measures of the degree of localization of different industrialization from the census of production. He has introduced two new concepts in the glossary of the theory of industrial location. These are as follows:

1) Location Factor
2) Coefficient of Localization

Location Factor: Location factor is an index of the degree of concentration of an industry in a particular place.

This index is arrived at by taking the percentage of all workers in a particular industry found in a certain region and dividing it by the proportion in that particular region of the total industrial workers in the country. The region is identified with the political divisions of a country. The underlying idea of such an index is that location should be explained as the degree of dissimilarity between the geographical distribution of the industry and the population of the country. The index works out as follows:

a. If an industry is evenly distributed over the whole country, the location factor for each region would be unit (= 1) because the proportion of the total industrial workers of the region would be equal to the proportion of the workers in a particular industry.

b. If an industry is not evenly distributed over the whole industry, the location factor would either be more than unity (>I) or less than unity.

When the location factor is more than unity, the region is supposed to have a higher share of the industry than what is legitimately due to it. If the location factor is less than unity, the region has a lower share of the industry that is due to it.

Location Quotient: The coefficient of location indicates the propensity of an industry to concentrate. The coefficient of location for an industry can be worked out by the following formula. The coefficient is the sum (divided by 100) of the deviations of the regional percentages of workers in the particular industry from the corresponding regional percentages of workers in all country.

i) Complete coincidence, region b3 region, of the particular industry with all industry gives a coefficient of 0.

ii) Extreme differentiation (e.g., workers in the particular industry being all concentrated in one region) gives a figure approaching 1.

The object of arriving at such an index is to classify industries according to their qualities of dispersion or concentration. On the basis of the coefficient of localization, all industries can be divided into three degrees.

a. High coefficient industries
b. Medium coefficient industries
c. Low coefficient industries

Industries with a high coefficient of localization like mining industries are centralized at particular regions. Conversely industries with a low coefficient of localization such as leatherwork, brick making, building, etc. can develop in different regions and are thus dispersed. In between are such industries as textiles, jute, paper, cement, etc. which have a wide choice of location.

10.6 CONCLUSION

Industries, like human beings, it appears, have a tendency to concentrate in particular regions and places. It is not by chance alone that most of the big industries in India are located in and around big cities, transport centers and areas rich in mines and minerals. The textile industry, which was first to develop in the organized sector, was pre-dominantly located till 1920 in the Mumbai region. Being a place well connected with sea, rail and road, having cotton growing areas nearby, plentiful.' cheap skilled labor, banking and credit facilities, technical and professional services, humid climate, vast market and enterprising business communities with financial resources and experience, Mumbai attracted textile and many other industries in organized sector. Kolkata and Chennai too have had location advantages and, therefore, industrialized early. Concentration of sugar industry in U.P. and Bihar in early' stages of industrialization was mainly due to the unique position these states enjoyed in cane cultivation. Iron and steel mills came up in Bihar and Bengal because of rich deposits of iron ore and coal in these states. Petroleum industry started in Assam after first oil well was struck in Digboi in 1890. The recent concentration of software industry in Bangalore and Hyderabad is a clearly established phenomenon, as has been the flight of industry from different parts of the country and their relocation and rehabilitation in other parts. Economists have been at pain to explain this phenomenon. As a result, a number of theories, known as the theories of location have been developed in the recent 1 past.

10.7 SUMMARY

Industry, like human beings, has a tendency to concentrate in a few regions and areas. The decision to locate the plant at a specific site is the most critical decision that an entrepreneur has to take. He is influenced by different considerations. Weber pioneered the deductive theory of industrial location. Sargant Florence followed with an inductive analysis of the same phenomenon. Modern economists too have made their contribution to the debate. The debate brings out clearly the factors that influence the decision relating to the location of the industry. The concept of location is, however dynamic one. It keeps on changing with changes in different factors.

10.8 GLOSSARY

1. Material Index: refers to the proportion of the weight of localized materials to that of the final product.
2. Location Weight: refers to the weight to be transported during the whole - process of production.
3. Labour Cost Index: refers to the proportion of labour cost to value of the product.
4. Agglomerative Factors: refers to the advantages or cheapening of production due to the concentration of an industry.
5. Deagglomerate Factors: refers to the reduction in the cost of production due to decentralization of industries.

10.9 ANSWER TO CHECK YOUR PROGRESS

1. How far the location theories are applicable in practice? Discuss briefly Weber’s theory industrial location.
2. What are the demerits of Weber and Losch theory, from which the other location theory postulated?
3. What are the stages of the theory of ‘profit maximization’?
4. Why, according to Losch, hexagonal market area develops to serve the region? Explain it with diagram.

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10.12 TERMINAL QUESTIONS

1. What are the major factors that influence location of any industry? Write down the major socio-economic factors in detail.
2. Critically examine the Weber’s theory of industrial location.
3. Give an account of the profit maximization theory of August Losch.

UNIT 11 - INDUSTRIES AND RELATED ASPECTS

11.1 OBJECTIVES

After reading this unit learner will be able:

- To know about the various industries.
- To know the influence of industries on the world.
- To know the involvement of different sectors in them.
- To know their history andmajor change in its past years.

11.2 INTRODUCTION

Industries act as an important pillar of our society. From what we eat to what we wear, what we use, everything are a result of these industries. Let us look a little closely how these things are done and how we get them now.

11.3 INDUSTRIES RESOURCE BASE, DISTRIBUTION, POTENTIALS OF GROWTH AND PROBLEMS WITH REFERENCE TO IRON AND STEEL, COTTON TEXTILE, PETROCHEMICALS AND FOOD PROCESSING

Iron and Steel Industry:

The growth and development of iron and steel industry is a reflection of global economy. It still forms the backbone of the engineering and construction industries. However, it has declined its pre-eminent position it enjoyed in the once-celebrated steel age in the global industrialization phase.However, iron and steel still hold supreme position among metals and products because of their unique basic qualities. The iron and steel industries however, are now building a firm foundation in the developing countries rather than the developed countries. However, the foundation of iron and steel industries depend upon the raw materials used in these industries. There are numerous raw materials used in these industries:

1. **Iron Ores:**They are of widely variety in Fe content ranging on average from magnetites 72%, haematites 68%, limonites 45% and siderites 36%, with iron stones like taconites also. Haemetite ore is most preferred for steel making.
2. **Ferro-alloys:**These are chemical compounds. Most important alloys are chromium, cobalt,, manganese, nickel, tungsten, vanadium, aluminium, copper, tin, magnesium, lead and zinc. Titanium and zirconium are also used occasionally.
3. **Scrap:**Scraps hold second position to iron ore among the raw materials of steel industry. Iron scraps derived from dismantled structures of factories, plants, machineries, old vehicles, etc. are recycled and widely used in this industry.
4. **Fuels**: The most important fuels are coal and coke. Modern blast-furnace use coke. To produce one ton of raw-iron, around 450 tonnes of coke is used. Many iron and steel plants even to-day use charcoal.

5. **Electricity**: Electricity is required for the production of iron and steel industry. So Hydro-electricity or Thermal power or Atomic power is required.
6. **Water**: Water is an important raw material for iron and steel industry. It is mainly used to quench coke, to cool blast furnaces, to make steam to coal furnace doors, to operate hydraulic machinery and to have sewage disposal.
7. **Air**: Air is an important raw material for iron and steel industry. Near about 4 tones of air are required to make a ton of steel.
8. **Flux (Limestone and dolomite)**: Flux is used in the blast-furnace to draw impurities out of the melting ore. Limestone and dolomite combine with the extracted impurities to form slag.
9. **Refractories**: Both blast and steel furnaces are lined with refractories. Refractories are used for lining furnaces for smelting iron ore. It is also used for lining of the furnaces of locomotives, boilers and making fire bricks.
10. **Silica or Sand** is used for moulding.

The iron and steel industry depicts a changing nature in its growth and production pattern. In the mid-1970s, the relatively developed countries of NorthAmerica, Western Europe and Japan accounted for nearly two-third of the world's steel production. But gradually the spatial pattern has changed and attention has now shifted to the developing regions.Towards the end of the last century, the growth of steel production in countries like China, South Korea, Brazil and India has changed the entire pattern of steel production in the world.

Table 11.1 Production of Iron and Steel in Major Countries of the World

Countries	Pig Iron	Crude Steel
China	131.23	128.5
Japan	80.5	105.4
USA	47.9	102.0
Russia	43.3	55.5
Germany	27.3	41.7
South Korea	24.8	43.4
Brazil	27.7	27.8
Ukraine	25.7	31.7
India	21.3	26.9
France	13.6	20.0
Italy	10.9	26.6
Great Britain	10.9	16.1

Table 11.1 indicates the production of iron and steel in major countries of the world.It becomes clear from the table that China is the leading producer of iron and steel in the world, which accounts for about 23.9 per cent production of pig iron and 17 per cent of crude steel of the world's production.Japan is the second largest producer with 14.7 per cent pig iron and 13.9 per cent crude steel production of the world.USA once the highest producer now ranks third in the world followed by Russia. India's position is 9th in the iron and steel production and its production of pig iron and crude steel accounts for 3.9 and 3.6 per cent respectively.

1. **China:**China is having the oldest system of fabricators of iron, as is evident from its historical records. But until the adoption of her five-year plan in 1953, China had only insignificant iron and steel manufacturing of modern type.Gradually, China has developed the iron and steel industry and now it is the highest producer of iron and steel in the world.

   Since 1973, growth of steel production in China was spectacular and within a span of 15 years China was able to increase its production of crude steel to 217 percent. In that period consumption increased 300 per cent. This growth rate clearly reveals the rapid pace of industrialisation that is now going on in China.At present, China is having following important areas of iron-steel industry:

   i. Southern Manchuria is the largest steel plant of China at Anshan and other plants at Pensihu and Mukden.
   ii. Shansi is also an old region of iron and steel production. In this region Taiyuan has been developed as a major steel centre.
   iii. The Lower Yangtze Valley: In this region Hankow, Shanghai, Hanyang and Chungking are the main centres of iron and steel industry.
   iv. Other centres are located at Paotow, Chinling Chen, Canton, Singtao and Huangsih.

2. **Japan:**In spite of the shortage of raw material (iron and coal), Japan has become one of the leading steel producers of the world. After China, Japan is the second largest producer of pig iron and crude steel in the world.

   Yawata, the first steel plant was built in 1901 by government. Yawata is a major centre of heavy industry with about one fifth of Japan's steel capacity. Kamaishi in Honshu and Muroran in Hokkaido are small tidewater plants.

   In Japan, large-scale concentration of iron and steel industry has occurred in the following regions:

   i. The Tokyo-Yokohama Region:It is having all facilities required for the growth of iron-steel industry. The reclamation of Tokyo Bay provided large, extensive plane land for steel manufacturing units. The Tokyo-China region is the main area in which steel industrial units have been developed at Hitachi and North Tokyo.

ii. Nagoya Region: It contributes about 20 per cent of the Japanese steel production. This region had witnessed a massive growth of industries within the period 1950-60.
iii. Osaka-Kobe Region: At the head of the Osaka Bay, a highly industrialised area known as the Kinki has developed. The port of Osaka is the main centre. Other centres of this region are Amagaski, Kobe, Hemegi, Sakai and Wakayama.
iv. Fukuoka-Yamaguchi Region: It is located in the extreme south of Japan within Kyushu and westernmost end of Honshu. The first government steel plant was established at Yawata in 1901. Kita-Kyushu is another notable iron and steel centre of this region.
v. Oka-Yamaha Region: It is a new industrial region situated in between Osaka-Kobe and Hiroshima.
vi. Hokkaido Region: The main centre of this region is Murroran. A fairly big sized iron and steel industry has developed here depending upon local coal and iron ore.

The most striking feature in the locational pattern of Japan's steel plants is that they are situated either on the Bay-Coast or on some canal or river. This is because of the fact that most of the Japanese steel plants depend upon outside raw material. Another feature is that they are located in the heart of great industrial districts which provide ready market for finished steel. In fact, localisation of iron and steel industry in Japan is market-oriented.

3. **United States of America:** Once USA was the highest producer of iron and steel but now its rank is third in the world, next to China and Japan. In the US first iron and steel plant was established in 1629 at Massachusetts. During last 380 years or so the US steel industry has undergone through several changes. This change has not only occurred in growth and production pattern but also in localisation pattern. The major iron and steel regions in the USA are as follows:

i. Appalachian or Pittsburgh Region: The most important of all the regions is the northern Appalachian region of western Pennsylvania and eastern Ohio. This district contains about 42.5 per cent of the blast furnace capacity of the country and its centre, Pittsburgh, is the second greatest centre of steel industry in the world. The mills in this region are located almost exclusively in the narrow valleys of the headwater streams of the Ohio River, including the upper reaches of the Ohio itself. The region, often known as the Pittsburg-Youngstown region, includes several districts. The Pittsburgh district consists of industries located in the valleys of the Ohio, Monongahela, and Allegheny, within 60 km of Pittsburgh. The Youngstown or the 'valley' districts consist of industries in the valleys of the Shenango and the Mahoning rivers.

   Wheeling, Johnstown, Stenhenville and Beaver Falls are other important steel-producing centres. The chief disadvantage of the region is its remoteness from the sources of iron ore supplies, which come from the Lake Superior region partly by rail and partly by water.

ii. Lake Region: The lake region falls into:

   a. The Lake Erie ports; Detroit, Cleveland and Buffalo, etc.;

   b. The centers near the head of Lake Michigan, Chicago-Gary or Calument district; and

   c. The Lake Superior region, Duluth. These districts represent a somewhat different adjustment to the three factors in the localisation of the industry, coal, iron and market. The Lake Erie ports are nearer to the Appalachian coal, but farther from the iron ore than the Duluth region.

The Michigan region is midway between the two. One important advantage that all these districts enjoy over the Pittsburg region is that, owing to their location on the lake shores, one extra handling of iron ore is eliminated.

On the other hand, these centres are located a little away from the market. Duluth, for example, has in its immediate hinterland the forest, farm, and the ranching country, with little demand for iron and steel goods.

Detroit is the largest steel consuming centre in the USA particularly because of its automobile industry.

iii. Atlantic Seaboard Region: On the Atlantic Seaboard, it is only the Middle Atlantic region (New York, Philadelphia and Baltimore, etc.) that is important. The chief advantage that this region enjoys is in respect of its location, both in relation to the tidewater, and the proximity to the large industrial centres of the East. Its location near the centre of the great manufacturing region of the Atlantic Seaboard, the region of the densest population, and of the most intense industrial development in North America, is the most remarkable.

The Middle Atlantic region is the only major region in which the production of pig iron and steel is notably greater, in proportion, than the iron ore consumed, because of the relatively larger amounts of scrap available in this highly industrialised region. There are many steel mills in this region which operate without blast furnaces, depending both on scrap and pig iron imported from other areas, particularly the Northern Appalachian region.

iv. South Appalachian: In the Southern Appalachians, in Alabama, however, large deposits of these raw materials are found in closer proximity than anywhere else in North America if not the world. While the ore is of low grade and requires shaft mining, much of the rock is lime and the ore is, therefore, self-fluxing. The region lacks, however, large industrial centres in the neighborhood and has, therefore, a considerable amount of surplus pig iron which goes to the North.

v. Western Region: This region extends from Colorado in the interior to the California on the west. Among the steel region in the USA, this is a new region. The first steel mill, although had been setup in 1882 at Pueblo. Later on steel industries were developed at Fontana in California and Provo at Utah. For these plants, iron ore is obtained from Wyoming and coal from Colorado.

4. Russia-Ukraine (erstwhile USSR): Prior to disintegration in 1991, USSR was the leading steel-producing country of the world. Now also Russia and Ukraine are important iron and steel producers of the world. Russia ranks 4th in the production of pig iron and crude steel, while Ukraine stands 8th in world ranking.In the post-revolution period, the Soviet steel industry had achieved a remarkable expansion. During the Second World War, however, the Soviet iron and steel industry was affected badly.Most of the large production centres were either destroyed or damaged. However, soon the country recovered and by 1975 became the largest producer of iron and steel in the world.The four important iron- and steel-producing regions are:

i. Ural Region:It lies on both sides of the Urals. The major steel centres of this region are – Magnitogorsk, Chelyabink, Nizhnitagil, Sverdlovsk, Serov, Perm, Orsk, etc. Magnitogorsk is the largest steel-producing centre of Russia.
ii. Kuznetsk or Kuzbas Region:It is located in the north of the Alai Mountains and south of Tomsk. This steel region is coal-based. The supply of iron ore is from the Ural region. Novokuznetsk is the leading steel centre of this region.
iii. Moscow Region:Important centres of iron and steel in this region are Tula, Lipetsk, Cherepovetsk and Gorky.
iv. Others:Other regions are isolated and developed in various parts. These are Baikal, St. Petersburg, Lower Amer valley and Pacific coastal region.

5. Ukraine: Now, Ukraine is an independent country and has 8th position in world s production of iron and steel. In this region all the raw materials, i.e., iron ore, coal, limestone, manganese are available for steel production.A dense network of railways and cheap water transport facilitate the growth and development of iron and steel industry. The main centres of iron and steel plants are Krivoirog, Kerch, Zhdanow, Tagarerog, Zaporozhye, Pittsburgh, Dniepropetrovsk, etc.Other notable steel-producing centres of independent countries are Tbilisi, Tashkent and Bogovat in Uzbekistan and Tamir Tan in Kazakhstan.

6. Germany: Before World War I, Germany was the second largest iron and steel producer in the world. It was the largest exporter of steel goods in the world. German iron and steel industry was handicapped since after the war of 1914 by the loss of ore, coal and productive capacity.Germany, however, made a remarkable recovery within a few years, and in spite of her depleted resources she produced in 1939 more than the 1913 production of steel. In 1937 she had established the great Hermann Goering Steel Works at Salzgitter to utilise the grade ores in its Harz Mts.

The division of Germany was the main cause of lower status in terms of iron and steel production. But after re-unification of East and West Germany in 1990, the country is now one of the leading steel-producing countries in the world and ranks 5th in the world with an annual production of 27.3 crore tons of pig iron and 41.7 crore tons of crude steel.The most important centre of iron and steel industry in Germany is the Rhenish-Westphalia, contributing more than 80 per cent of the steel produced in Germany, and 85 per cent of pig iron. It manufactures a wide variety of specialities.

Other regions of importance are the Siegerland Hessen-Nassau, Northern and Central Germany, Saxony, and South Germany. The greatest centre is Essen in the Ruhr valley where the world famous works of Krupp are situated.

7. **South Korea:**South Korea is the 6th leading country of the world in iron and steel production. It is the third Asian country after China and Japan which produces high-grade of steel. Its annual production is 24.8 crore tons of pig iron and 43.4 crore tons of crude steel.

8. **Brazil:** Brazil is the 7th ranking country in iron and steel production in the world. Its annual production is 27.7 crore tons of pig iron and 27.8 crore tons of steel.The development of the production of steel in Brazil has been spectacular. Since 1973, production of steel has witnessed more than 300 per cent increase. The consumption of steel within the country is very low.Therefore, Brazil is able to export bulk of her steel production. Most of the steel industries are located around Sao-Paulo and Curumba.

Brazil possesses vast amount of iron ore. The largest of these deposits is located near Minas-Gerraes. Another large steel plant is located at Santa Catarina. Most of the mills obtain energy from hydel-power plants.

9. **India:**India has a long history of the use of iron and steel. However, it was only after the first decade of the 20th century that manufacture of iron and steel as a modern industry made a beginning in this country. It was in 1911 that India’s first iron and steel plant – the Tata Iron and Steel Company Ltd. (TISCO) was set up in Jamshedpur in Bihar in private collaboration with a US firm. Nearly three and a half decades later another plant was launched at Burnpur in neighbouring Bengal — the Indian Iron and Steel Company Ltd. (IISCO) — with British participation.

At the commencement of Five-Year Plans (1951) there were three steel plants located at Jamshedpur, Asansol and Bhadravati. Not only capacity of these plants was increased but six integrated plants in public sector have been established at Durgapur, Rourkela, Bhilai, Bokaro, Vishakhapatnam and Salem, Apart from these more than 140 mini steel plants have also been set up to meet the growing internal demand. India is having the largest iron ore deposits in the world and also having coal, therefore, having very good prospects of the further growth of iron and steel industry.

10. France: Till 1973, France was the 6th largest producer of steel in the world but now its position is 10th. France is the biggest iron ore-producing country of West Europe but there is scarcity of coal. In France, two regions are notable for iron and steel production:

i. Lorraine, and
ii. Sambre-Meuse. Metz, Briey, Nancy and Longway are notable steel centres of Lorraine region, while ClermountFerrand, Le Creusot, St. Etienne, Lille, Valenciennes, Le Harre and Marseilles are important centres of Sambre-Meuse region. In Saar basin also, steel industry has developed on local coal deposits and iron ore from Lorraine.

11. Great Britain (UK): Great Britain was not only the pioneer but a leading steel-producing country in the world for a long time. But its decline started in the first quarter of the 20th century. Now once again Great Britain has been able to establish itself as one of the important iron- and steel-producing countries and ranks 12th in the world.The main advantage of UK's iron and steel industry is that most of the centres are well-situated in relation to their coal and ore supplies and also have good facilities of importing raw material and exporting finished goods.The most important steel-producing centres of UK are as follows:

i. North East Coast (Middles-borough, near New Castle, is the largest producing centre, and has the most modern equipment in Britain's industry).
ii. Derby, Leicester, etc.
iii. South Wales (Cardiff).
iv. Lincolnshire.
v. West Coast.
vi. Scotland (Glasgow).
vii. Sheffield and Birmingham (the oldest, but not the most outstanding).
viii. Staffordshire.

12. Italy: Italy now has emerged as a leading iron- and steel-producing country not only of Europe but of the world. It ranks 11th in the world's production of iron and steel. Italy's annual production is 10.9 crore tons of pig iron and 26.6 crore tons of crude steel.Although Italy is having shortage of both coal and iron ore but it has developed this industry through well-planned management. The major steel plants of Italy are located at Naples, Genoa, Aosta and Trieste.

Other than these Poland, Czech Republic, Sweden, Holland, Australia, Canada, Mexico, South America, South Africa, Turkey, North Korea, Iran, Taiwan, Malaysia and Vietnam also have developed iron and steel plants.

Cotton Textile Industry:

Cotton is the world's most important natural fibre. In the year 2007, the global yield was 25 million tons from 35 million hectares cultivated in more than 50 countries. There are five stages in its making into textiles:

- Cultivating and Harvesting
- Preparatory Processes
- Spinning- giving yarn
- Weaving- giving fabrics
- Finishing- giving textiles

Cotton is a soft, fluffy staple fiber that grows in a ball, or protective case, around the seeds of the cotton plants. The plant is a shrub native to tropical and subtropical regions around the world, including the Americas, Africa, and India. The greatest diversity of wild cotton species is found in Mexico, followed by Australia and Africa. Cotton was independently domesticated in the Old and New Worlds.

The fiber is most often spun into yarn or thread and used to make a soft, breathable textile. The use of cotton for fabric is known to date to prehistoric times; fragments of cotton fabric dated from 5000 BC have been excavated in Mexico and between 6000 BC and 5000 BC in the Indus Valley Civilization. Although cultivated since antiquity, it was the invention of the cotton gin that lowered the cost of production that led to its widespread use, and it is the most widely used natural fiber cloth in clothing today.

Current estimates for world production are about 25 million tonnes or 110 million bales annually, accounting for 2.5% of the world's arable land. China is the world's largest producer of cotton, but most of this is used domestically. The United States has been the largest exporter for many years. In the United States, cotton is usually measured in bales, which measure approximately 0.48 cubic meters (17 cubic feet) and weigh 226.8 kilograms (500 pounds).

Production of Cotton:

Cotton cloth is produced in three different sectors viz., Mills, Power-looms and Handlooms:

1. **Mills:**The mill sector played a dominant role in cotton textile industry at the initial stage. But its importance was reduced drastically with the growth of powerlooms and handloom.
2. **Powerlooms:**The decentralizedpowerloom sector plays a pivotal role in meeting the clothing needs of the country. The production of cloth as well as generation of employment has been rapidly increasing in powerloom sector. This sector not only contributes significantly to the cloth production in the country but also provides employment to millions of people.

   The powerloom industry produces a wide variety of cloth with intricate designs. The powerloom sector accounts for about 63 per cent of the total cloth production in the country and contributes significantly to the export earnings.
3. **Handlooms:**The handloom sector provides the spun arn and the cotton cloth, altogether. It gives employment to over many persons engaged in weaving and allied activities than

the past. This sector constitutes nearly 14 per cent of the total cloth produced in the country like India and also contributes substantially to the export earnings.

The production of spun yarn and cotton cloth in India has increased considerably during the 53 years from 1950-51 to 2003-04. The production of spun yarn registered more than fourfold increase from 533 million kg in 1950-51 to 2,121 million kg in 2003-04.

Although the total production of cotton cloth increased considerably, the share of mill sector has been drastically reduced. This is an indication of our efforts to decentralise the industry and create greater employment opportunities.

Cotton textile industry is quite widespread in the world and as many as 90 countries are producing cotton yarn and/or cloth in varying quantity. But the main concentration of textile industry is limited to few countries.

There are two types of production related with cotton textile, one is the production of cotton yarn and another is the production of cotton cloth, although many countries produce both the items.The following table indicates the important producers of cotton yarn and their production:

Countries	Production (in lakh metric tonnes)	Percentage of World Production
China	284.0	26.4
India	226.7	21.0
USA	158.8	14.7
Pakistan	115.0	10.7
Indonesia	75.4	7.0
Brazil	40.5	3.8
Turkey	40.0	3.7
South Korea	23.7	1.2
Italy	21.2	2.0
Egypt	16.4	1.5
Japan	15.8	1.5

Table 11.2

Leading producers of cotton yarn in the world:

Apart from the above countries Germany, Portugal, Greece, Uzbekistan, Syria, France, Bangladesh, Turkmenistan and Iran are also notable producers of cotton yarn.

The leading producers of cotton cloth in the world are China, India, Russia, USA, Japan, Italy, Germany, Hong Kong, Egypt, France and Romania.The production of cotton cloth in these countries is as follows:

Countries	Production (in '00	Percentage of World

	million sq. meters)	Production
China	2256	25.7
India	1250	14.2
Russia	865	9.8
USA	373	4.2
Japan	177	2.0
Germany	90	1.0
Hong Kong	82	0.9
Egypt	61	0.7
France	81	0.9
Romania	54	0.6

Table 11.3

Important Producers of Cotton Cloth in the World

The other producers of cotton cloth in the world are Brazil, Spain, Pakistan, Turkey, Uzbekistan, Bolivia, Vietnam, Korea Republic, Czech Republic, Portugal, Belgium, Poland, South Africa and Syria.

The cotton textile industry is fairly widespread in the world; however, there are areas of concentration. A brief description of the important areas of cotton textile industry is given here to explain the general pattern of distribution.

1. **China:**Cotton textile is one of the oldest types of industry in China. Since very old days, weaving and spinning was normal practice of village weavers and most of the output was contributed by cotton industry. Several characteristics of this industry help to explain this locational diversity and concentration.In the first place, there is a ready market for its product. With its vast population, China has a vast domestic market for cheap cotton goods, and its low labour costs, based on its large labour supplies, enable to sell textile abroad.

   The first modern factory was a textile mill in Shanghai built in 1888. Soon Shanghai had become a major textile centre along with South Manchuria.Besides the advantages of local supplies of raw materials, cheap labour, and regional consumer markets the cotton-growing tracts of Manchuria had an additional advantage of having the remarkable coal mines within the state.The first mainland cotton mill was located outside the coastal China – on the cotton-growing region of Manchuria at Tsing Kiang. Owing to its favourable geographical situation large quantities of cotton are grown in Liao river valley.The cotton industry retains its pre-eminence here: in 1949 there were 247 factories and by 1957 about fifty more had been opened, engaged in spinning, weaving, dyeing and Calico printing, By 1965 the number of spindles had doubled.Multiple centres of textile production are also being set up at various new sites in the interior of People's Republic of China.

The textile industry had previously been concentrated in Shanghai and Tientsin. Production has improved, and new centres have been opened up in the cotton-growing belt in Honan, Hopei, Shansi and Shensi, as well as single factories serving local needs at Lan Chow, Urumchi, Kashgar, Chengtu, Taiyuan, Chengchow, Hongchow, Nanking, Kaiteng, Tientsin, etc. Cloth is now made at Taiyuan and looms are being constructed at Chengchow.

Now, China has emerged as the largest cotton textile-producing country in the world. The Beijing-Hankow industrial conurbation including centres like Paoting, Singtai, and Chengchow has emerged as a leading textile centre. Of course, among all the textile-producing centres, Shanghai was the most important. At one stage, this region produced more than 70 per cent of the Chinese textile production.The emergence of different textile centres lowered the relative importance of Shanghai, but it still maintains dominating role in textile industry. The adjacent Hankow region now produces huge amount of textile products.The Wushan integrated textile plants contribute significant amount of cotton products. The Canton textile units were set up very recently. As the plants are modern, output of textile goods per worker is very high in this region.

2. **India:**India is the second largest cotton textile producer in the world. The first cotton mill in India was erected in Calcutta in 1818, while first mill in Bombay (now Mumbai) was started in 1854, which was destined to become the home of the cotton mill industry.The early concentration of the cotton textile industry in Mumbai was governed not so much by natural and permanent factors as by other advantages, such as abundance of capital and credit facilities, the presence of cheap and speedy means of transport and the temporary growth of the demand for yarn from China, which Mumbai was in an exceptionally favourable situation to meet.

   The year 1877 marks the turning point in the development of the industry from the point of view of its distribution. It saw the beginning of a rapid construction of mills in upcountry centres like Nagpur, Ahmedabad, Sholapur, Kolhapur, etc., situated right in the heart of the cotton-producing tracts.This later distribution was influenced to a very much larger extent by natural factors, such as the vicinity of sources of raw material, plentiful labour and large marketing centres, and was made possible by the development of a railway communication.The cotton industry received a considerable stimulus from the conditions created by war. The large patronage extended to the mill by the Government in respect of their military requirements in cotton goods in the Eastern theatres of the war, together with the shrinkage in the Lancashire imports into India due to the preoccupation of the Lancashire mills with war work and the sharp rise in the prices of imported cloth due to shortage of shipping, led to a considerable increase in home consumption, though the difficulty of importing machinery prevented speedy development which would otherwise have taken place. Recently, there hasbeen a tendency on the part of the Indian mills to increase the manufacture of finer goods, and a certain amount of long-staple cotton is imported from the USA and elsewhere for this purpose. An improvement in the quality of the home-grown cotton will help the situation. It is significant to note that even within these particular areas or regions, the industry is predominantly localised within a few important industrial centres like Mumbai, Ahmedabad, Sholapur, Vadodara, Pune, Kanpur, Delhi, Indore, Gwalior, Coimbatore, Kalol, Bhagalpur, Warangal, Calcutta, Howrah, Serampur, Konnagar, Sodepur, Panihati, etc.

At present, there are more than 1,220 cotton mills in India; of these, 283 are composite mills and the remaining are the spinning mills. Production wise, Maharashtra tops with 16.4 per cent yarn and 52.3 per cent cloth production in the country, followed by states of Tamil Nadu (30.4% yarn and 8.8% fabric), Gujarat, Uttar Pradesh, Madhya Pradesh, West Bengal, Rajasthan, Punjab, Karnataka, etc.

3. **Russia:**Russia ranks third in cotton cloth production in the world and it produces about ten per cent of the total cotton cloth of the world. Although in Russia textile industry has not received priority in its development plans.Before Revolution (1917) the cotton textile industry was localised in Moscow and Ivanovo region but now it has developed in other regions also.The important regions are:
   i. Moscow-Ivanovo Region is the oldest and the most important textile region. Ivanovo is having a large number of cotton spinning and weaving centres, also known as ‘Manchester of Russia’. The other centres of this region are — Yoroslav, Kostromov, Shuya, Kovrov, Uro-Khavo-Zuyevo, etc. Moscow is another centre, around which Noginsk, Pavlovsky, Yegoryevsk, Serpukhov, etc., have developed.
   ii. Leningrad or St. Petersburg Region is also known for cotton textile industry. St. Petersburg, Narva and Tallin are important centres of this region.
   iii. Kalinin Region extends west of Moscow. Kalinin, Vishniye, Volochak are important textile centres.
   iv. Siberia Region has been developed on availability of cheap hydro-electricity, transport facility and labour. Several centres like Omsk, Novosibirsk, Barnaul, Briansk, Kamarovo, Kansk, Leninsk-Kuznetskiye, Kustney have cotton textile industry.
   v. Volga basin and Ural region also have cotton textile units. The development of textile industry in Russia is due to huge domestic market, hydro-electricity, developed transport system and skilled labour.

4. **USA:**USA is the leading cotton textile producer in the world. It ranks third in cotton yarn production and fourth in cotton cloth production in the world. The two factors responsible for its growth and development are: (a) capital, and (b) the local market.In USA cotton textile industry is localised in the following regions:

i. New England:New England used to be the largest centre until a few years ago but the South has surpassed it now. Within New England, the mills are scattered, though a large number of spindles are concentrated within thirty miles of Providence in southern New England.

   Fall River is the largest centre, with New Bedford, only 30 km away, as the second largest centre. This region has developed earlier because of availability of hydro-power and suitable climate. In this region temperature is fewer variables and atmosphere more humid than in the neighbouring regions.The manufactures are characterised by fine goods, and finishing is a feature of the New England industry. A large quantity of cloth comes for finishing, dyeing, printing, etc., from the South and other cotton-manufacturing regions of the USA.

ii. Mid-Atlantic:The Middle Atlantic States cotton factories are located in Pennsylvania, New York and Maryland. But Philadelphia is the only point at which there is concentration. The existence of these mills in Philadelphia, and the character of their output is chiefly due to labour supply, supplemented by machine shops and market facilities.The Mid-Atlantic States are pre-eminent in the production of knitted goods. In both, New York and Pennsylvania, there is localisation of the knitting industry, around Cohoes in the Mohawk valley and at Philadelphia. Philadelphia has been the principal seat of the hosiery industry in the United States ever since the Germans settled in German Town.

iii. Southern States:The growth of cotton industry in the southern states has increased within recent years. The most extensive construction of mills in the South has been in three states – North Carolina, South Carolina, and Georgia.The Southern States have advantages such as proximity of raw cotton, water-power and cheap labour. The other advantage of the South in comparison with the New England states is its lower operating cost.

5. **Japan:**After China and India, Japan is the third leading Asian country in cotton textile production. The first cotton mill in Japan was established in 1862 at Kagoshima, but it was about 15 years later that cotton mills began to be started in quick succession, especially in and around the city of Osaka.The main geographical factors helping in the establishment of a successful cotton industry in Japan are:

   i. A suitable climate
   ii. Cheap water-power
   iii. Transport facilities
   iv. Supply of cheap and skilled labour
   v. The proximity to the large markets of China and India.

   The Japanese industry is said to enjoy the following advantages over her competitors due to the following reasons:

   i. Cheaper and efficient labour

ii. Greater proximity to the large consuming markets
iii. Better organization
iv. Better service from plant

Japan has to import almost all of the raw materials needed for textile industry. The pioneer attempts to set up industries were made around cotton-growing tracts of Nobi and Kanto regions. Now the major textile centres are located at Chukyo, Hanshin, Toyama, Kyushu and Keihin and also at Osaka and Nagoya.

Spatially, majority of the cotton mills are located within the northern half of Japan.The bulk of the textile goods are produced in following regions:

i. The Kwanto Plain
ii. Nagowa
iii. The Kinki Plain
iv. Along the Northern Coast.

As the industry became more and more export-oriented, textile establishment gradually shifted towards coasts. At the beginning of the decade of 1990s, old obsolete mills closed down their productions. The new mills with updated machineries came into existence. Most of the Japanese textile mills are now using the latest technologies.The priority was given to reduce the cost of production. Soon, Japan became the exporter of not only textile products but also the textile machines. At present, a healthy competition is discernible between small-scale sectors and the big industrial estates of textile industry.

6. **Germany:**Germany is one of the leading producers of cotton textile. The history of cotton textile industry in Germany is quite old. Initially, the industry was set up depending upon imported cotton and most of the industries were developed along Rhine river valley. But Ruhr industrial region soon became a leading textile centre.The cotton manufacturing centres of Germany are grouped into the following three groups:

   i. North-Western:Consisting of Rhine region towns like Barmen and Elberfield, and Ems-Vechta towns like Pheine and Gronau.
   ii. Central:Consisting of towns along the three mountain ranges which separate Bohemia from Germany, Reichenbach, Chemnitz, Leipzig andDresden
   iii. South-Western:Consisting of towns like Augsburgh, Stuttgart and Mulhouse.

   The north-western region had the advantage of local market in the industrial populations which also provided it with cheap labour. The other centres had the advantage of water power, pure water and the cheap labour of the mountain populations.

7. **Hong Kong:**Hong Kong ranks 7th in production of cotton cloth in the world. The industry in Hong Kong was set up by the refugees from communist China in 1949. Hong Kong is a free trade area and one of the principal ports of the world. Manufactured goods, particularly textile provide three-fourths of total export earnings.

Three major parts of Hong Kong's giant textile industry – the spinning, weaving and finishing business are in a decline from which they may never fully recover. Employment in the industry has plummeted in the past years.Mills are shutting down or leaving machines idle. Local garment makers are importing more and more yarn and fabrics for their needs. The textile industry together with the garment-making industry still is the largest manufacturing industry in terms of sales and employment.The industry's problem is basically one of costs. Higher labour, land and energy costs have made Hong Kong yarns and fabrics more expensive than those from Taiwan, South Korea and China.

8. **The United Kingdom:**UK was the leading cotton manufacturing country in the world, but it no longer dominates the world in cotton textile production. The history of cotton textile industry cannot be completed without describing the contribution of United Kingdom. The Industrial Revolution in the 18th century gave the impetus to the development of cotton textile industry in Great Britain. The subsequent invention of spinning machines encouraged the growth.

   The humid climate and local skilled labour helped a lot during the initial period of development.The cotton textile industry in the United Kingdom attained such a high fame that at end of 19th century the country became the undisputed leader of the cotton textile industry.The early centres were developed around Scottish lowlands, Nottingham, Ireland and Lancashire. Gradually, Lancashire became the most developed textile centre in the world.

   The factors that helped in early development of textile industry in UK, especially in Lancashire region were — suitable humid climate, skilled local labours, abundant water resources, availability of local coal, cheap price of land and cotton import facility, etc. Apart from Lancashire, Manchester has also emerged as a leading textile centre.The cotton manufacturing towns of Bottom, Bury, Rochdale, Oldham and Stockport (in Cheshire) are located in a semi-circle around Manchester.

   The relative position of UK in textile industry has been decreased considerably due to overall decrease of consumption of cotton goods, loss of overseas market and emergence of new textile-producing countries like China, India, Japan, etc.

9. **Other Countries:** In Europe other cotton textile-producing countries are France, Italy, Switzerland, Romania, Czech Republic, Belgium, Poland and Spain. France's cotton textile industry has had a long history.

   The textile industry of France was developed on imported cotton, particularly from USA. The industry is concentrated in the north-eastern industrial region. The major centres of textile-producing centres are Belford, Kolman and Nausi.

   Italy has also emerged as an important cotton textile producer in Europe. The major centres of textile industry are located in the Po basin and in the Alpine valleys. Milan, Korno, Bergamo, Turin, Genoa, Breccia, Verona and Como are the main centres of cotton textile industry.

Switzerland is having cotton textile industry in the northern part of the country. The most important centre is the Saint Galen.

Romania is also significant in cotton textile production. It’s important centres are located at Pitesi, Birlad, Oradea, Guirgui, Bukharest, Brasov, Sibiu, Baia, Mare and Timisoara.

In Latin America, Mexico, Brazil, Argentina and Peru are important in cotton textile production. Mexico is the major cotton manufacturing country, not only in Latin America but also in the world.The textile industry was first developed in the Orizaba region and later in the Mexico City. The major centres of cotton textile in Mexico are Heroico, Nogales, Ciudad Juarez, PiedrasNegras, San Louis Potos, Cudad de Mexico, Toluca de Lerdo and Cuernavaca.

Brazil is another cotton textile-producing country of Latin America and is also important in the world. The important cotton textile centres of Brazil are: Rio Grande doSul, Minasgerais and Rio de Janeiro.

In Argentina textile industry has developed at Buenos Aires, La Plata and Azul, while in Peru it has developed at Trujillo, Lima, Calao, lea and Cuzco.

In Africa, Egypt and South Africa are the main cotton textile producers, although Nigeria, Ethiopia and Tanzania also produce some quantity of cotton fabric.Egypt is famous for its good quality of cotton and has also developed textile industry at Iskandaria, Tanta and Dumyat. Egypt ranks 10th in cotton yarn production and 8th in cotton cloth production in the world.

South Africa also has developed cotton textile industry at Johannesburg, Bloemfontein, Durban, East London and Worcester.

In Asia, apart from China, India and Japan, Pakistan, South Korea, Indonesia and Turkey are the leading producers of cotton textile.Pakistan is a major cotton-producing country in Asia and has also developed cotton textile industry. Cotton mills in Pakistan are located at Lahore, Lyallpur, Multan, Karachi, Sahadra, Montgomery and Peshawar.

South Korea has made good progress in cotton textile industry in recent years. The major cotton textile centres are Inchou, Taegu, Masan, Pusan, Kwangju and Seol.Indonesia is also a textile exporting country of Asia. Similar is the case with the Philippines.

Turkey is another Asian country having cotton textile industry in prominence. Turkey is a producer of good quality of cotton. Izmir, Izmit, Sivas, Kyseri, Bursa, Erzurum, Usak, etc., are the main centres of cotton textile industry in Turkey.

Problems of Cotton Textile Industry:

Although cotton textile is one of the most important industries, it suffers from many problems. Some of the burning problems are briefly described as under:

1. **Scarcity of Raw Cotton:**The cotton textile industry suffers a lot as a result offued between countries and relatively a problem like partition, because most of the long staple

cotton growing areas went to the other country. Apart from this, the shortage of raw material in all is a big problem. Although much headway has been made to improve the production of raw cotton, its supply has always fallen short of the demand. Consequently, much of the long staple cotton requirements are met by resorting to imports by a country in a situation like this.

2. **Obsolete Machinery:**Most of the textile mills which have old with obsolete machinery results in low productivity and inferior quality. In the developed countries, the textile machinery installed even 10-15 years ago has become outdated and obsolete, whereas in developing countries about 60-75 per cent machinery is 25-30 years old.
   Only 18-20 per cent of the looms in the developing countries like India are automatic whereas percentage of such looms ranges from cent per cent in Hong Kong and the USA., 99 per cent in Canada, 92 per cent in Sweden, 83 per cent in Norway, 76 per cent in Denmark, 70 per cent in Australia, 60 per cent in Pakistan and 45 per cent in China.
3. **Erratic Power Supply:**Power supply to most cotton textile mills if erratic and inadequate, adversely affects the production.
4. **Low Productivity of Labour:**Labour productivity in developing countries is extremely low as compared to some of the advanced countries. On an average a worker in them handles about 2 looms as compared to 30 looms in Japan and 60 looms in the USA. If the productivity of an American worker is taken as 100, the corresponding figure is 51 for U.K. 33 for Japan and only 13 for India.
5. **Strikes:**Labour strikes are common in the industrial sector but cotton textile industry suffers a lot due to frequent strikes by a labour force.
6. **Stiff Competition:**Cotton mill industry has to face stiff competition from powerloom and handloom sector, synthetic fibres and from products of other countries.
7. **Sick Mills:**The above factors acting singly or in association with one another have resulted in many sick mills.

Check Your Progress I

Q.1 What do you mean by ‘scraps’?

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Q.2 Mention the top three countries of cotton yarn production.

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Petrochemicals Industry:

Before a large scale petrochemical production, some principal precursors were produced such as: acetylene, ethylene, propylene, benzene, xylene, butane, toluene, and naphthalene, etc. Petrochemical industry is like the most advanced chemical industry, very complex capital-and-tech-intensive industries. Today, more than 3000 individual petrochemical products enter into the modern commerce. The business changes very rapidly and new processes simplify old ones, so that many older important processes and products become economically or technologically obsolete. Many of the processes for making ammonia, ethyl, alcohol, acetic acid, acetone, glycerin, acetylene and other major chemicals are now almost totally petroleum-derived. Petrochemical industry has originated from three fossilfuels of oil, coal and natural gas.

Adhesives	Industrial Gases
Agrochemicals	Lubricants and Additives
Alcohols	Medicinal Products
Ammonia	Nitrogen Industries
Antifreeze and	Paints, Varnishes, etc
Antiknock	Plastics, Polymers, etc
Detergents	Plasticizers
Dyes, Lakes and Toners	Rubber, Rubber Chemicals
Explosives	Solvents
Fertilizers and Pesticides	Sulphur and Sulphuric Acid
Flavours and Perfumes	Surface Coating
Floatation Agents	Synthetic Fibres
Food Additives	Synthetic Motor Fuels

Table 11.4

Some Major Products of Petrochemical Industry:

The petrochemicals sector is one of the most important sectors, providing key intermediates as ethylene, propylene and benzene, derived from oil and natural gas. All these form the raw materials for a series of downstream processing in some other hundreds of chain products.

Crude Oil: Crude oil, as a product of natural change in organic materials over long geological periods, is a mixture of thousands of organic substances. The products of oil refineries have proved to be very adaptable to changing human needs, through changing patterns of *refining*or *processing,* manufacturing a variety of fuels, and through chemical changes going into producing a host of pure and other chemical substances and the petrochemicals. Refining processes have become extremely large and quite complicated, with several ranches, all interrelated and technical. High level technical aid is required because:

i. Sudden price increases for oil and changing markets have required extensive technical readjustment designed to make better use of an expensive and increasingly scarce commodity.

ii. Industry's expansion into many other chemical material fields has led to increasing supply of raw materials formerly supplied by other sources.

As such, chemical engineering and petroleum processing have in a very real sense grown up together. Petroleum crudes vary widely, each kind requiring different refining procedures.

Natural Gas Liquids: Gasoline condensed from natural gas contains fewer high-boiling constituents than from crude oil refining, and is therefore more volatile.

Liquified Petroleum Gas (LPG): While large cities in developing countries and some other countries get pipeline gas as fuel, so-called bottle gas, or cylinder gas system was developed for use in isolated areas. It is filled with propane, with a lower molecular weight than butane.

The distribution of petrochemical industries is the way more same where they find their raw materials. We will discuss the major distributed areas with the raw materials along with an account of petrochemical industries in India.

USA:USA is by far the giant among the global producers of chemical and chemical products, covering just two percent points short of the one-quarter of global total in 2005. Highest development of chemical centres are located in tune with the demand areas, concentrating in the NE American manufacturing belt, from the great lakes industrial districts to Michigan down to west Virginia and Ohio valley, and Gulf states of oil and gas fields like Louisiana, Oklahoma, Arkansas, Texas, to further west of California petroleum refining and petrochemical and related industries like synthetic rubber, synthetic paper and fertilizers, pharmaceuticals and agro-chemicals, pesticides, fungicides and insecticides. Lighter chemicals like plastics, chemicals, photographic materials and a host of other re typically well decentralized in much smaller units oriented as they are to common consumer needs.

China: China's petrochemical industry dates back to the 1960's, with many organic-chemical technologies having emerged since. Many of the new devices were practiced in SMEs in the 1970s. In the 1980s, however, several petrochemical complexes were constructed with foreign technologies, with few ones with domestic know-how. Chinese Petrochemical Corporation (Cincopec) formed in 1983 has been since a rising force in China's overall chemical industry, policy-making and rationalization of plants, and runs huge new petrochemical plants, often termed by foreign observers as the 'show cases' of the industry. Complexes such as Yanshan, Liaohua and the Daqing ethylene plants are the product of very advanced levels than other plants. In 1988, Sinopec had 24 pants on-stream and had already test runs at 37 plants on-stream manufacturing a variety of petrochemicals. In fact, in 1988 itself, Sinopec processed China's over 90% crude oil. The corporation produced 1.1 MT of ethylene, one MT of each synthetic resins and plastics, and about 190,000 tonnes of synthetic rubber, with six plants. Sinopec's Qilu Petrochemical Co. completed polyvinyl chlorine plant with a capacity of 2 lakh tones a year. Synthetic resins comprise in China mainly polyethylene, polypropylene and polystynene, while synthetic fibre production has been also rising, with 16 plants under the Sinopec Corporation.

Shanghai Petrochemical Works, the Liaoyang Petrochemical Fibre Co., and the Tianjin Petrochemical Fibre Co. are large. China has achieved almost world standards in acrylic fibres in Shanghai. Through the 1990s and recently, China has made great strides in diversified and technologically modernized chemical and petrochemical industries and growth has steadily climbed up.

India: Petrochemicals in India is a problem because of very high prices of its feedstock stuffs like oil and naphtha. Its major wings are polymers, synthetic fibres, elastomers and surfactant intermediate-LAB, and their total production was 5.4^{th} tones. India has become an important player among the developing countries in drugs and pharmaceuticals industry. Indi has about 19,000 plastic processing units, with 70-80% in small sector, turning out a quarter of polymers.

Food Processing Industry:

The Food Industry is a complex, global collective of diverse businesses that supply most of the food consumed by the world population. Only subsistence farmers, those who survive on what they grow, and hunter-gatherers can be considered outside of the scope of the modern food industry. One of the most emerging and influential industry among them is the food processing industry.

Food processing includes the methods and techniques used to transform raw ingredients into food for human consumption. Food processing takes clean, harvested or slaughtered and butchered components and uses them to produce marketable food products. There are several different ways in which food can be produced:

i. One off production: This method is used when customers make an order for something to be made to their own specifications, for example a wedding cake. The making of one-off products could take days depending on how intricate the design is.
ii. Batch production: This method is used when the size of the market for a product is not clear, and where there is a range within a product line. A certain number of the same goods will be produced to make up a batch or run, for example a bakery may bake a limited number of cupcakes. This method involves estimating consumer demand.
iii. Mass production: This method is used when there is a mass market for a large number of identical products, for example chocolate bars, ready meals and canned food. The product passes from one stage of production to another along a production line.
iv. Just-in-time (JIT) (production): This method of production is mainly used in restaurants. All components of the product are available in-house and the customer chooses what they want in the product. It is then prepared in a kitchen, or in front of the buyer as in sandwich delicatessens, pizzerias, and sushi bars.

The origin of food processing goes all the way back to ancient Egypt, yet the period of those developments seems to symbolize the history of the culture of mankind. Nowadays, bread, which is characterized by its use of the fermentation action of yeast and which uses wheat flour as its raw material, is baked all over the world. The origins of beer also go back to Babylon and Egypt in the period from 3,000 to 5,000 BC. The foundation of the modern industry was built up with the introduction of machinery and technology of new methods from Germany. Nowadays, the processed foods that are thriving in grocery shops are modern processed foods and traditional foods, but their manufacturing technology, process control and manufacturing and packaging environmental facilities have been advanced and rationalized to an incomparable extent in the last 30 years. As a result, products with high quality and uniformity are now being manufactured. This is based on the advancement of food science, and is, moreover, due to the general introduction of hygienics, applied microbiology, mechanical engineering, chemical engineering, electronic engineering and high-polymer technology. The most remarkable developments until now have been convenient pre-cooked frozen foods, retort pouch foods and dried foods. The mass production of excellent quality processed foods without using unnecessary food additives has been made possible in the last 30 years by grading and inspecting the process materials, carrying out proper inspections of processed foods, and advances in processing technology, installation and packaging technology and materials. The history of processed food is the history of the rationalization of advanced technology related to raw material treatment operations, processing operations, storage operations, other processing equipment, cleaning of facilities, sterilizing and conservation treatment operations and effluent and waste treatment operations. Worthy of note recently are developments in container and tank lorry transportation, concentration using membrane technology in processing operations, vacuum refrigeration, vacuum freezing and pressurized extrusion molding using two axle extruders. In storage operations, technologies such as vapor drying, heat exchange sterilization, deoxygenation agents, sterile filling packaging and PET bottle packaging have been developed. We have heard the plans of soft drinks manufacturers who want to switch from active sludge methods of wastewater treatment to methane fermentation methods

The food processing sector comprises of three segments based on the levels of processing:

- **Primary Processing of Food**:Primary processing of food comprises of sorting, grading and packaging of fruits and vegetables, milk, rice, spices, etc.
- **Secondary Processing of Food:** Secondary processing of food comprises of re-shaping of food for ease of consumption. It includes flour, oil cakes, tea leaf and beverages powder etc.
- **Tertiary Processing of Food (or) Value Added Food Segment:**Value added food segment includes processed fruits and vegetables, juices, jam & jelly etc.

The food processing industry includes a diverse group of companies involved in the processing of products like fish, meat, milk, crops and water. It comprises of large corporate operating at various, and in some cases multiple levels in the food processing value chain.

- **Fruits & Vegetables**
  Beverages, Juices, Concentrates, Pulps, Slices, Frozen & Dehydrated products, Wine, Potato wafers/Chips etc.
- **Fisheries**
  Frozen & Canned products mainly in fresh form.

- **Meat& Poultry**
  Frozen and packed food mainly in fresh form, Egg powder.
- **Milk& Dairy**
  Whole milk powder, Skimmed milk powder, Condensed milk, Ice cream, Butter and Ghee.
- **Grain and Cereals**
  Flour, Bakeries, Biscuits, Starch, Glucose, Cornflakes, Malted foods, Vermicelli, Pasta foods, Beer and Malt extracts, Grain based alcohol.
- **Consumer Foods**
  Chocolates, Confectionery, Soft/Aerated beverages.

Reasons of Rapid Enhancement of this Industry:

1. **Changing Profile and Tastes of the Consumer:**Rapid urbanization, increase in the number of nuclear families, increase in the number of working women, less time devoted in the household have changed a lot of habits. Increased literacy and rising per capita income have induced the customers to increase their spend on value added food, which has a higher shelf life, packs greater nutritive value and takes less time to cook. This has led to change in consumer tastes and preferences towards processed food.
2. **Product Innovation:** Companies are offering a wider range of products to the consumers as a result of their investments into product innovation, research and development. They are moving up the value chain, e.g. cooperatives are transitioning from being pure producers of milk to offering a wide range of dairy products such as flavoured yogurts, ice creams, etc. New entrants are trying to entice the markets and capture market share by offering new flavours and localized versions of international products such as in India, chips made in Indian flavours and from Indian spices.
3. **Increased Spending on Healthy and Nutritional Foods:** The changing lifestyle and working habits of the younger generation especially, has lead to a rise in lifestyle diseases such as diabetes, blood pressure, cardiac problems, muscular pains, etc. With a rise in disposable income levels and increasing awareness, consumers spend on healthy and nutritional food has also gone up.
4. **Advent of Branded Food and Organized Retail:** With a higher disposable income and a higher propensity to spend, the consumers are looking for quality branded food. Organized retail has helped a greater penetration in the rural markets in the developing countries and has improved the shopping experience of the consumers. It has also helped to maintain the shelf life of the packaged food by providing the required infrastructure.
5. **Rising Export Opportunities:**The demand of processed food is higher in the developed economies where the pace of life is much faster than that of emerging markets. Moreover, the preference for special localized food, such as, Indian processed food like pickles has added to the global demand. India has a greater integration with the global

economy and its proximity to key export markets serves as a stronger link between the trading countries.

6. **Better Preservation and Packaging techniques**: With improvement in technology, better preserving and packaging techniques have been developed that not only increase the shelf life but also improve the nutritive value of the processed food. A more conscious consumer is increasingly demanding such processed food as it promises to be more hygienic and nutritive than the raw agricultural produce which has high levels of pesticides, insecticides spayed upon it.

The food processing industry is the new face of the food industry. It is equipped with all the technological assistance that it needs and innovative ideas that lead it to the newer side of the food industry. The food processing industry is widely distributed in the world with mostly its roots in the developed countries like USA, Japan, Mexico, etc., but it is gaining great popularity in developing countries too, due to the new fast fuming life which is gaining much influence amid the people, and hence, the shelf food and better quality foods are becoming the priority of the people world over. India ranks 5th in terms of food processing industry and ranges a great variety in food processing. The food processing industry has come up with new alternatives in the country like India as in terms of job opportunities, better facilities, hygiene and even development.

Challenges or Problems faced by the Industry: The challenges faced by the units, especially (Small and Medium Enterprises) SMEs, operating in the sector are diverse and need to be addressed on several fronts.

1. **Inadequate infrastructure:** Unlike large corporates, SMEs cannot invest heavily to create their own infrastructural support and rely heavily on common facilities such as grading and packaging, cold storage, warehouse facilities, customized transportation, logistics parks, and integrated supply solutions.
2. **Lack of adequate trained manpower:** With a lot of development happening in the food processing sector, emerging skill shortages between the demand and supply of specfic skills can potentially hamper the competitiveness of the industry. The impact will be more severe on the SMEs as the investment in training and human resource development is minimal at their level. The number of institutes providing proper training suitable to the industry is also not adequate.
3. **Seasonality of raw material:** Since the industry is largely based on agricultural and horticulture produce, the seasonality of the raw material makes it imperative for the units to hold larger proportion of inventory. This increases the investment in inventory holding facilities at the premises and also blocks the capital, which is already scarce for the SME.
4. **Access to Credit:** Like in any other industry, the biggest challenge for any SME is access to credit. Even though the industry has been included for priority sector lending, the credit facilities extended to the SMEs is still lower due to the inherent risk involved with small enterprises.

Check Your Progress II

Q.1 Mention the raw materials being used in petrochemical industries.

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Q.2 What do you mean by 'food processing'?

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11.4 CONCLUSION

It turns out that these industries have shaped out our lives tremendously, into what we are living today. Without them it won't be possible to live the way we do today. The major industries were talked upon and their demand and challenges were taken into account. It is also been explained that why a certain industry is at a specific place, i.e., due to the availability of raw materials or land for the use, etc. All in all we get to know about the technical enhancements which have taken through time in these industries to get what we need now.

11.5 SUMMARY

- Iron is the most abundant metal on the Earth's surface.
- Scraps hold second position to iron ore among the raw materials of steel industry. Iron scraps derived from dismantled structures of factories, plants, machineries, old vehicles, etc. are recycled and widely used in this industry.
- The use of cotton for fabric is known to date to prehistoric times; fragments of cotton fabric dated from 5000 BC have been excavated in Mexico and between 6000 BC and 5000 BC in the Indus Valley Civilization.
- Petrochemical industry is like the most advanced chemical industry.
- Food processing includes the methods and techniques used to transform raw ingredients into food for human consumption. Food processing takes clean, harvested or slaughtered and butchered components and uses them to produce marketable food products.

11.6 GLOSSARY

1. SMEs : Small and Medium Enterprizes.

2. Scrap : Iron scraps are discarded iron pieces derived from dismantled structures of factories, plants, machineries, old vehicles, etc. are recycled and widely used in this industry.

3. Refractories : Refractories are used for lining furnaces for smelting iron ore.

11.7 ANSWER TO CHECK YOUR PROGRESS

Check Your Progress I

Ans.1 Iron scraps are discarded iron pieces derived from dismantled structures of factories, plants, machineries, old vehicles, etc. are recycled and widely used in this industry.

Ans.2 China, India and USA.

Check Your Progress II

Ans.1 Oil, Coal and Natural Gas

Ans.2 Food processing includes the methods and techniques used to transform raw ingredients into food for human consumption. Food processing takes clean, harvested or slaughtered and butchered components and uses them to produce marketable food products.

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11.10 TERMINAL QUESTIONS

Q.1 What are the reasons of rapid enhancement of the food processing industries?

Q.2 Explain in detail the top three countries with iron and steel plants.

Q.3 Describe the petrochemicals industry in India in comparison with China.

Q.4 Describe the various problems faced by the cotton textile industries.

UNIT 12 - INDUSTRIAL ASSOCIATION, INTEGRATION, INFRASTRUCTRE AND PROBLEMS

12.1 OBJECTIVES

After reading this unit learners will able:

- To know about the Industrial Sector.
- To know about their origin and various factors involved.
- To know about the different phases of their development.
- To know about the various problems that takes place due to this industry.
- To know the various ways in which it helps in boosting up the economy.

12.2 INTRODUCTION

Industry is central to the economies of modern societies and an indispensable motor of growth. It is essential to developing countries, to widen their development base and meet growing needs. And though industrialized countries are said to be moving into a post industrial, information-based era, this shift must be powered by a continuing flow of wealth from industry. Many essential human needs can be met only through goods and services provided by industry. The production of food requires increasing amounts of agrochemicals and machinery. Beyond this, the products of industry form the material basis of contemporary standards of living. Thus all nations require and rightly aspire to efficient industrial bases to meet changing needs. Industry extracts materials from the natural resource base and inserts both products and pollution into the human environment. It has the power to enhance or degrade the environment; it invariably does both.

12.3 RELATIONSHIP BETWEEN INDUSTRIES, DEVELOPMENT OF INDUSTRIES, DEVELOPMENT OF INTEGRATION BETWEEN INDUSTRIES INFRASTRUCTURE GROWTH AND LIMITATIONS

Industrial Development:

The Industrial Revolution led to the development of factories for large-scale production, with consequent changes in society.A period of social and economic change that transforms a human group from an agrarian society into an industrial one, involving the extensive re-organisation of an economy for the purpose of manufacturing called ***Industrialisation*** came. As industrial workers' incomes rise, markets for consumer goods and services of all kinds tend to expand and provide a further stimulus to industrial investment and economic growth.

Originally the factories were steam-powered, but later transitioned to electricity once an electrical grid was developed. The mechanized assembly line was introduced to assemble parts in a repeatable fashion, with individual workers performing specific steps during the process. This led to significant increases in efficiency, lowering the cost of the end process.

Later automation was increasingly used to replace human operators. This process has accelerated with the development of the computer and the robot.

The Industrial Revolution, which took place from the 18th to 19th centuries, was a period during which predominantly agrarian, rural societies in Europe and America became industrial and urban. Prior to the Industrial Revolution, which began in Britain in the late 1700s, manufacturing was often done in people's homes, using hand tools or basic machines. Industrialization marked a shift to powered, special-purpose machinery, factories and mass production. The iron and textile industries, along with the development of the steam engine, played central roles in the Industrial Revolution, which also saw improved systems of transportation, communication and banking. While industrialization brought about an increased volume and variety of manufactured goods and an improved standard of living for some, it also resulted in often grim employment and living conditions for the poor and working classes.

This development and economic growth are closely related and can be articulated within the concept of cycles or waves. Each wave represents a diffusion phase of a series of technological innovations creating entirely new economic sectors, and thus opportunities for investment and growth. Since the beginning of the industrial revolution in the late 18th century, five waves have been identified:

- **1st wave (1785-1845)**. Leaned on innovations such as water power, textiles and iron. The beginning of the industrial revolution was mainly focusing on simple commodities such as clothes and tools. The conventional maritime technology relying on sailships was perfected, supporting the creation large colonial/commercial empires, mainly by Great Britain, France, the Netherlands, and Spain. Significant inland waterway systems were also constructed. The costs of production and transportation were significantly reduced.
- **2nd wave (1845-1900)**. Involved the massive application of coal as a source of energy, mainly through the steam engine. This induced the development of rail transport systems, opening new markets and giving access to a wider array of resources. The steamship had a similar impact for maritime transportation and permitted expanded commercial opportunities in global trade. Also, the mass production of cotton substantially improved the opportunities of the textile industry.
- **3rd wave (1900-1950)**. Electrification was a major economic change as it permitted the usage of a variety of machines and appliances and permitted the development of urban transit systems (subways and tramways). Another significant improvement was the internal combustion engine, around which the whole automotive industry was created and expanded the mobility of passengers and freight.
- **4th wave (1950-1990)**. The post World War II period represented significant industrial changes with new materials such as plastics (petrochemicals) and new sectors such electronics (television). The jet engine expanded the aviation industry towards the mass market and mobility could be realized globally and created an active aerospace industry.
- **5th wave (1990-2020)**. The current wave mainly relies on information systems, which have tremendously modified the transactional environment with new methods of

communication and more efficient forms of management of production and distribution systems (logistics). This spawned new industries related to personal computing devices, mainly computer manufacturing and software programming, but more recently e-commerce as information processing converged with telecommunications.

These waves are related to the phases of development of the world economy. As time progressed, the lapse between each wave got shorter. For instance, the first wave lasted 60 years while the fourth wave lasted 40 years. This reflects a growing potential for innovation and the capacity of economic systems to derive commercial opportunities from an innovation once it has been adopted. Innovations are no longer the result of individual efforts, but are organized and concerted actions whose results are rapidly diffused. Also, at the end of a cycle the rate of innovation usually declines as most of the main innovations in the driving sector have already occurred and that the industry has been captured by commercial and regulatory interests that focus more on rent seeking than innovation. It remains to be seen which innovations and technologies are going to support the next wave of economic development. Robotics, automation and sustainability are likely to be among the key drivers.

Britain: The Birthplace of the Industrial Revolution

Before the advent of the Industrial Revolution, most people resided in small, rural communities where their daily existences revolved around farming. Life for the average person was difficult, as incomes were meager, and malnourishment and disease were common. People produced the bulk of their own food, clothing, furniture and tools. Most manufacturing was done in homes or small, rural shops, using hand tools or simple machines.

Overwhelmingly, the technological innovations that marked eighteenth-century industrialization took place in Britain. Understanding this British dynamism has been an enduring historical problem, producing both classic answers and intense debate among historians.

Geographical accidents offer one explanation for British success. A number of factors contributed to Britain's role as the birthplace of the Industrial Revolution. Britain had abundant supplies of coal of a quality especially well suited to iron production, and its lack of wood forced it to exploit this resource from the seventeenth century on; in contrast, France had plenty of wood and relatively little coal, and Holland had only peat, which could not produce the high temperatures needed for large-scale iron production. As a relatively small island with numerous navigable rivers, Britain also enjoyed the advantages of cheap water transportation, which allowed the development of an unusually well-integrated national market. The remarkable development of seventeenth-century London offered further economic advantages; as the British historian Anthony Wrigley pointed out a generation ago, London offered a large, concentrated market for industrial products, far more important as a share of the nation's population than contemporary Paris, and it provided a laboratory for new social practices, encouraging both producers and consumers to try out new products.

Historians have also noted the chronological accidents that aided British industrial development. During most of the eighteenth century, French economic growth roughly equaled British, but the generation of political chaos that followed the French Revolution of 1789 gave British manufacturers a chance to establish themselves in new markets, with little competition from continental industry. By the end of the Revolutionary Wars, in 1815, Britain had fully established its economic supremacy in Europe.

Efforts to explain British economic successes in terms of culture, politics, and social organization have stimulated more debate among historians. In its social structure, Britain was as aristocratic as other European countries, and its merchants were as eager as merchants elsewhere to achieve acceptance among the landed gentry. But the British aristocracy was probably unusual in the respect that it accorded commerce and manufacturing, and the gentry-dominated British Parliament energetically defended commercial and manufacturing interests against foreign competition. British law was certainly unusual in the protections it gave inventors and property holders. Between 1624 and 1791, Britain was the only European nation with a system of patent laws, designed to give inventors the profits of their achievements. The system both encouraged innovation and expressed British society's admiration for it. In other respects, however, differences between Britain and other countries were less significant. Acquisitive, profit-oriented economic attitudes characterized most of eighteenth-century Europe; and Britain was like other Protestant countries of the early modern period in having a relatively well-educated working class. As for advanced education in the sciences and engineering, eighteenth-century Britain lagged well behind France.

By the late eighteenth century, Britain was also Europe's leading imperial power, holding territories in North America, the Caribbean, and India, and benefiting from the trade in African slaves. Additionally, Britain was a politically stable society. It was a further important explanation for British industrialization. Colonies, offered raw materials at a discount and ready markets for industrial goods, and the high profits generated by colonial trade permitted British merchants to make expensive investments in machines and factories. But recent scholarship has tended to present colonial markets and materials as only a secondary cause of British economic successes. Few historians would deny the rapacity of eighteenth-century imperialism or the determination of British governments to use any means that might advance the country's economic interests; to protect domestic cotton manufacturers, for instance, importation of Indian cloth was rigorously prohibited. The critical fact in Britain's economic development seems to have been the demand for goods within the country itself and the readiness of manufacturers to use novel means to meet that demand. Colonialism perhaps mattered less as a source of capital than as a source of economic novelties, encouraging Europe as a whole and Britain in particular to undertake business innovations. Such colonial products as tea, coffee, tobacco, and sugar were among the early mass-market luxuries that became the model for later industrial production. More substantial goods like Chinese ceramics and Indian cotton fabrics stimulated determined, and eventually successful, efforts at imitation. The eighteenth-century global economy thus helps to explain Britain's industrialization; indeed, based on a product that did not grow in Europe, the cotton industry itself was only conceivable in the setting of a global economy. But the critical fact was manufacturers' readiness to respond to opportunities that the global economy presented.

As the demand for British goods increased, merchants needed more cost-effective methods of production, which led to the rise of mechanization and the factory system.

Changes in the World System due to Industrialization:

1. **The First Changes of Industrialization-The Textiles and the Iron and Steel Industry:** The textile industry, in particular, was transformed by industrialization. Before mechanization and factories, textiles were made mainly in people's homes (giving rise to the term cottage industry), with merchants often providing the raw materials and basic equipment, and then picking up the finished product. Workers set their own schedules under this system, which proved difficult for merchants to regulate and resulted in numerous inefficiencies. In the 1700s, a series of innovations led to ever-increasing productivity, while requiring less human energy. For example, around 1764, Englishman James Hargreaves (1722-1778) invented the spinning jenny ("jenny" was an early abbreviation of the word "engine"), a machine that enabled an individual to produce multiple spools of threads simultaneously. By the time of Hargreaves' death, there were over 20,000 spinning jennys in use across Britain. The spinning jenny was improved upon by British inventor Samuel Compton's (1753-1827) spinning mule, as well as later machines. Another key innovation in textiles, the power loom, which mechanized the process of weaving cloth, was developed in the 1780s by English inventor Edmund Cartwright (1743-1823).

   Developments in the iron industry also played a central role in the Industrial Revolution. In the early 18th century, Englishman Abraham Darby (1678-1717) discovered a cheaper, easier method to produce cast iron, using a coke-fueled (as opposed to charcoal-fired) furnace. In the 1850s, British engineer Henry Bessemer (1813-1898) developed the first inexpensive process for mass-producing steel. Both iron and steel became essential materials, used to make everything from appliances, tools and machines, to ships, buildings and infrastructure.
2. **Transportation and the Industrial Revolution:**The transportation industry also underwent significant transformation during the Industrial Revolution. The steam engine was also integral to industrialization. In 1712, Englishman Thomas Newcomen (1664-1729) developed the first practical steam engine (which was used primarily to pump water out of mines). By the 1770s, Scottish inventor James Watt (1736-1819) had improved on Newcomen's work, and the steam engine went on to power machinery, locomotives and ships during the Industrial Revolution. Before the advent of the steam engine, raw materials and finished goods were hauled and distributed via horse-drawn wagons, and by boats along canals and rivers. In the early 1800s, American Robert Fulton (1765-1815) built the first commercially successful steamboat, and by the mid-19th century, steamships were carrying freight across the Atlantic. As steam-powered ships were making their debut, the steam locomotive was also coming into use. In the early 1800s, British engineer Richard Trevithick (1771-1833) constructed the first

railway steam locomotive. In 1830, England's Liverpool and Manchester Railway became the first to offer regular, timetabled passenger services. By 1850, Britain had more than 6,000 miles of railroad track. Additionally, around 1820, Scottish engineer John McAdam (1756-1836) developed a new process for road construction. His technique, which became known as *macadam*, resulted in roads that were smoother, more durable and less muddy.

3. **Communication and Banking in the Industrial Revolution:** Communication became easier during the Industrial Revolution with such inventions as the telegraph. In 1837, two Brits, William Cooke (1806-1879) and Charles Wheatstone (1802-1875), patented the first commercial electrical telegraph. By 1840, railways were a Cooke-Wheatstone system, and in 1866, a telegraph cable was successfully laid across the Atlantic.The Industrial Revolution also saw the rise of banks and industrial financiers, as well as a factory system dependent on owners and managers. A stock exchange was established in London in the 1770s; the New York Stock Exchange was founded in the early 1790s. In 1776, Scottish social philosopher Adam Smith (1723-1790), who is regarded as the founder of modern economics, published "The Wealth of Nations." In it, Smith promoted an economic system based on free enterprise, the private ownership of means of production, and lack of government interference.
4. **Quality of Life During Industrialization:** The Industrial Revolution brought about a greater volume and variety of factory-produced goods and raised the standard of living for many people, particularly for the middle and upper classes. However, life for the poor and working classes continued to be filled with challenges. Wages for those who labored in factories were low and working conditions could be dangerous and monotonous. Unskilled workers had little job security and were easily replaceable. Children were part of the labor force and often worked long hours and were used for such highly hazardous tasks as cleaning the machinery. In the early 1860s, an estimated one-fifth of the workers in Britain's textile industry were younger than 15. Industrialization also meant that some craftspeople were replaced by machines. Additionally, urban, industrialized areas were unable to keep pace with the flow of arriving workers from the countryside, resulting in inadequate, overcrowded housing and polluted, unsanitary living conditions in which disease was rampant. Conditions for Britain's working-class began to gradually improve by the later part of the 19th century, as the government instituted various labor reforms and workers gained the right to form trade unions.

New World Scenario:

As recently as 1950, the world manufactured only one-seventh of the goods it does today, and produced only one-third of the minerals. Industrial production grew most rapidly between 1950 and 1973, with a 7 per cent annual growth in manufacturing and a 5 per cent growth in mining. Since then growth rates have slowed, to about 3 per cent yearly between 1973 and 1985 in manufacturing and virtually zero growth in mining. That earlier, rapid growth in production was reflected in the rising importance of manufacturing in the economies of virtually all countries. By 1982, the relative share of value added to gross domestic product by manufacturing (the 'manufacturing value added', or MVA) ranged from 19 per cent in developing countries as a whole to 21 per cent in industrialized market economies and 51 per cent of net material product in centrally planned economies (Table 12.1). If the extractive industries are taken into account, the share is even higher.

Table 12.1 Share of Manufacturing Value Added GDP, by Economic Grouping and Income Group *(in percent)*

Group of Countries	1960	1962	1970	1980
Developing Countries	14.2	19.0	16.6	19.0
Low Income	11.2	15.0	13.8	15.0
Lower-Middle Income	11.0	16.6	13.5	16.4
Intermediate Income	10.6	17.6	14.4	17.1
Upper-middle Income	19.4	23.3	21.6	24.1
High Income	17.2	17.9	16.2	17.2
Developed Market Economies	25.6	27.1	26.3	27.9
Centrally Planned Economies*	32.0	50.8	42.4	50.5

Source: UNIDO, **World Industry: A Statistical Review 1985** (Vienna: 1966).
** Figures refer to the share of manufacturing value added (estimated) in net material product. Data are constant (1975) prices.*

In recent years, the trend of the 1950s and 1960s has been reversed. Manufacturing has declined in importance relative to other sectors of the economy. In many countries, this decline has been in progress since 1973. It is most noticeable in the case of industrial market economies, but the share of MVA in GDP has also declined in nearly half the 95 developing countries surveyed by UNIDO. This may reflect the growing interaction between industry and all fields of science and technology and the increasing integration of industry and services, as well as industry's ability to produce more with less.

The relative importance of industry as an employer has been declining for some time in developed countries. But the shift in jobs towards the service sector has accelerated sharply over the past 15 years with the increasing adoption of new processes and technologies. Economists continue to argue over whether the advent of an information-based economy will further depress employment in industry or will expand job opportunities overall.

Most developing countries started at independence with virtually no modern industry. Then during the 1960s and 1970s their industrial production, employment, and trade consistently grow faster than these sectors in developed market economies. By 1984, developing countries accounted for 11.6 per cent of world MVA (still well short of the 'Lima target' of 25 per cent adopted by UNIDO in 1975). The centrally planned economies of Eastern Europe had raised their share of world MVA from 15.2 per cent in 1963 to 24.9 per cent in 1984.

The international trade in manufactured goods, which has consistently grown fatter than has world manufacturing output, is one of the factors underlying the changing geography of industrialization. Many developing nations, particularly newly industrialized countries (NICs), have shared in this growth and made spectacular progress in industrialization. Taking the Third World as a whole, exports of manufactured goods have grown steadily relative to primary exports, rising from 13.3 per cent of their total non-oil exports in 1960 to 54.7 per cent in 1982.

In general, developing-country industrial production is diversifying and moving into more capital intensive areas such as metal products, chemicals, machinery, and equipment. And heavy industries, traditionally the most polluting, have been growing in relation to light industries. At the same time, the share of industries involved in food products, and to a lesser extent in textiles and clothing, has fallen significantly.

Environmental Decline and Response:

Industry and its products have an impact on the natural resource base of civilization through the entire cycle of raw materials exploration and extraction, transformation into products, energy consumption, waste generation, and the use and disposal of products by consumers. These impacts may be positive, enhancing the quality of a resource or extending its uses. Or they may be negative, as a result of process and product pollution and of depletion or degradation of resources.

The negative environmental impacts of industrial activity were initially perceived as localized problems of air, water, and land pollution. Industrial expansion following the Second World War took place without much awareness of the environment and brought with it a rapid rise in pollution, symbolized by the Lob Angeles smog; the proclaimed 'death' of Lake Erie; the progressive pollution of major rivers like the Meuse, Kibe, and Rhine; and chemical poisoning by mercury in Minamata. These problems have also been found in many parts of the Third World as industrial growth, urbanization, and the use of automobiles spread.

Public concern grew rapidly and forced a broad debate on environment conservation and economic growth. The possibility that the process of industrial growth would run into material resource constraints became an important theme in this debate. Although non-renewable resources are by definition exhaustible, recent assessments suggest that few minerals are likely to run out in the near future.By the late 1960s, growing awareness and public concern led to action by governments and industry in both industrial and some developing countries. Environmental protection and resource conservation policies and programmes were established, along with agencies to administer them. Initially policies focused on regulatory measures aimed at reducing emissions. Later a range of economic instruments were considered - taxation, pollution charges, and subsidies for pollution control equipment - but only a few countries introduced them. Expenditures rose, gradually at first, reaching 1.0 per cent and as high as 2.0 per cent of GNP in some industrial countries by the late 1970s.

Industry also responded to these problems by developing new technologies and industrial processes designed to reduce pollution and other adverse environmental impacts. Expenditures on pollution control measures rose rapidly in some highly polluting industries; and corporations began to set up their own environmental policy and control units. Guidelines and codes of conduct were published covering safety of products and plant operations, trade practices, technology transfer, and international cooperation. National and international industry associations have also developed guidelines and voluntary codes of practice.

The results were mixed, but during the decade a number of industrial countries experienced a significant improvement in environmental quality. There was a considerable roll back in air pollution in many cities and water pollution in many lakes and rivers. Certain chemicals were controlled.But these achievements were limited to some industrial countries. Taking the world as a whole, fertilizer run-off and sewage discharges into rivers, lakes, and coastal waters have increased, with resulting impacts on fishing, drinking water supply, navigation, and scenic beauty. The water quality of most major rivers has not markedly improved over the years. It is, in fact, worsening in many of them, as it is in many smaller rivers. Industrialized countries still suffer from 'traditional' forms of air and land pollution. Levels of sulphur and nitrogen oxides (NOV), suspended particulates, and hydrocarbons remain high and in some cases have increased. Air pollution in parts of many Third World cities has risen to levels worse than anything witnessed in the industrial countries during the 1960s.

It is becoming increasingly clear that the sources and causes of pollution are far more diffuse, complex, and interrelated - and the effects of pollution more widespread, cumulative, and chronic - than hitherto believed. Pollution problems that were once local are now regional or even global in scale. Contamination of soils, ground-water, and people by agrochemicals is widening and chemical pollution has spread to every corner of the planet. The incidence of major accidents involving toxic chemicals has grown. Discoveries of hazardous waste disposal sites - at Love Canal in the United States, for example, and at Lekkerkek in the Netherlands, Vac in Hungary, and Georgswerder in the Federal Republic of Germany - have drawn attention to another serious problem.

In the light of this and the growth trends projected through the next century, it is evident that measures to reduce, control, and prevent industrial pollution will need to be greatly strengthened. If they are not, pollution damage to human health could become intolerable in certain cities and threats to property and ecosystems will continue to grow. Fortunately, the past two decades of environmental action have provided governments and industry with the policy experience and the technological means to achieve more sustainable patterns of industrial development.

At the beginning of the 1970s, both governments and industry were deeply worried about the costs of proposed environmental measures. Some felt that they would depress investment, growth, jobs, competitiveness, and trade, while driving up inflation. Such fears proved misplaced. A 1984 survey by OECD of assessments undertaken in a number of industrial countries concluded that expenditures on environmental measures over the past two decades had a positive short term effect on growth and employment as the increased demand they generated raised the output of economies operating at less than full capacity. The benefits, including health, property, and ecosystem damages avoided, have been significant. More important, these benefits have generally exceeded costs.

Costs and benefits have naturally varied among industries. One method of estimating the cost of pollution abatement in industry compares expenditures on new plants and equipment that have pollution control facilities to hypothetical expenditures on new plants without such features. Studies using this comparison in the United States found that pollution abatement expenditures foe new plant and equipment for all manufacturing industries in that country in 1984 amounted to $4.53 billion, or 3.3 per cent of total new expenditures. The chemical industry spent $580 million (3.8 per cent) on such equipment. Similar studies in the Japanese steel industry found that new investment in pollution control equipment reached as high as 21.3 per cent of total investment in 1976 and even today remains around 5 per cent.

Firms involved in food processing, iron and steel, non-ferrous metals, automobiles, pulp and paper, chemicals, and electric power generation - all major polluters have borne a high proportion of the total pollution control investment by industry. Such costs provided a strong incentive for many of these industries to develop a broad range of new processes and cleaner and more efficient products and technologies. In fact, some firms that a decade ago established teams to research and develop innovative technologies to meet new environmental standards are today among the most competitive in their fields, nationally and internationally.

Waste recycling and reuse have become accepted practices in many industrial sectors. In some industrialized countries technologies to scrub sulphur and nitrogen compounds from smokestack gases made remarkable advances in a relatively short time. New combustion techniques simultaneously raise combustion efficiency and reduce pollutant emissions. Innovative products and process technologies are also currently under development that promise energy- and resource-efficient modes of production, reducing pollution and minimizing risks of health hazards and accidents.

Pollution control has become a thriving branch of industry in its own right in several industrialized countries. High-pollution industries such as iron and steel, other metals, chemicals, and energy production have often led in expanding into the fields of pollution control equipment, detoxification and waste disposal technology, measurement instruments, and monitoring systems. Not only have these industries become more efficient and competitive, but many have also found new opportunities for investment, sales, and exports. Looking to the future, a growing market for pollution control systems, equipment, and services is expected in practically all industrialized countries, including NICs.

Relationship between Industries:

Different industries of various fields, whether big or small, bounds to have a relationship with each other in some sort or the other. The relationship is generally intense and cordial. They tend to have work with each other and with each other's help make up the industrial sector fast working and moving all together. These relationships between the industries are of great value as the help and should remain active and pleasant, otherwise a stagnation or doom to the industrial sector is sure. This happens due to various reasons.

The industrial sector is interdependent on each other. They are interdependent on each other for various items. It may be possible that the finished product of an industry may become the raw material or material of work for another industry. From a needle to biggest airplane everything is being made in an industry. It I not possible for a single industry to make all the parts and move out of the influence of other industries and create a whole product. Hence, industries are interrelated to each other through their field of work and their acceptance of products needed by them for usage.

There can be numerous examples to show this. Let us take an example of the shoe making industry. The shoe making industry needs rubber for making soles. Then it gets special intended fabric from cottage industries that wove up the special fibre and give it to them. This fibre is the finished product of the cottage industry which gets to be the raw material of the shoe making industry. Then they need special machine for all their work. This assistance is give by the iron and steel industry to them. Without these machines they won't be able to make the shoes.After this different other processes goes in the making of the shoes and when they are produced then they are given their shoe laces which is a finished product of another industry.

Hence, this shows the interdependence of every industry on each other and this only binds them all together. They know that without any single sector they won't survive and this leads to a better relationship pattern which results in the overall growth of the industries.

Industrial Infrastructure: Growth and Limitations:

Infrastructure is a heterogeneous term, including physical structures of various types used by many industries as inputs to the production of goods and services (Chan et al., 2009). This description encompasses "social infrastructure" (such as schools and hospitals) and "economic infrastructure" (such as network utilities). The latter includes energy, water, transport, and digital communications. They are the essential ingredients for the success of a modern economy. Conceptually, infrastructure may affect aggregate output in two main ways:

i. Directly, considering the sector contribution to GDP formation and as an additional input in the production process of other sectors; and
ii. Indirectly, raising total factor productivity by reducing transaction and other costs thus allowing a more efficient use of conventional productive inputs.

Infrastructure can be considered as a complementary factor for economic growth. How big is the contribution of infrastructure to aggregate economic performance? The answer is critical for many policy decisions – for example, to gauge the growth effects of fiscal interventions in the form of public investment changes, or to assess if public infrastructure investments can be self-financing. The empirical literature is far from unanimous, but a majority of studies report a significant positive effect of infrastructure on output, productivity, or long-term growth rates. Infrastructure investment is complementary to other investment in the sense that insufficient infrastructure investment constrains other investment, while excessive infrastructure investment has no added value. To the extent that suboptimal infrastructure investment constrains other investment, it constrains growth. Empirical estimates of the magnitude of infrastructure's contribution display considerable variation across studies. Overall, however, the most recent literature tends to find smaller (and more plausible) effects than those reported in the earlier studies, likely as a result – at least in part – of improved methodological approaches that also allow better estimates of the causal relationship. This empirical correlation is the subject of considerable heterogeneity depending on the countries and time periods under study, possibly indicating assetquality issues, complementarities with other production factors, non-linearity due to the network character of infrastructure, and larger policy and institutional factors that still need to be better understood.

Limitations of Industrial Infrastructure and Problems Faced and Remedial Measures:

Growing populations and high proportions of young people in the Third World are leading to large increases in the labour force. Agriculture cannot absorb them. Industry must provide these expanding societies not only with employment but with products and services. They will experience massive increases in the production of basic consumer goods and a concomitant build-up of industrial infrastructure - iron and steel, paper, chemicals, building materials, and transportation. All this implies considerable increase in energy and raw material use, industrial hazards and wastes, accidents, and resource depletion.

The problems and prospects for industrial development vary among the countries of the Third World, which differ greatly in size and resources. There are some large countries with abundant natural resources and a substantial domestic market that provide a base for wide-ranging industrial development. Smaller, resource-rich countries are trying to build up an export-oriented processing industry. Several developing countries have based much of their industrial development on export industries in garments, consumer electronics, and light engineering. In many countries, however, industrial development is restricted to a few consumer-goods industries that cater to relatively small domestic markets.

The developing countries share in world production of iron and steel rose from 3.6 per cent in 1955 to 17.3 per cent in 1984, when four countries - Brazil, China, India, and the Republic of Korea - produced more than 10 million tons of steel each, as much as in many medium-sized industrialized countries.At the same time that this industry is contracting in many developed countries, it is expected to expand by 38 million tons between 1982 and 1990 in the developing world. Latin America is projected to account for 41 per cent of this rise, Southeast Asia for 36 per cent, the Middle East for 20 per cent, and Africa for 1.3 per cent.

Many developing countries still depend heavily on their exports of minerals and other commodities, mostly in unprocessed or only intermediately processed forms. In the case of several major minerals such as aluminium and nickel, a few transnational corporations control the whole industry, from mining through final processing. Some countries have been moderately successful in increasing the share of refined products in their exports. Yet most of these 'manufactured' goods are processed further in the industrial country that imports them. Thus in 1980, only 39 per cent of all Third World exports of manufactured goods were ready for final use, while 43 per cent of its total exports were unprocessed.This ratio should improve as developing nations move into the further stages of processing. These improvements should be speeded up.

The expected growth in basic industries foreshadows rapid increases in pollution and resource degradation unless developing countries take great care to control pollution and waste, to increase recycling and reuse, and to minimize hazardous wastes. These countries do not have the resources to industrialize now and repair the damage later; nor will they have the time, given the rapid pace of technological progress. They can profit from the improvements in resource and environmental management being achieved in industrialized countries, and so avoid the need for expensive clean-ups. Such technologies can also help them reduce ultimate costs and stretch scarce resources. And they can learn from the mistakes of developed countries,

Economies of scale are no longer always the primary consideration. New technologies in communications, information, and process control allow the establishment of small-scale, decentralized, widely dispersed industries, thus reducing levels of pollution and other impacts on the local environment. There may, however, be trade-offs to be made: small-scale raw material processing, for example, is often labour-intensive and widely dispersed but intensive in the use of energy. Such dispersed industries could relieve big cities of some of their population and pollution pressures. They could provide non-farming jobs in the countryside, produce consumer goods that cater to local markets, and help spread environmentally sound technologies.

Industrial growth is widely seen as inevitably accompanied by corresponding increases in energy and raw material consumption. In the past two decades, however, this pattern appears to have fundamentally changed. As growth has continued in the developed market economies, the demand for many basic materials, including energy and water, has levelled off; in some cases, it has actually declined in absolute terms.Energy consumption per unit of GDP in OECD countries has been dropping at a rate of 1-3 per cent every year since the late 1960s. Between 1973 and 1983, these nations improved energy efficiency by 1.7 per cent annually.Industrial water consumption per unit of production has also declined. Older pulp and paper mills typically used about 160 cubic metres of water per ton of pulp; those built during the 1970s, however, used only 70. With advanced techniques that keep water circulating within a closed system, and with proper staff training, use rates could be lowered to 20-30 cubic metres per ton of pulp.

An integrated steel mill uses about 80-200 tons of water for every ton of crude steel. However, since only about 3 tons of water per ton of crude steel are lost, mostly by evaporation, recycling can greatly reduce consumption.Closed water circulation systems are not unique to the steel industry or to developed market economies. Between 1975 and 1980, the chemical industry's output in the USSR increased by 76 per cent, but the total consumption of fresh water remained at the 1975 level. And between 1981 and 1986, Soviet industrial output increased by 25 per cent but industrial water consumption remained constant.

Declines in consumption of other raw materials began much earlier. In fact, the amount of raw materials needed for a given unit of economic output has been dropping over this entire century, except in wartime, for practically all non-agricultural commodities.A recent study of consumption trends of seven basic materials in the United States bears this out, as do studies in Japan. Japan used only 60 per cent as much raw materials for every unit of industrial production in 1984 as it used in 1973.These efficiency trends do not result from a decline in manufacturing in favour of service industries, for over these periods the output of the manufacturing sector continued to grow The productivity and efficiency of resource use are constantly improving, and industrial production is steadily switching away from heavily material intensive products and processes.

The two oil price hikes of the 1970s shocked many countries into saving money by promoting conservation measures, switching to other fuels, and raising overall energy efficiency. These events demonstrated the importance of energy pricing policies that take into account their current stock, depletion rates, availability of substitutes, and any unavoidable environmental damage associated with their extraction or processing. They also indicated the potential of similar pricing policies for other raw materials.

Some have referred to these processes as the increasing 'de-materialization' of society and the world economy. Yet even the most industrially advanced economies still depend on a continued supply of basic manufactured goods. Whether made domestically or imported, their production will continue to require large amounts of raw materials and energy, even if developing countries progress rapidly in the adoption of resource-efficient technologies. To sustain production momentum on a global level, therefore, policies that inject resource efficiency considerations into economic, trade, and other related policy domains are urgently needed, particularly in industrial countries, along with strict observance of environmental norms, regulations, and standards.

Technology is another criteria of this. It continues to change the social, cultural, and economic fabric of nations and the world community. With careful management, new and emerging technologies offer enormous opportunities for raising productivity and living standards, for improving health, and for conserving the natural resource base. Many will also bring new hazards, requiring an improved capacity for risk assessment and risk management.Information technology based chiefly on advances in micro-electronics and computer science is of particular importance. Coupled with rapidly advancing means of communication, it can help improve the productivity, energy and resource efficiency, and organizational structure of industry.

New materials such it fine ceramics, rare metals and metal alloys, high-performance plastics, and now composites allow more flexible approaches to production. They also contribute to energy and resource conservation, as in general they require less energy to manufacture and, being lighter, contain less matter than conventional materials.

Biotechnology will have major implications for the environment. The products of genetic engineering could dramatically improve human and animal health. Researchers are finding new drugs, new therapies, and new ways of controlling disease vectors. Energy derived from plants could increasingly substitute for non-renewable fossil fuels. New high-yield crop varieties and those resistant to unfavourable weather conditions and pests could revolutionize agriculture. Integrated pest management will become more common. Biotechnology could also yield cleaner and more efficient alternatives to many wasteful processes and polluting products. New techniques to treat solid and liquid wastes could help solve the pressing problem of hazardous waste disposal.

Advances in space technology, now the almost exclusive domain of industrial countries, also hold promise for the Third World, even for agriculture-based economies. Weather forecasting services provided through a satellite and communications network can help farmers in deciding when to plant, water, fertilize, and harvest crops. Remote sensing and satellite imagery could facilitate optimal use of the Earth's resources, permitting the monitoring and assessment of long-term trends in climatic change, marine pollution, soil erosion rates, and plant cover.

These new technologies and the Green Revolution blur the traditional distinctions between agriculture, industry, and services. And they make it possible for developments in one sector to more radically affect those in another. Agriculture has become virtually an 'industry' in developed countries. Agriculture-related services - especially for regional weather forecasting, storage, and transport - are becoming ever more important. New techniques of tissue culture and genetic engineering could soon generate plant strains able to fix nitrogen from the air, a development that would drastically affect the fertilizer industry, but that would also reduce the threat of pollution by agrochemicals.

The chemical and energy industries are moving increasingly into the seeds business, providing new seeds that meet specific local conditions and requirements - but that may also need specific fertilizers and pesticides. Here research and development, production, and marketing need to be carefully guided so as not to make the world even more dependent on a few crop varieties - or on the products of a few large transnational. Yet new technologies are not all intrinsically benign, nor will they have only positive impacts on the environment. The large-scale production and widespread use of new materials, for example, may create hitherto unknown health hazards (such as the use of gallium arsenate in the microchip industry.)Risk research might be carried out and products manufactured where safeguards are weak or where people are unaware of the dangers. The need for caution in introducing a new technology is reinforced by the experience of the Green Revolution, which, despite formidable achievements, raises concerns over dependence on relatively few crop strains and large doses of agrochemicals. New life forms produced by genetic engineering should be carefully tested and assessed for their potential impact on health and on the maintenance of genetic diversity and ecological balance before they are introduced to the market, and thus to the environment.

Strengthen International Efforts to Help in Accelerating and Maintaining a Fair Industrial Infrastructure in Developing Countries:

Pollution-intensive, resource-based industries are growing fastest in developing countries. These governments will thus have to substantially strengthen their environmental and resource management capabilities. Even where policies, laws, and regulations on the environment exist, they may not be consistently enforced. Many developing nations have begun to build up their educational and scientific infrastructure, but their technical and institutional capacity for making the most of imported or new technologies remains small. Some countries thus continue to depend on outside technical and managerial skills for the maintenance of industrial operations. For lack of capital, they often find that a new industry can only be started with the support of foreign aid, commercial loans, a direct investment, or a joint venture with a transnational corporation.

The importance of private investment and the key role of transnational corporations have already been highlighted.It is inconceivable that a successful transition to sustainable development can be achieved unless the policies and practices are reoriented around sustainable development objectives. Those external agencies that support and facilitate private investment, particularly export credit and investment insurance organizations, should also incorporate sustainable development criteria into their policies and practices.

The problems of developing-country governments are compounded by the vagaries of the international economic system, such as high debts, high interest rates, and declining terms nftrade for commodities. These do not encourage hard-pressed governments to spend high proportions of their meagre resources on environmental protection and resource management. The developing countries themselves will eventually have to bear the consequences of inappropriate industrialization, and the ultimate responsibility for ensuring the sustainability of their development rests with each government. They must define their own environmental goals and development objectives, and establish clear priorities among competing demands on their scarce resources. They will also need to search for more self-reliant means of industrial and technological development. The choices are theirs, but they will need all the assistance - technical, financial, and institutional - that the international community can muster to help them set an environmentally sound and sustainable course of development.

Large industrial enterprises, and transnational corporations in particular, have a special responsibility. They are repositories of scarce technical skills, and they should adopt the highest safety and health protection standards practicable and assume responsibility for safe plant and process design and for staff training. The transnational should also institute environmental and safety audits of their plants measured against standards at other subsidiaries, not just against those of other local companies, which may have less stringent requirements. These audits and their follow-up should be made available to governments and other interested parties.

Particular care is required in dealing with toxic chemicals and hazardous wastes, and in contingency planning for accidents. The views of non-governmental organizations and the local community should be sought in planning new industrial facilities. The relevant national and local authorities must be fully informed about the properties, potentially harmful effects, and any potential risks to the community of the technology, process, or product being introduced. The necessary information should be disclosed to nearby residents in an easily understandable manner. The enterprises must cooperate with the local government and community in contingency planning and in devising clearly defined mechanisms for relief and compensation to pollution or accident victims.

Many developing countries need information on the nature of industry-based resource and environmental problems, on risks associated with certain processes and products, and on standards and other measures to protect health and ensure environmental sustainability. They also need trained people to apply such information to local circumstances. International trade associations and labour unions should develop special environmental training programmes for developing countries and disseminate information on pollution control, waste minimization, and emergency preparedness plans through local chapters.

Check Your Progress I

Q.1 What do you mean by 'Industrialisation'?

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Q.2 What reasons explains the emergence of industrial revolution in Britain?

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12.4 CONCLUSION

Conclusively, the industrial sector has gone through many ups and downs and highs and lows. The more it tends to be beneficial for our day to day lives and has become an integral part of our live through the day-to-day things we use, somewhere down the line it is also exploiting and harassing our environment. However, with proper measures this problem could be sorted out. Apart from this, it enjoys a status symbol of a developing nation. It is seen as a face of development worldwide. But, in developing countries like India much work is to be done to show a proper functioning of this sector. The infrastructure limits causes a problem in production and availability. The lesser and non-judicial utilization of resources is another problem linked to it. Hence, all this tend to haul up the problem of low rate economic growth a compared to developed countries. Whereas, if a little precaution and proper measures are taken over these issues surely this sector can give results in flying colours.

12.5 SUMMARY

- A period of social and economic change that transforms a human group from an agrarian society into an industrial one, involving the extensive re-organisation of an economy for the purpose of manufacturingis calledIndustrialisation.
- Industry is central to the economies of modern societies and an indispensable motor of growth.
- Industry extracts materials from the natural resource base and inserts both products and pollution into the human environment, hence, has the power to enhance or degrade the environment; it invariably does both.
- The Industrial Revolution, which took place from the 18th to 19th centuries, was a period during which predominantly agrarian, rural societies in Europe and America became industrial and urban.
- Industrialization marked a shift to powered, special-purpose machinery, factories and mass production.
- Since the beginning of the industrial revolution in the late 18th century, five waves have been identified:
    - **1st wave (1785-1845)**. Leaned on innovations such as water power, textiles and iron.
    - **2nd wave (1845-1900)**. Involved the massive application of coal as a source of energy, mainly through the steam engine.
    - **3rd wave (1900-1950)**. Electrification was a major economic change as it permitted the usage of a variety of machines and appliances and permitted the development of urban transit systems (subways and tramways).
    - **4th wave (1950-1990)**. The post World War II period represented significant industrial changes with new materials such as plastics (petrochemicals) and new sectors such electronics (television). The jet engine expanded the aviation industry towards the mass market and mobility could be realized globally and created an active aerospace industry.
    - **5th wave (1990-2020)**. The current wave mainly relies on information systems, which have tremendously modified the transactional environment with new methods of communication and more efficient forms of management of production and distribution systems (logistics).
- A number of factors contributed to Britain’s role as the birthplace of the Industrial Revolution. Britain had abundant supplies of coal;it also enjoyed the advantages of cheap water transportation, which allowed the development of an unusually well-integrated national market.Britain was also Europe's leading imperial power, holding territories in North America, the Caribbean, and India, and benefiting from the trade in African slaves. Additionally, Britain was a politically stable society.
- Industry and its products have an impact on the natural resource base of civilization through the entire cycle of raw materials exploration and extraction, transformation into

products, energy consumption, waste generation, and the use and disposal of products by consumers.

- These impacts may be positive, enhancing the quality of a resource or extending its uses. Or they may be negative, as a result of process and product pollution and of depletion or degradation of resources.
- Firms involved in food processing, iron and steel, non-ferrous metals, automobiles, pulp and paper, chemicals, and electric power generation - all major polluters have borne a high proportion of the total pollution control investment by industry.
- Innovative products and process technologies are also currently under development that promise energy- and resource-efficient modes of production, reducing pollution and minimizing risks of health hazards and accidents.
- High-pollution industries such as iron and steel, other metals, chemicals, and energy production have often led in expanding into the fields of pollution control equipment, detoxification and waste disposal technology, measurement instruments, and monitoring systems.
- Infrastructure is a heterogeneous term, including physical structures of various types used by many industries as inputs to the production of goods and services which includes energy, water, transport, and digital communications. They are the essential ingredients for the success of a modern economy.
- Industrial growth is widely seen as inevitably accompanied by corresponding increases in energy and raw material consumption.
- Many developing nations have begun to build up their educational and scientific infrastructure, but their technical and institutional capacity for making the most of imported or new technologies remains small.

12.6 GLOSSARY

1. MVA : Manufacturing Value Added

2. Luddite : The word "luddite" refers to a person who is opposed to technological change. The term is derived from a group of early 19th century English workers who attacked factories and destroyed machinery as a means of protest. They were supposedly led by a man named Ned Ludd, though he may have been an apocryphal figure.

3. Industrialisation : A period of social and economic change that transforms a human group from an agrarian society into an industrial one, involving the extensive re-organisation of an economy for the purpose of manufacturing.

4. Infrastructure : Infrastructure is a heterogeneous term, including physical structures of various types used by many industries as inputs to the production of goods and services which includes energy, water, transport, and digital communications. They are the essential ingredients for the success of a modern economy.

12.7 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress I

Ans.1 A period of social and economic change that transforms a human group from an agrarian society into an industrial one, involving the extensive re-organisation of an economy for the purpose of manufacturing is called 'Industrialisation'.

Ans.2 Refer section 12.3.1.

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12.10 TERMINAL QUESTIONS

Q.1 What are the phases of Industrial revolution?

Q.2 Explain the growth measures in various fields during Industrial Revolution.

Q.3 What do you mean by Industrial Infrastructure? How is it shaping itself to gain new profits?

BLOCK 4 : TERTIARY ACTIVITIES

UNIT 13 - TERTIARY ACTIVITIES AND SERVICE: CONCEPTS, CLASSIFICATION AND IMPORTANCE

13.1 OBJECTIVES

After reading this unit you will be able to understand meaning, concepts, classification and importance of tertiary activities and service. The tertiary sector covers a wide range of activities from commerce to administration, transport, financial and real estate activities, business and personal services, education, health and social work.

It is made of the market services sector (trade, transports, financial operations, business services, personal services, accommodation and food service activities, real estate, information-communication), non-market sector (public administration, education, human health, social work activities).

The perimeter of the tertiary sector is therefore defined by complementarily with agricultural and industrial activities (the primary and secondary sectors).

13.2 INTRODUCTION

Tertiary activity consists of all service occupations. Transport, communication, trade, health, education and administration are important examples of tertiary activities. These tertiary activities help in the development of the primary and secondary sectors. These activities, by themselves, do not produce a good, but they are an aid or a support for the production process. So these are also known as support services.

This sector provides services to the general population and to businesses. Activities associated with this sector include retail and wholesale sales, transportation and distribution, entertainment (movies, television, radio, music, theater, etc.), restaurants, clerical services, media, tourism, insurance, banking, healthcare, and law.

13.3 MEANING OF TERTIARY ACTIVITIES AND SERVICE

Business activity is divided into three categories: primary, secondary and tertiary. Primary activities include extracting raw materials. Secondary activities involve manufacturing and construction. Tertiary activities are based on providing a service. In order to completely understand tertiary activities, you must be familiar with primary and secondary activities as they are directly linked.

Tertiary activities are service based and provide non-tangible value to customers. Examples of companies working in this area include banks, consultancy and public transport. Most companies involved in tertiary activities do not have operations associated with primary or secondary activities.

13.4 CONCEPT OF TERTIARY ACIVITIES AND SERVICE

(Tertiary Activities), these actions include all those actions related to the delivery of primary or secondary production items to consumers, industrialists.
Transportation, communication and communication of goods, distribution and services of institutions and individuals under such activities; Such as merchants, brokers, banks, insurance, social services and exchanges are included. Proceeding one step further, Prof. Jean Gottman included only direct services in tertiary production, according to him, indirect services are quaternary production. From this point of view, teaching, Politics, research etc. are the fourth activities. Now the activities of human beings on the ground are considered to bring about a complete change in the basis of economic and economic activities in many ways. That is why in the field of economic geography, the importance of such activities of man is increasing rapidly because he is not only satisfied with his life - his subsistence or his present form, but he was constantly striving for better living system.

This is the reason that after discovering the initial resources in the physical environment, every next time, he has been inventing or inventing new resources by mixing different types of new natural objects and self-made goods or with technology. For this reason, research, intensive study and research are also considered to be important or fundamental in every developed next economic activity. Therefore, such a research system or new technology and continuous knowledge occurring in the whole world maintains an unyielding craving. That is why it has developed the exchange, transport and communication and conveyance vehicle at a high level. Knowledge of the events of the entire world today is made available directly to humans and researchers in their own home or workshop through the latest communication mediums, so that there can be no hindrance in the continuous development of economic activities. On the economic activities of any country, various level of means of production, trade, commerce and transport and communication system (exchange), the geographical conditions there that is natural environment (climate, structure, minerals, soil, surface, condition, bio-world etc.) It has special and many levels of impact. Due to such facts, the field of economic geography is connected in many ways to the facts of physical geography. Likewise, changing political geography can also be seen to have a clear impact on the level patterns of economic activities developed in countries, such as the economic activities of socialist and capitalist countries. It must be kept in mind here that political geography is variable, so economic activities are also essentially necessary to remain constantly dynamic in terms of time and area. For example, in Russia, there is a rapid change in the economic behavior due to a complete ideological change in power. With regard to the field of economic geography, the following three facts are of fundamental importance. According to the first ideology, it is a study of human economic activities and their means of livelihood. According to the second ideology, it is the study of the physical and cultural environment of a human being which has an impact on his life and work. According to the third ideology, it is a polymorphic activity found in different parts of the world; Such as - the production, distribution and consumption of agricultural, mineral and industrial resources, commerce, business, transport and communication are properly studied. All these elements can be called life lines of economic geography. In North America, this science is also called Geo-economic or Geo-economies or Economic geography. In fact, economic geography has two systems - first, it gives a precise description of the physical and economic resources of the earth and second, it also states that humans have used these resources and natural systems for their own benefit. How is it used? Therefore, under it, the interaction between the productive human's economic activities and physical means is studied. In the name of economic development, the resultant punishment of misuse done by human beings on various levels has also got him in many ways. It is an important fact that in any state, economic landscapes are born out of the interrelations of different aspects of economic activities. The ultimate goal of economic geography is to analyze and interpret it.

13.5 CLASSIFICATION AND IMPORTANCE OF TERTIARY ACIVITIES

Tertiary activities are generally divided into four categories: social services, distribution services, services to companies and services to consumers. Social services are provided by public and private sectors and they include activities related to administration, education and healthcare. Distribution services are activities that deal with the movement of people, goods and information from one place to another. Services to companies are the activities that are contracted to other companies or organizations. Services to consumers include catering businesses, repairs, cleaning and hotels.

13.6 CONCLUSION

Tertiary activities typically require qualification and personal effort. The value that is given in the tertiary sector cannot be stored. Services are demanded when needed and thus must be close to consumers. The tertiary sector has a low level of mechanization. Most services cannot be offered using machinery.

13.7 SUMMARY

In this chapter we tried to explain that Tertiary activities are service based and provide non-tangible value to customers. Examples of companies working in this area include banks, consultancy and public transport. Most companies involved in tertiary activities do not have operations associated with primary or secondary activities. The region provides services to the general population and businesses. Activities related to this sector include retail and wholesale sales, transportation and distribution, entertainment (cinema, television, radio, music, theater, etc.), restaurants, clerical services, media, tourism, insurance, banking, healthcare and law.

13.8 GLOSSARY

- Tertiary activity : consists of all service occupation. These tertiary activities help in the development of the primary and secondary sectors.
- Consultancy : a professional practice that gives expert advice within a particular field.
- Associated : (If a person or thing) connected with something else.
- Machinery : The organization or structure of something or for doing something.
- Resource : a stock or supply of money, materials, staff, and other assets can be drawn on by a person or organization in order to function effectively.

13.9 ANSWER TO CHECK YOUR PROGRESS

Q1. What is the meaning of tertiary activities?

Ans. Tertiary activities are service based and give non-tangible value to customers. Most companies that are involved in tertiary activities do not have operations involving primary or secondary activities. The tertiary sector is the fastest growing industry in today's economic world.

Q2. What are examples of tertiary activities?

Ans. Examples of tertiary activities are:

- Telecommunication.
- Hospitality industry/tourism.
- Mass media.
- Healthcare/hospitals.
- Public health.
- Pharmacy.
- Information technology.
- Waste disposal.

Q3. What is the difference between primary activities and tertiary activities?

Ans. Primary activities are those activities that which involve exploitation of natural resources. It is the base for production of other goods that is it provides raw materials. Example: Agriculture, mining, animal husbandry. Tertiary activities are those activities that provide services to the people.

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13.12 TERMINAL QUESTIONS

Q1. Explain the Concept of Tertiary activities and service?

Ans. (Tertiary Activities), these actions include all those actions related to the delivery of primary or secondary production items to consumers, industrialists. Transportation, communication and communication of goods, distribution and services of institutions and individuals under such activities, such as merchants, brokers, banks, insurance, social services and exchanges are included. Proceeding one step further, Prof. Jean Gottman included only direct services in tertiary production, according to him, indirect services are quaternary production. From this point of view, teaching, Politics, research etc. are the fourth activities.

Q2. Explain the Classification and importance of Tertiary activities.

Ans. Tertiary activities are generally divided into four categories: social services, distribution services, services to companies and services to consumers. Social services are provided by public and private sectors and they include activities related to administration, education and healthcare. Distribution services are activities that deal with the movement of people, goods and information from one place to another. Services to companies are the activities that are contracted to other companies or organizations. Services to consumers include catering businesses, repairs, cleaning and hotels.

UNIT 14 - TRADE

14.1 OBJECTIVES

After reading this unit you will be able :

1. To understand meaning and importance of trade.
2. To understand its significance in regional and national economy.
3. To discuss trade strategies.

14.2 INTRODUCTION

Trade means exchange of goods. Traders essential because nature has not provided resources to all regions equally. The unequal distribution of resources is the base of trade. When people produce a circular quantity, they tend to exchange the surplus production with commodities they lack. This is how trade begins. When human wants Limited trade develop locally or regionally. An increase in population, higher living standards or natural calamities like a draught demand imports of goods from distant places. Four factors or condition initiate grade

(1) the will to exchange goods,
(2) mutual contact between regions all countries,
(3) surplus production,
(4) variation in commodity.

14.3 MEANING OF TRADE

Trade is one of the most important activities of a man. It is the most important aspect of the world economic organization. It is a significant aspect in the relation of one country with another. On it to large degrees at the wellbeing of the people of a country, the standard of living. Although many conditions favor, or hinder, international trade comma throughout its long history, foreign trade has rested fundamentally on basis of there is regular distribution of natural resources and on the ability of people to use technology in their development. People trade to obtain commodities they cannot produce themselves or things they can purchase elsewhere at lower cost than they produce them.

Trade is simply the exchange of goods and commodities takes place at any level. The earliest form of trade was barter; in which goods were exchange for goods. The barter system is still carried on in some primitive societies and shows the underdeveloped economy of such societies. The barter system of trade has the following three characteristics.

1. It depends upon two people buying mutually able to satisfy one another's wants;
2. A rate of exchange has to be determined before transaction can take place; and
3. The exchange of large for small commodities is difficult; thus, the present trade of these difficulties is mostly done through the medium of currency.

The famous popular form of present trade is retail trade in which the seller sells goods to individual customer for money.

TYPES OF TRADE

On a large scale, world trade has become the following two types:
Internal or Domestic Trade, and International or External Trade

1. **Internal Trade:** Internal trade is also known as Home trade. It is conducted within the political and geographical boundaries of a country. It can be at local level, regional level or national level. Hence trade carried on among traders of Delhi, Mumbai, etc. is called home trade. Internal trade can be further sub-divided into two groups, viz.,

Wholesale Trade: It involves buying in large quantities from producers or manufacturers and selling in lots to retailers for resale to consumers. The wholesaler is a link between manufacturer and retailer. A wholesaler occupies prominent position since manufacturers as well as retailers both are dependent upon him. Wholesaler act as a intermediary between producers and retailers.

Retail Trade: It involves buying in smaller lots from the wholesalers and selling in very small quantities to the consumers for personal use. The retailer is the last link in the chain of distribution. He establishes a link between wholesalers and consumers. There are different types of retailers small as well as large. Small scale retailers include hawkers, pedlars, general shops, etc.

International Trade: External trade also called as Foreign trade. It refers to buying and selling between two or more countries. For instance, If Mr.X who is a trader from Mumbai, sells his goods to Mr.Y another trader from New York then this is an example of foreign trade. External trade can be further sub-divided into three groups, viz.,

Export Trade: When a trader from home country sells his goods to a trader located in another country, it is called export trade. For e.g. a trader from India sells his goods to a trader located in China.

Import Trade: When a trader in home country obtains or purchase goods from a trader located in another country, it is called import trade. For e.g. a trader from India purchase goods from a trader located in China.

Entreport Trade: When goods are imported from one country and then re-exported after doing some processing, it is called entrepot trade. In brief, it can be also called as re-export of processed imported goods. For e.g. an indian trader (from India) purchase some raw material or spare parts from a japanese trader (from Japan), then assembles it i.e. convert into finished goods and then re-export to an american trader (in U.S.A).

14.4 SIGNIFICANCE OF TRADE IN REGIONAL AND NATIONAL ECONOMY

Trade is a symptom of civilization. The economic progress of a nation is based upon trade. One Nation exchanges its Hercules production for the circulars of another nation. In this way, everybody tends to produce only that commodity for which nature has given him the greatest capacity. Climate, topography and social organization determine the capacity of production. They also, on the other hand, determine the need for commodities. The origin of trade is thus the function of geography. Successful trade provides for developing/emerging nations: A source of foreign currency to help a nation's balance of payments.

Intra-regional trade refers to trade which focuses on economic exchange primarily between countries of the same region or economic zone. In recent years countries within economic-trade regimes such as ASEAN in Southeast Asia for example have increased the level of trade and commodity exchange between themselves which reduces the inflation and tariff barriers associated with foreign markets resulting in growing prosperity.

14.5 TRADE AS AN ENGINE TO GROW

Trade is the most dynamic and policy thrust as an engine to growth according to the current trade and economic theories, and received wisdom of the modern period. Normative liberal theory since Adam Smith's wealth of Nations (1776) portrays a positive link between free trade and economic growth. This is also trust of the current globalization wave. However, in real world free trade is rare practice, as it encumbered by many factors and policies. Dependent trade between two trading partners with highly unequal exchange rates and other economic and indirectly working dependency structures of the weaker one is harmful for the latter. Beneficial trade is the independent trade between partners of the same economic club with equal economic ranking, and specialization and competitive abilities as it prevails between developed countries. Such a trade enhance economic growth and general wellbeing.

Trade is recognized as an engine for inclusive economic growth and poverty reduction that contributes to the promotion of sustainable development. Accounting for a significant share of low-income countries' GDP, international trade can be an important source of finance to both the private sector and the public sector in developing countries. Trade growth enhances a country's income generating capacity, which is one of the essential prerequisites for achieving sustainable development. Trade can also serve as an effective means to facilitate the diffusion of technologies around the world, including of vital green technologies. A predictable trading environment can help to promote long term investments that could further enhance the productive capacity of a country. An increase in exports enhances the country's income growth at least at the aggregate level. While an increase in imports at competitive prices can improve consumer surplus and the prospective competitiveness of domestic producers that use imported intermediates. Market access conditions, both foreign market access for a country's exports and domestic market access for imports, are thus an important determinant of the effectiveness of trade as a means of implementation. Trade promotes growth and enhances economic welfare by stimulating more efficient utilization of factor endowments of different regions and by enabling people to obtain goods from efficient sources of supply. Trade also makes available to people goods which cannot be produced in their country due to various reasons. Trade liberalization is a key element in growth and a sustainable national development strategy. Economic growth occurs at the producer level, and perhaps the most powerful incentive for producers to raise productivity is competition. Developed and developing country partners have increased their focus on trade as an integral part of national development strategies and trade-related development assistance to support those strategies.

BENEFITS OF TRADE

Benefits of trade, as the trade theory suggest, can be derived by developing strong and diverse level of comparative and competitive advantage. No country enjoys absolute advantages of a country have to be constant structural dynamisms in the production and export structures. Trade can be the engine of growth only under such dynamic structures and can provide multiple benefits as follows:

1. More open liberalized economies on average continue to experience faster and higher growth than less open economies.
2. Trade offset inherent differential factor endowments and scarcities in countries. All countries lack some or other factors or resources. This inherent scarcity can be offset by trade through outsourcing, i.e. importing scarce or less available resources from other countries. Japan has been relatively a 'resource less' country in terms of coal, iron ore, petroleum and other vital factor endowments, but its industrialized production structure and vast trading machine have built up to be the second largest global economy after the US.
3. Trade enhances variety of production structures, diversity of products and higher factor productivity and efficiency. Outsource items, i.e. imports, have to be paid for, and therefore, exports are required to earn foreign exchange to pay for them this increasing competitiveness establishes a virtuous circle of high trading by expanding production structure, and export-import regime, with constant quality enhancement.
4. Factors of production are allocated more efficiently in such dynamically expanding economy. Lead factors of economy and well allocated scarce resources, dynamize other stagnant and slowly moving sub-sectors or sectors of the economy, which then try to catch up through these 'growth impulses. This is the motivation-oriented multiplier effect of dynamic 'lead sector'.
5. Consumption demand rises high production leads eventually to per capita income growth in a liberal justice-oriented regime in general. People's purchasing power rises to demand more and varied consumer goods. Since producing all much varied good is not at all feasible and adventurous in an expanding economy, cheaper and better-quality goods are imported. This enhances consumer welfare by increasing choice among goods with often lesser price. People also are motivated to earn more to have higher disposable income.
6. Open trade and import policies also limit the scope for arbitrary changes in the domestic policies or orienting policies to favor the demands of specific 'elite' or 'interest' and feudal groups as it happened usually in earlier societies.
7. Free flow of imports, ideas, technology, FDI and other investment resources across the borders lead to further growth and competitive structures. Imports do not necessarily harm the economy, as some still think of the mercantilist ideas. If the import regimes are carefully selected and ploughed back into the socio-economic fabric, they provide several advantages. All economies import to build up economic growth and expand their export structures by quantity as well quality.

8. Expanding trade and global integration offer one sure way of crossing through the resource and labor based export regime and continued unfavorable trade gap, as well as the 'resource-curse' regime.

TRADE: TRENDS AND PATTERN

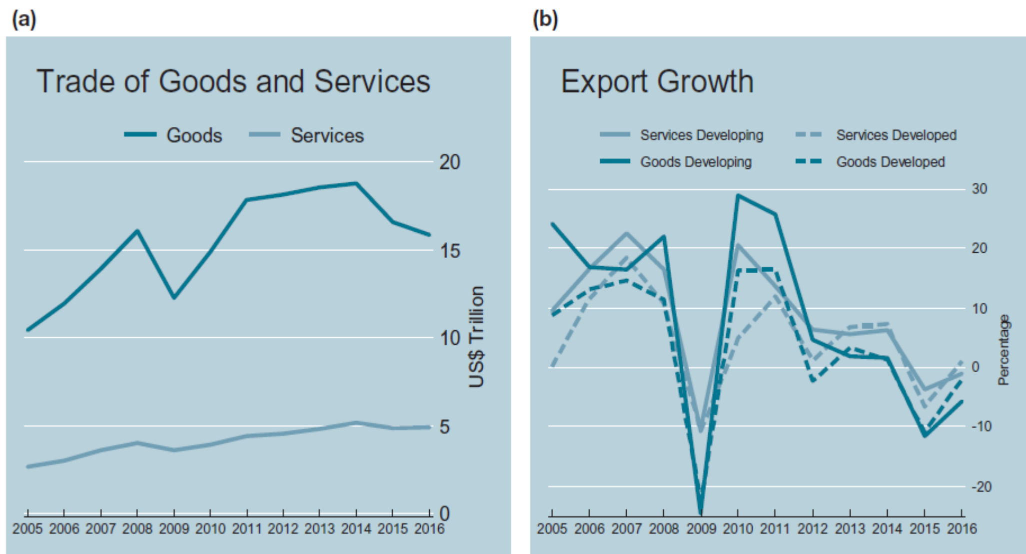

Figure 1: Value and Growth Rates in World Trade in Goods and Services

International trade can be broadly distinguished between trade in goods (merchandise) and services. The bulk of international trade concerns physical goods, while services account for a much lower share. World trade in goods has increased dramatically over the last decade, rising from about \$10 trillion in 2005 to more than \$18.5 trillion in 2014 to then fall to about \$16 trillion in 2016. Trade in services greatly increased between 2005 and 2016 (from about \$2.5 trillion to almost \$5 trillion). The value of international trade of both goods and services declined substantially in 2015 and 2016 (figure 1). Following the strong rebound in 2010 and 2011, export growth rates (in current dollars) are now at much lower level than in the pre-crisis period and were negative both in 2016 and 2016 for developing and developed countries (figure 1).

Trade has emerged as one of the fastest growing sectors of the world economy as its records show during 1950-2018 onwards. Through out the period, both exports and imports registered faster expansion than that of the global output growth. The export sector in merchandise showed in annual growth at an impressive 11% rate with 11.2% rise in developed economies, 11% in developing countries and 9.2% in East European Transition economies. Imports were also identical with 10.9% global average, 11% in developed, 10.8% in developing and 9.3% in Transition economies. These average growth trends naturally fluctuated at different rates in the decennial average. The culminating year 2000 of the twentieth century recorded the strongest global trade as well as global output growth in more than a decade. It was the result of the continued acceleration in output in North America, and developing Asia, and a post-stagnation growth in South America and Russia as well. Other regional economies also experienced growth. The North American and West European economies which normally put up over 60% of global output as well as trade recorded their highest GDP growth in the 1990s. In fact, the global economy was beneficial to all regions. However, the second half of the year saw a crashing downfall, culminating in a bare 1.3% growth in output in 2001 and a downfall of 0.9% in global trade.

The data display the changing pattern of shares in total world of ten largest trading countries of the world. In the pre-World War II and up to 1980 world share of the industrial countries figured in general to around 80 percent. Five developing countries, e.g. South Africa, Brazil, Nigeria, Singapore and Hong Kong and a mere 8 percent share in 1980. Japan rose from the ashes after the World War II to catch up 7% share in 1980. It had already risen to the status of developed industrial nations by 1970. By 1999, global pattern changed to a different sort. The world trade had quadrupled in value between 1980-1999, and the share of ten largest trading developed economies has slide down to its two-third to 66%. Developing rapidly China made a bold entry spinning 4% total world trade share. While Japan retained its share of 7%, all core nations experienced a decline. By 2005 again world trade had doubled in value since 1999, but nine large trading nations severely dropped in their respective share, with China alone increasing its share to 7%, and becoming third in rank after the US and Germany. Developing countries on the whole had increased their share to about one-third in global trade. Hong Kong figured among the largest nine, while South Korea, Mexico and Taiwan were fast struggling upward, being among the top ten nations.

Globally, 50 top economies account for 93.2% of export and 92% of imports respectively. Naturally, OECD (30) economies are dominating traders, with one-third of the world share. The remaining two-third goes to the developing and CIS economies. The top ten 12 countries approach about two third of global export and import total, excepting China and Russia, all other ten are OECD economies. BRIC economies form an important group among emerging countries. Together, they accounted for 13.4% and 10.7% global export and import respectively. All of these have been constantly increasing their share. While China and India have emerged as the fastest growing economies for last five years and so, all of the four economies show vigorous growth among the emerging economies. Least developed partition of world trade has been growing, but very slowly. Their share in the world merchandise trade grew to 1% in 2010, and that due to higher international price of commodities.

The developing economies product is still less diversified. Primary resource and labor-intensive low-tech, low value and less competitive products still dominate the trade composition which now earn 80% of their fore by trade.

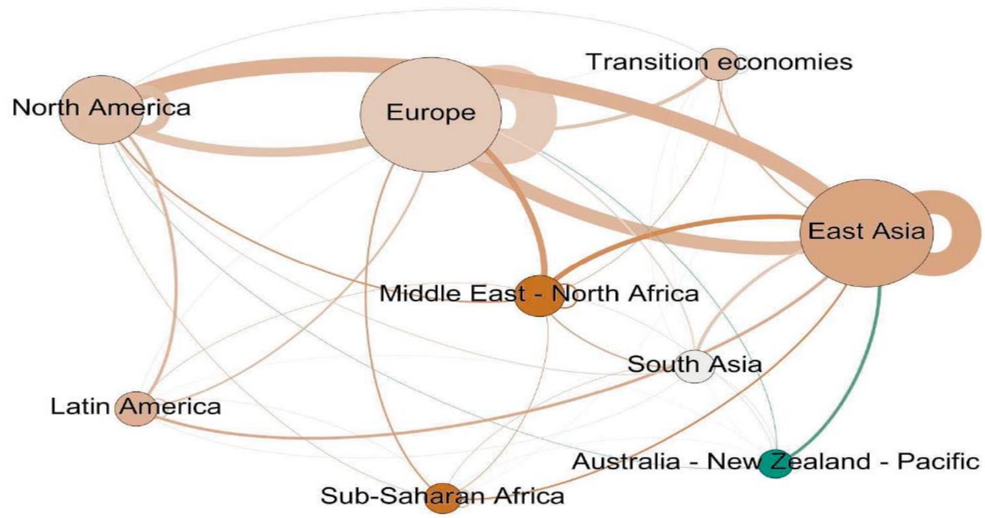

Figure 2: Trade Flow Across the Regions in World

Thus, commodity flows are downsizing in foreign exchange earnings. They have been increasingly participating in world trade, and earning some of its dividends even with comparatively less diversified trade composition. Their export share of total GDP rose sizeably between 1990-2010. SSA and East Asia and Pacific region fared much better during the period in comparison to even high-income economies as a whole. They do realize that trade in high-tech knowledge-deep products and medium-tech products have been cutting edge money fetching products in world trade. Emerging economies among the developing world have focused their attention on trade structural dynamics on these product line. As a consequence, the share of manufacturing products of the developing world in world market attained about a quarter of exports share in 2003.

China, the United States, Germany and Japan remained the top four traders for both merchandise exports and imports in 2015. China was the leading exporter, with total exports of US$ 2.27 trillion and a 14 per cent share of world exports, followed by the United States (US$ 1.50 trillion, 9 per cent), Germany (US$ 1.33 trillion, 8 per cent) and Japan (US$ 624 billion, 4 per cent). The fifth biggest exporter was the Netherlands, with total exports of US$ 567 billion, representing a 3 per cent share of world exports.

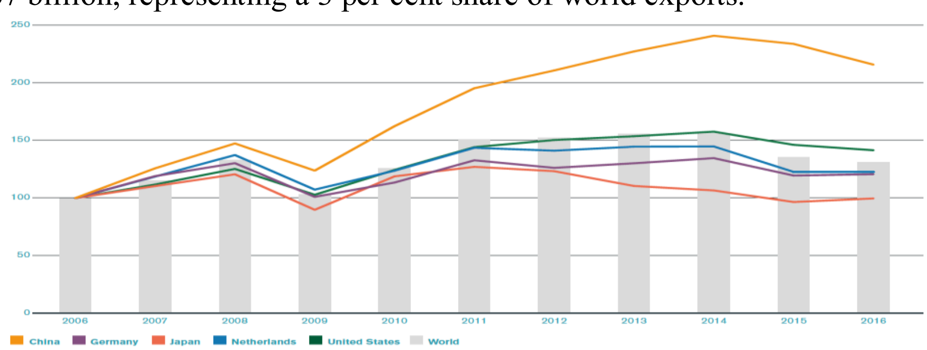

Figure 3: Leading Traders and World Exporters in Merchandise Trade, 2006-2016

China's share of world merchandise trade in 2016 declined for the first time since 1996, falling to 11.8 percent compared with 12.2 per cent in 2015. China's exports totalled US$ 2.10 trillion, a decline of 8 per cent following a 3 per cent decrease in 2015. Chinese exports made a slow start to 2016, with an initial decline of 13 percent compared with the same quarter of 2015. On the imports side, a decline of 5 per cent on a year-on-year basis was less marked than the decline of 14 percent recorded in 2015. In volume terms, import demand from China grew by 3 per cent following a decline of 2 percent in 2015. China's trade balance remained positive in 2016 but declined by US$ 83.2 billion to US$ 510.7 billion in 2016. This follows an improvement of US$ 124.0 billion to its trade balance in 2014 and an improvement of US$ 210.8 billion in 2015. Preliminary data shows that trade surplus in manufactured goods, which account for more than 96 per cent of China's total exports, reached US$ 969.8 billion in 2016 compared with US$ 1.06 trillion in 2015. The three top regional destinations for China's exports of manufactured goods in 2015 were Asia (37 per cent share), North America (26 per cent) and Europe (20 per cent). Preliminary data show that on the imports side, demand from China for manufactured goods declined at a pace of 5 per cent in 2016 following a decline of 8 per cent in 2015. Imports of fuels and mining products were affected by the decline in prices of these commodities in 2016.

The United States exported goods with a value of US$ 1.45 trillion in 2016 and imported goods totalling US$ 2.25 trillion. Merchandise exports decreased by 3 per cent, following a decline of 7 per cent in 2015. Agricultural goods, which represented 11 per cent of goods exports in 2016, grew by 3 per cent following a decline of 12 per cent in 2015. The net trade deficit on goods was lower than in 2015 during the first three quarters of 2016 but a decline during the fourth quarter of the year dragged down GDP growth for 2016 to 1.6 per cent. The US trade balance improved by US$ 16.0 billion in 2016 following a decline of US$ 42.5 billion in 2014 and US$ 20.7 billion in 2015. The US merchandise trade deficit with developing economies reached US$ 541.5 billion in 2016, down from US$ 558.2 billion in 2015. Exports declined 3 per cent to US$ 809.7 billion, caused primarily by a decline in machinery and transport equipment products. Imports were down 3 per cent to US$ 1.35 trillion from US$ 1.39 trillion in 2015. The United States' two partners in the North American Free Trade Agreement (NAFTA) – Canada and Mexico - received over 34 per cent of all US merchandise exports in 2015 and were responsible for 26 per cent of all US imports.2 The United States ran a trade deficit of US$ 87.7 billion in goods with its NAFTA partners in 2016: US$ 67.7 billion with Mexico and US$ 20.4 billion with Canada. Over the past two years, US merchandise trade has declined by 4 per cent, compared with average growth of 2 per cent in 2013 and 2014. Within the European Union, Germany was the largest exporter of goods (totalling US$ 1.34 trillion) followed by the Netherlands (US$ 569.7 billion) and France (US$ 501.3 billion). Germany recorded a trade surplus of US$ 284.8 billion in 2016 compared with US$ 43.5 billion for the European Union as a whole. Germany remains the main recipient of world exports to the European Union, with imports valued at US$ 1.05 trillion, or 20 per cent of the EU's total imports. The Netherlands remained the fifth largest exporter of goods in the world, with a share of 4 per cent of global trade. In terms of imports, the United Kingdom overtook Japan as the world's fourth-largest importer of goods behind Germany, with imports of US$ 635.8 billion in

2016, an increase of 2 per cent. The United Kingdom accounted for 12 percent of EU imports in 2016 while France's share was 11 per cent. Japan was the world's fourth-largest exporter of merchandise trade and fifth-largest importer in 2015, with a 4 per cent share of total trade. Among developed economies, Japan showed the highest exports growth in value and volume terms. Japan's merchandise exports rose by 3 per cent while imports fell by 6 per cent. Export growth in 2016 followed a decline of 9 per cent in 2015, with exports US$ 20.1 billion higher than in 2015. Growth was largely driven by a recovery in exports of manufactured goods, which account for more than 87 per cent of the country's total exports. The 6 percent decline in imports was less marked than the 20 per cent decline in 2015. Japan recorded an increase in demand for agricultural and manufactured products following a decline in 2015. Japan's trade balance was positive in 2016, with a surplus of US$ 38.0 billion, after recording a deficit of US$ 23.2 billion in 2015 and US$ 122.0 billion in 2014. Overall, Europe is the third-largest destination of Japanese manufactured goods, accounting for 12 per cent of these exports, with Asia and North America representing 53 per cent and 25 per cent shares respectively. Within Asia-Pacific Economic Cooperation (APEC), Japan represented 8 per cent of the total merchandise trade of the group in 2016.

Africa's exports experienced a significant 30 per cent decline in dollar terms in 2015. Accounting for about 40 per cent of the region's exports, Sub-Saharan oil-exporting countries, such as Equatorial Guinea and Congo, were significantly affected by the 60 per cent decline in oil prices. Nigeria saw a decline of almost 50 per cent in its export revenues in dollar terms. This weakness was also due to a variety of other factors, including slow growth in North Africa and domestic and political turmoil. Growth in South Africa and Morocco was relatively better than the average for the region, with a less marked decline in the value of their exports.

Asia experienced the lowest regional decline in total exports in 2015, with a fall of 7 per cent. However, the larger Asian economies, such as Malaysia and the Philippines (net exporters of manufactured products), experienced a decline of 15 per cent and 6 per cent respectively while Indonesia's exports fell by 15 per cent. On the other hand, Viet Nam (a net importer of manufactured goods) and Bangladesh (a clothing exporter) experienced growth of 8 and 6 per cent respectively despite declining prices for manufactured goods in 2015. Developing Asia continues to account for the bulk of developing economies' share in world exports, representing 67 per cent of developing economies' exports.

Figure 4: Merchandise Trade by Region

The participation in global trade of the Middle East, South and Central America and the Commonwealth of Independent States is still largely confined to agricultural products, energy and other commodities, so their trade flows are vulnerable to price movements influenced by international markets. Their total exports amounted to US$ 841 billion, US$ 540 billion and US$ 500 billion respectively in 2015. Compared to 2014, their exports declined by 35, 21 and 32 per cent respectively.

In 2015, the top ten exporters of commercial services were the same as the top ten importers but the order of the top ten differed. The United States maintained its position as the world's leading trader of commercial services. Although US exports stagnated, its imports were up by 3 per cent, reflecting its ongoing economic recovery. China was the second-largest services exporter in 2015, with a 6 per cent share in global services exports. The country was the only leading services exporter to record positive growth for both exports and imports (2 per cent and 3 per cent respectively). However, China remained a net importer of services, mainly due to the rapid increase in its travel imports in recent years. Among other leading Asian traders, imports fell more steeply than exports, with Japan's services imports down by 9 per cent. In US dollar terms, leading European traders saw declines in their services trade, with the sharpest export reduction in France (-13 per cent) and the biggest fall in imports in Germany (-12 per cent). However, it should be noted that in euro terms growth was positive in both countries. Imports rose by 4 per cent in Ireland, as payments for business services as well as for charges for the use of intellectual property thrived. Ireland recorded the most dynamic growth rate among leading importers of commercial services.

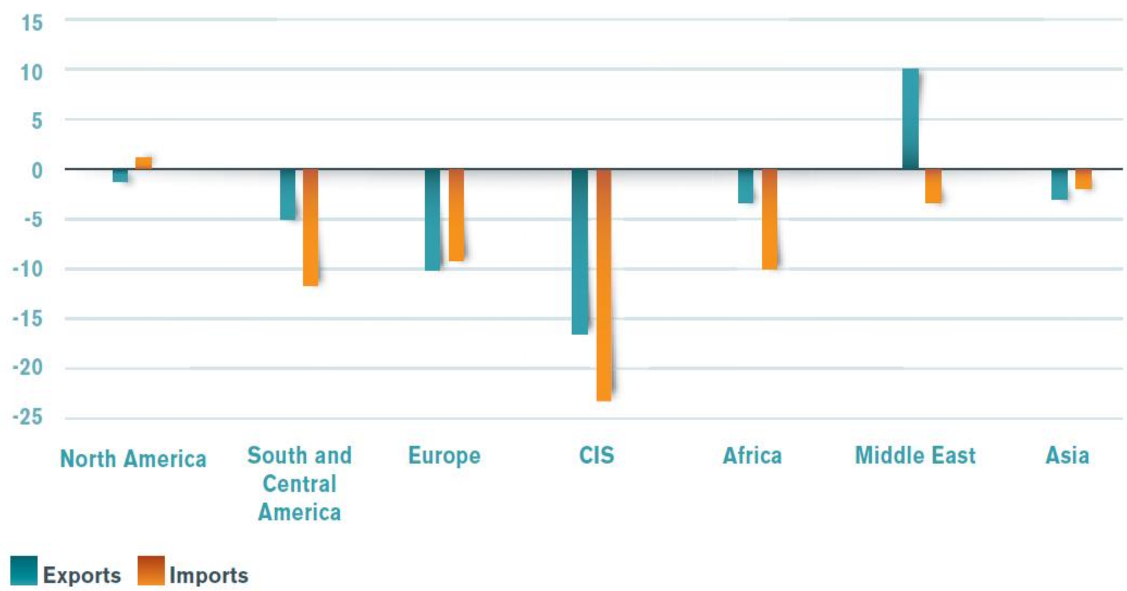

Figure 5: Trade in Commercial Services by Region

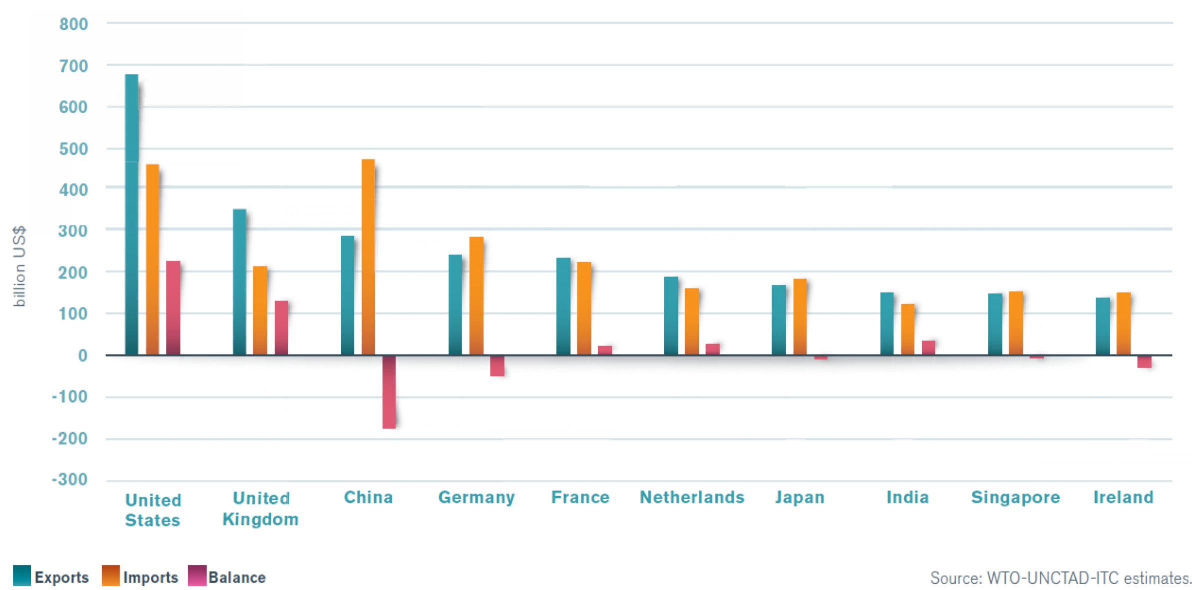

Figure 6: Leading Traders of Commercial Services

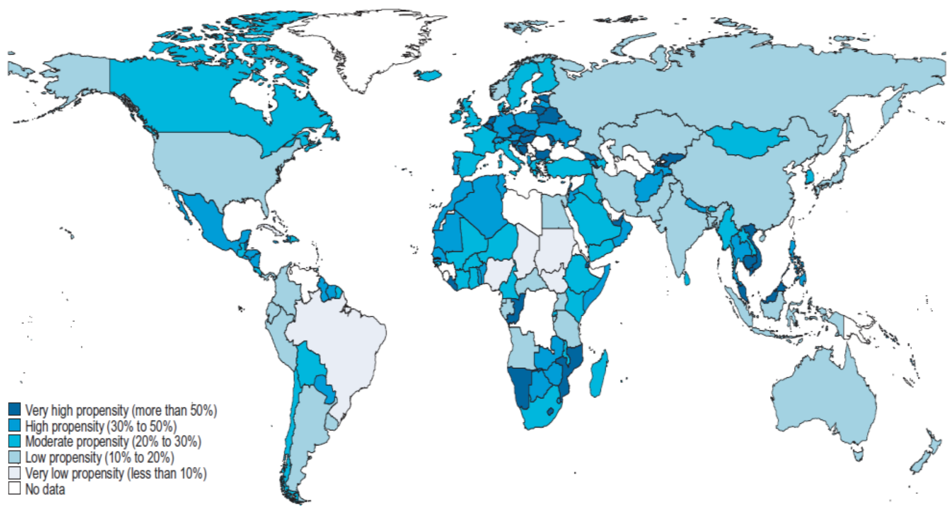

Figure 7: Imports of Goods and Services over Gross Domestic Products

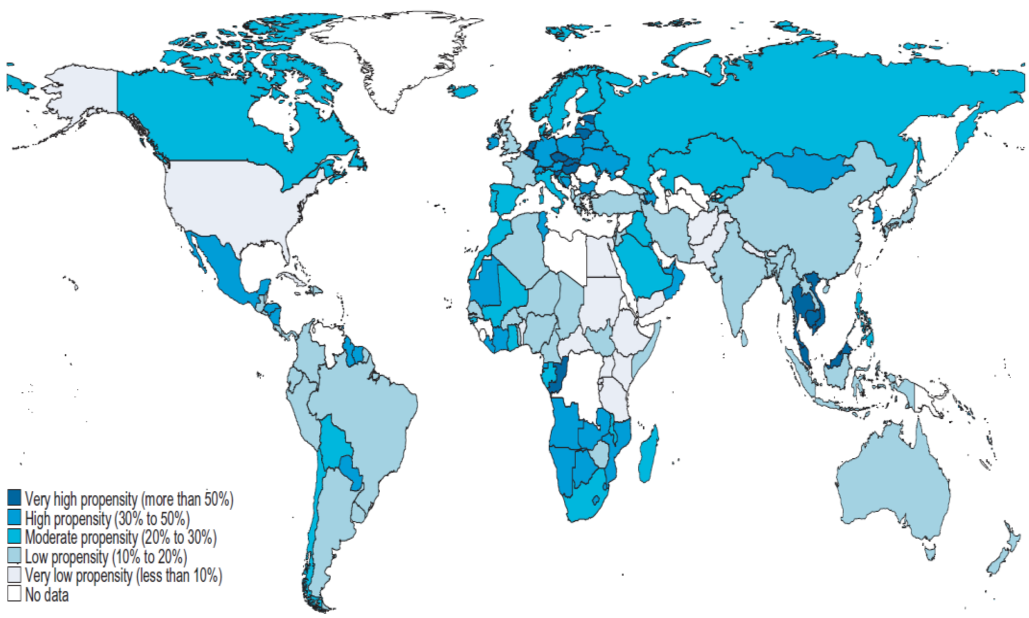

Figure 8: Exports of Goods and Services over Gross Domestic Products

14.6 TRADE AS A HINDRANCE TO GROW

The world is a group of more than 210 sovereign nation states and territories. They all vary in population and territorial size, resources, development, history, culture, society and political economy. Global forces, MNEs and supranational organization like WTO, IMF/World Bank impact differently on them. In the overall situation, most of these find themselves individually to be quite weak in facing up to these larger powerful forces. For instance, they have individually weak power while negotiating with the MNEs or WTO. The only measures they think is of forging collective and cooperative power-system with other willing, and preferably identical and contiguous countries by establishment trade blocs and after good workable experience to moving on moving to towards economic integration. The world is group of more than 210 sovereign nation states and territories. They all vary in population and territorial size, resources, development, history, culture, society and political economy. Global forces, MNE s and supranational organizations like WTO, IMF/World Bank impact differently on them. In the overall situation, most of these find themselves individually to be quite weak in facing up to these larger powerful forces. For instance, they have individually weak power while negotiating with the MNEs and WTO. The only measure they think is of forging collective and cooperative power-system with other wiling, and preferably identical and contiguous countries by establishing trade blocs and after good workable experience to moving to towards economic integration. Balassa's made a significant theoretical contribution through the step wise five-tier progression of a wiling group of sovereign states to forge an economic integration through some period of time. Each tier prepares the member states to the practical experience for the onward progress for achieving the goal. the theory states that while the member states move forward to the next tier, each has to surrender some of the required part of the respective national sovereignty for the sake of strengthening the group's bonded solidarity. These five steps are as follows: (1) the first-tier association is the free trade area status of the emerging union. At this stage, members are obliged to remove all the barriers to trade within the union, while they are allowed to continue their trading activities in their independent ways with non-member states. (2) next upper tier is the group's ascent towards establishing a custom union. At this level, members allow free movement of goods among themselves while they agree to impose a common array of restrictions on trade with non-members. (3) the third upper stage is the evolution of the common market. Members continue the intra-group free movement of merchandise retaining all the conditions of custom union status, including common sanction on trade with non-member, but adding also free movement of labor as well as the entrepreneurs. (4) the fourth stage, is among themselves the establishment of the economic union together with all the condition market, while further integrating movement by establishing a common Central Bank, unified monetary and tax system, and crucially a common foreign exchange policy. (5) the final stage is the forging of the economic union of the member states, characterized by complete removal of all types of barriers, in intra-union movement of merchandise as well as factor production and establishing uniform social and economic policies. Member states are also obliged the decision struck by the union authority which features at this stage a full functioning secretariat with executive, judicial and legislative branches for the smooth functioning secretariat with executive, judicial and legislative branches for smooth functioning of the union.

MAJOR REGIONAL TRADE:

Concept of regional trade and economic association and mutual integration of a set of countries, preferably among close neighbor in a contiguous region has grasped the imagination of most sovereign nation states as a rational measure to cope up with their trade and economic difficulties. The expanding and thickening dominance of TNCs in trade and economic growth and the proceeding roller of globalization have together put immense pressure on individual nation states of any size and economy. Nation states under these grueling situations have naturally become more proactive to strengthen their economies, finances and trade outlets by compromising mutually much larger in size, population, economic strength and trading power. European Union is the most successful economic, trading and political union, now consisting of 27 states of Europe. Small European nations are no longer under siege for trade and economic power as each was before EU.

European Union is earliest experiments for some kind of association of countries were attempted in Western Europe in nineteenth century but they could not continue. In the mid-twentieth century, Belgium, the Netherland and Luxembourg formed a Custom Union in 1948. This union worked successfully and expanded to form in 1952 the European Coal and Steel Community (ECSC) linking the Benelux with France, West Germany and Italy as other member states. The community was popularly known as the Common Market.

NAFTA (North American Free Trade Agreement) creation is the culmination of an earlier economic cooperation between US and Canada known as the Automotive Agreement struck in 1965. Its success prompted free trade in automotive industry between the two neighbors. The gaining advantage led the two nations further into forging a Free Trade Agreement (FTA) or CFTA, effective from Jan 1, 1989. Thus, CFTA became at that time the largest global free trade area, extending from the Arctic Circle to the Rio Grande river. The US-Canada bilateral trade was more than any other two country trade. They have virtually free trade in merchandise, energy, services and investments.

Latin American experiment of cooperation. The UN Economic Commission for Latin America (UNECLA) made vigorous attempts to bring Latin American Counties into a strong common market in the 1950s. however, there were several problems faced in such an effort. These problems were very daunting in form of great physical distances with little continuing road or railway linkages between countries. Since most countries were largely settled in coastal areas, the interiors were largely thinly peopled or vast wilderness and forested. The countries had enormous disparity of cultures and development levels. Political problems and law and order situations were also quite forbidding, however, instead of pan Latin American association, three regional groups were formed, such as the Central American Common Market (CACM), the Caribbean Economic Community (CARICOM) and the third bloc appeared as the largest one consisting of all Latin American nations excepting Mexico known as the Latin American Free Trade Association (LAFTA).

The Asia-Pacific Economic Cooperation Forum (APEC) is the biggest economic and trade organization with the largest territorial coverage and high potential scope. While attempting to liberalize the economies of the extensive Pacific basin rapidly, the objective launches to forge free trade throughout the region. APEC started in the beginning with eleven nations of the Pacific Rim, including the US and Canada. The membership expanded to involve more than 20 nations by 1995. As a consequence, the trading share of APEC in the total global trading has been steadily rising, as visible though 1990s onwards. Since the various nations have diverse economic resources and product composition of wide-range quality, intra-bloc trading holds the lion’s share rising tempo. ASEAN is one of very progressive association spinning continued growth and development as a regional bloc. Founded in 1967 with five founding member states of Indonesia, Malaysia, the Philippines, Singapore and Thailand, now the ASEAN boasts of ten-member states in the continuous closet monsoonal climatic regions of SE Asia. After Brunei's joining the group in 1984, Vietnam also joined belatedly by 1995. Following them, Colombia, Lao Republic and Myanmar also joined the group with great cultural unity amidst diversity and some political problems, the organizations steady growth on the path of trading and other economic channels is highly prospective. Investments are not only mutually growing but also widening in scope including manufacturing, telecommunication area and financial services. After taking a ten-year discussion, SAARC (South Asian Association for Regional Cooperation) was founded in 1995. Its seven-member states are Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The organization was set up to reach an agreement on mutual preferential trade, as well as launch a forum for resolving some political, economic and other bi-lateral and multi-lateral issues through proceedings resolved at annual meet of the member states held in different nations by turns. The hangover of problems is simmering between and among the South Asian nations such as river water disputes and now terrorism at high level. India and Pakistan have fought three level wars, Bangladesh, being the eastern wing of Pakistan got separated through a bloody war between the two wings of Pakistan. Sri Lanka has fought the terrorism LTTE group. Pakistan historically harbors distrust with India, the alleged big brother.

Africa, particularly the Sub-Saharan Africa has been on a very low rank in the world trade and economic development level. Africa display as a typical example of weaker and even failed trade and economic cooperation, among its several organizational endeavors. Such failures are to be visualized in terms of several mutual mistrusts due to historical and political reasons. Even after decades of decolonization, most dominating trading partners are each nation ex-colonial powers. As a result, inter-African trade links or even bi-lateral trade among African nations is highly underdeveloped and even discouraged, because of several reasons. One of the earliest establishments of the East African Economic Community as a custom union with common currency among Kenya, Uganda and Tanzania. The three states even flew in unified Airline, e.g., East African Airways. The union collapsed due to several political and other troubles in 1977. In North Africa, Arab Maghreb Union was founded with Algeria, Libya, Mauritania, Tunisia and Morocco as its member. The EC was proceeding apace towards path of full European economic and political integration, as many as seven countries, called the 'outer seven' Austria, Denmark, Norway, Portugal, Sweden, Switzerland and UK established their own free trade area and termed it the European Free Trade Association (EFTA) on Jan 4, 1960. Their aim was to facilitate in future to set up wider multinational association for abolition of custom barriers. Finland and Iceland also joined later. The free trade was confined only to the industrial goods. The member countries were free to set up their own growth partnership. However, little progress was made.

Several Global multilateral organizations emerged during the last seven decades. The UNO and its several organs like the FAO, IDO, WHO, UNDP and others; three Bretton woods institution (IBRD or World Bank, IMF, GATT) and regional development banks like the inter-American Development Bank (IADB), Asian Development Bank, African Development Bank, etc came later in 1964 and WTO replaced GATT in 1995. The Second World War erupted in 1939 when the world has been struck by the Great Depression of the 1930s. The two had together disrupted the world economy and trade, peace, security and development. An international meet of 44 nation states, majority from the industrial world was organized at Bretton woods, New Hampshire, USA in 1944 with a view to overseeing reforming the world economic, financial and trade regulations in the Post-War II period. Three institutions known as Bretton woods institution came into existence.

The International Monetary Fund (IMF), for the convertibility of currencies and financial orders.

The International Bank for Reconstruction and Development (IBRD), popularly known as the world Bank, and General Agreement on Tariffs and Trade (GATT)

Another international meeting was held by 54 nations at Haryana, Cuba in winter 1947-48, and drafted a charter for International Trade Organization (ITO). However, ITO failed ratification by the US Congress as it was perceived to pose a threat to the sovereignty of the nation-states. As such the GATT Agreement Charter was set at Geneva in 1947, and took effect in 1948. Geneva became its headquarters. It gathered strength over time and registered over hundred nation-states as its members. The GATT's main task among others was to pursue measures of reduction of tariffs on about 45,000 items entering the world trade and set rules in this respect. It met quite some success in this area.

Marrakesh Agreement on January 1, 1995 established the WTO, ratified on Jan 4, 1995, replacing GATT. WTO (World Trade Organization) was empowered with its authority over member states (145 including China) to execute its resolution. In case of trade disputes, members are obliged to accept third party arbitration. In case of its failure, countries face trade sanction. Thus, states have to shed off some aspect of their sovereignty and curtailment of their traditional powers to control flow of goods and resources across their borders. UNCTAD (UN Conference on Trade and Development) was enacted by the UN General Assembly in 1964 as a permanent inter-government organization with the particular objective of monitoring, researching and suggesting measures to help the special problems faced by the South in international trade, and economic development areas. GATT had granted the South through its Article 18 the right to use trade restriction in case of balance of payment problem. But the provisions proved to be weak and ineffective. The South pressed its demand to the UN for such a body to look after their trade and development related special problems and weaknesses. UNCTAD provides for an intergovernmental consensus-building for trade and development, carries out policy and research analysis and technical cooperation in international trade, investment, globalization and development. UNCTAD monitor the implementation of the UN Program of Action for the LDCs; analyses the effects of major international initiatives for them and assists them in understanding the key issues in multilateral trade negotiations. It has arranged three UN Conferences on the LDCs.

14.7 TRADE STRATEGIES

A trading strategy outlines the specifications for making trades, including rules for trade entries, trade exits, and money management. When properly researched and executed, a trading strategy can provide a mathematical expectation for the specified rules, which helps trades and investors determine if a trading idea is potentially profitable. Investors should generally consider using a systemized trading strategy, but be aware of its many limitations. Trading strategies aren't a guarantee for success, but they may be effective in increasing risk-adjusted returns.

Import substitution: Import substitution refers to the use of domestic products to replace imported goods, or, by limiting the import of industrial manufactured goods to promote domestic industrialization. Import substitution policy refers to a country to adopt various measures to restrict the import of certain foreign industrial products, promote domestic industrial products production, gradually in the domestic market to replace imported goods, to create favorable conditions for the domestic industrial development, realize industrialization. Also known as import substitution industrialization policy, is the product of the inward oriented economic development strategy. The general practice is countries by giving preferential treatment of Taxation, investment and sales, encourage foreign private capital to set up a joint venture or cooperation of enterprises in the domestic; or through the supplied materials and assembling with supplied parts, such as processing trade, to improve industrialization level. In order to make the domestic alternative industry development, we must use the means of raising tariffs, the number of restrictions, foreign exchange control and other means, to limit the import of foreign industrial products, so that the domestic import competition in the industry in less competitive and non-competitive conditions. The import substitution policy is to reduce or eliminate the import of this kind of commodity, and the policy of the domestic producers. The import substitution in the narrow sense is limited to the production of the domestic products, the import of a particular product. But in a broad sense, an area of import substitution, which aims to reduce or prohibit the import of certain products, cause the desired changes in the domestic economic structure, or create the driving force of investment in the domestic nontraditional fields, so that the resources have the opportunity to enter into this new industrial sector, resulting in the production and expansion of production activities, so that the overall economic structure has been improved. The implementation of import substitution in a certain extent stimulated the development of consumer goods industry in the national industry, strengthened the ability of developing countries to develop independently.

Export promotion: Export promotion is a trade and economic policy aiming to speed up the industrialization process of a country by exporting goods for which the nation has a comparative advantage. Export-led growth implies opening domestic markets to foreign competition in exchange for market access in other countries. Export-led growth is an economic strategy used by some developing countries. This strategy seeks to find a niche in the world economy for a certain type of export. Industries producing this export may receive governmental subsidies and better access to the local markets. By implementing this strategy, countries hope to gain enough hard currency to import commodities manufactured more cheaply somewhere else. In addition, a recent mathematical study shows that export-led growth is where wage growth is repressed and linked to the productivity growth of non-tradable goods in a country with under-valued currency. In such a country, the productivity growth of export goods is greater than the proportional wage growth and the productivity growth of non-tradable goods. Thus, export price decreases in the export-led growth country and makes it more competitive in international trade. Export promotion is important for mainly two reasons. The first is that export promotion can create profit, allowing a country to balance their finances, as well as surpass their debts as long as the facilities and materials for the export exist. The second, much more debatable reason is that increased export growth can trigger greater productivity, thus creating more exports in an upward spiral cycle.

CONSTRAINS OF DEVELOPING COUNTRIES IN TRADE

Developing countries face multiple constrains of internal and external origin in achieving success in global trade. While internal reasons constrain their supply side, external system constrain both their supply side as well as demand-side. Many developing countries are not able to attune their export structure to rapidly changing global market demand patterns. They continue to suffer from their rigid production structure. As a consequence, their exports are concentrated in much less diversified narrow-range of some primary commodities and partially processed, low-tech low value, labor-intensive manufactured products.

1. **High concentration index and low diversification and specialization:** More than 90-95% of export portfolio of developed economies consist of more than 200 diversified and specialized products. In contrast, less than one tenth of developing economies enjoy such status. Many developing economies and most LDCs still concentrate in one, two or three primary export commodities, consisting of crudely processed or unprocessed low value agricultural or mineral commodities. In general, higher share in a country's export of fewer items shows higher concentration.

2. **Term of trade, trade gap and trade imbalance and BOP problem:** These three problems are closely interrelated and continuing patterns, associated with price volatilities for commodities in world markets. Terms-of-trade are defined as unit values of export products divided by unit values of import items. The result is multiplied by 100 to express the terms in index form. The index 100 denotes the mean value of a nation's exports being equal to the mean value of its imports. An index lower than 100 means that import value is higher than that received from forex. This situation means there is an unfavorable or unbalanced term of trade. It is also termed as trade gap. Balance of trade refers to the trade balance in terms of visible tradables, e.g. exports-imports. In contrast, BOP problem relates to both the visible as well as invisible tradable. If BOP continue over years, it means that the country is not able to make full payments of its imports with its export earnings, or from its reserve funds in hard currency. Under the situation, it has to depend on foreign aid, donation, or undergo international debt. Thus, a developing country invariably experiences a two-gap development problem from lack

of capital and self-financing capacity for its imports which are essential for the process of economic development.

Oversupply of primary commodity exports: Several developing economies continue to oversupply primary commodities in limited export markets, individually or collectively. Such oversupply creates a market glut in export markets with identical items, which means their declining prices, which means their declining price. As a result, the market faces the serious problems of the fallacy of composition arising from the simultaneous expansion of export volume of the same commodities by a number of countries. The share of agriculture and primary commodities to the value of the world trade has experience a steady decline. Naturally, exports of the similar products by a number of countries in a shrinking market will put them as losers.

Problem of rapid structural change in production as well as export change: Developing economies basically require rapid structural change in production which could lead them towards modernization of agricultural, and improved industrialization. Industry enjoy some basic advantages being factory based and more organized. Their production can be controlled or expanded as per demand, and thus market prices can be more adaptively and quickly managed.

14.8 CONCLUSION

Trade may be understood, in its widest sense, as the reciprocal traffic of materials or goods directed by human agency from one place to another. It can also be defined as mercantile employment carried out as a means of livelihood or profit. The activity to satisfy human wants account for an extensive system of exchange between the inhabitants of different places. The monetary system enabled trade to develop into a specialized social activity. Production and consumption are the two main activities of man. Both these activities depend upon their sphere of circulation. This process is carried out by the merchant community. The exchange of goods led to regional contacts which in turn led to mutual and cultural dissemination.

International trade forms an integral part of the world economic growth. It spins great sources and opportunities for wealth creation and jobs for millions of people around the world. It lubricates and structure interlinks the various sectors of economy and regional frameworks within a country. As a country participates in the global trading system, it gets related to a much larger and variegated markets for its exports as well as sources of imports of input, resources and capital goods for its further growth.

14.9 SUMMARY

Today trade is a subset a complex system of companies which try to maximize their profits by offering products and services to the market (which consists both of individuals and other companies) at the lowest production cost. A system of international trade has helped to develop the world economy but, in combination with bilateral or multilateral agreements to lower tariffs or to achieve free trade, has sometimes harmed third-world markets for local products.

14.10 GLOSSARY

1. Trade: Trade is the activity of buying, selling, or exchanging goods or services between people, firms, or countries.... When people, firms, or countries trade, they buy, sell, or exchange goods or services between themselves.

2. Developed Countries: Developed country, industrialized country, more developed country, or more economically developed country, is a sovereign state that has a developed economy and advanced technological infrastructure relative to other less industrialized nations.

3. Developing Countries: A developing country (or a low and middle income country (LMIC), less developed country, less economically developed country (LEDC), or underdeveloped country) is a country with a less developed industrial base and a low Human Development Index (HDI) relative to other countries.

4. Export: An export in international trade is a good or service produced in one country that is bought by someone in another country. The seller of such goods and services is an exporter; the foreign buyer is an importer. Export of goods often requires involvement of customs authorities.

5. Import: An import is a good brought into a jurisdiction, especially across a national border, from an external source. The party bringing in the good is called an importer. An import in the receiving country is an export from the sending country.

6. Merchandise Trade: The Merchandise Trade Balance is the difference in value between imported and exported goods.

7. Commercial Service Trade: Commercial service means a service which is provided in exchange for income. Users/customers of the service may be institutional staff or students, the public or external organizations. It does not cover consultancy services which are covered by Consultancy.

8. Trade Imbalance: The balance of trade, commercial balance, or net exports, is the difference between the monetary value of a nation's exports and imports over a certain period. Sometimes a distinction is made between a balance of trade for goods versus one for services.

9. Trade Gap: A trade deficit is an economic measure of international trade in which a country's imports exceed its exports. A trade deficit represents an outflow of domestic currency to foreign markets. It is also referred to as a negative balance of trade (BOT). Trade Deficit = Total Value of Imports – Total Value of Exports.

10. Trade Agreements: A trade agreement (also known as trade pact) is a wide-ranging taxes, tariff and trade treaty that often includes investment guarantees. When two or more countries agree on terms that helps them trade with each other.

14.11 ANSWER TO CHECK YOUR PROGRESS

1. What do you understand by Trade? Explain its types with suitable examples.
2. Elaborate various trade agreements in world.

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14.14 TERMINAL QUESTIONS

1. Explain imports and Export in Developed and developing countries.
2. What are the benefits of trade, explain?
3. Describe trends and patterns of trade at world level, with data.

UNIT 15 - INTERNATIONAL TRADE: RICARDIAN THEORY, INTERNATIONAL TRADE WITH REFERENCE TO GATT AND WTO

15.1 OBJECTIVES

After reading this unit you will be able to understand the meaning and significance of International trade and Ricardian theory. The meaning of the word trade is often taken as buy-sell. Generally, the exchange of goods between individuals is given the noun of trade. In a specific sense, trade involves all those economic activities that relate to the production of the commodity to the consumer of the commodity, because distribution is done because consumers demand these goods. According to the Dictionary of Commerce, the sale and purchase of goods in the ordinary sense is trade. In a broader sense, trade involves all human economic activities that help in the exchange of goods or services in exchange for value. Definition of the word Business - According to Dr. N.K. Mishra, the word 'trade' refers to all those actions which are related to the production and distribution of goods and services, which are free and voluntary exchange between different persons from one place to another. It is, therefore, clear that trade refers to the purchase and sale of goods. The purchase and sale of goods is done with the aim of making profit, the person who performs these activities is called the business of those traders and their actions.

15.2 INTRODUCTION

- International trade is the exchange of capital, goods, and services across international borders or territories.
- Each nation should produce goods for which its domestic opportunity costs are lower than the domestic opportunity costs of other nations and exchange those goods for products that have higher domestic opportunity costs compared to other nations.
- Benefits of trade include lower prices and better products for consumers, improved political ties among nations, and efficiency gains for domestic producers.

Key Terms:

- Comparative advantage: The ability of a party to produce a particular good or service at a lower marginal and opportunity cost over another.

International trade is the exchange of capital, goods, and services across international borders or territories. Trading-partners reap mutual gains when each nation specializes in goods for which it holds a comparative advantage and then engages in trade for other products. In other words, each nation should produce goods for which its domestic opportunity costs are lower than the domestic opportunity costs of other nations and exchange those goods for products that have higher domestic opportunity costs compared to other nations.

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15.3 MEANING OF INTERNATIONAL TRADE

Since no country is self-sufficient for its goods, it has to fulfill its demands by trade from other countries. Knowledge of the economic situation of a country can only come from its business. It has been rightly said that "International trade is an economic barometer by which the standard of living of that country can be ascertained, but in countries where the population is dense, the value of trade per capita compared to those countries It is less where the population is less, so many times international trade does not determine the true economic level, but it is definitely known that a country is said to be compared to other countries. Goods (banana, tea, jute, rubber, spices, etc.) are obtained from countries that do not produce them on their own. Apart from this, the achievement of these items continues throughout the year without any hindrance. Consumers have the choice of choosing the items of their choice. For example, France is famous in the world for its ready-to-wear costumes, in Italy typewriters, in the production of its fashion and beauty products. Due to specialization, different types of goods are available at reasonable prices for different countries. Machine tools, sewing machines, fans, agricultural machinery and diesel pumps are sent from India to African countries. Information is expanded through international trade, social and cultural relations are increased in different countries. It is through this that economic and commercial development of a country takes place and as a result the standard of living of its inhabitants rises.

15.4 SIGNIFICANCE OF INTERNATIONAL TRADE

International trade between different countries is an important factor in raising living standards, providing employment and enabling consumers to enjoy a greater variety of goods.

International trade has occurred since the earliest civilizations began trading, but in recent years international trade has become increasingly important with a larger share of GDP devoted to exports and imports.

1. Make use of abundant raw materials: Some countries are naturally abundant in raw materials – oil (Qatar), metals, fish (Iceland), Congo (diamonds) Butter (New Zealand). Without trade, these countries would not benefit from the natural endowments of raw materials.

A theoretical model for this was developed by Eli Heckscher and Bertil Ohlin. Known as the Heckscher–Ohlin model (H–O model) it states countries will specialise in producing and exports goods which use abundant local factor endowments. Countries will import those goods, where resources are scarce.

2. Comparative advantage: The theory of comparative advantage states that countries should specialise in those goods where they have a relatively lower opportunity cost. Even if one country can produce two goods at a lower absolute cost – doesn't mean they should produce everything. India, with lower labour costs, may have a comparative advantage in labour-intensive production (e.g. call centres, clothing manufacture). Therefore, it would be efficient for India to export these services and goods. While an economy like the UK may have a comparative advantage in education and video game production. Trade allows countries to specialise. More details on how comparative advantage can increase economic welfare. The theory of comparative advantage has limitations, but it explains at least some aspects of international trade.

3. Greater choice for consumers: New trade theory places less emphasis on comparative advantage and relative input costs. New trade theory states that in the real world, a driving factor behind the trade is giving consumers greater choice of differentiated products. We import BMW cars from Germany, not because they are the cheapest but because of the quality and brand image. Regarding music and film, trade enables the widest choice of music and film to appeal to different tastes. When the Beatles went on tour to the US in the 1960s, it was exporting British music – relative labor costs were unimportant.

Perhaps the best example is with goods like clothing. Some clothing (eg value clothes from Primark – price is very important and they are likely to be imported from low-labor cost countries like Bangladesh. However, we also import fashion labels Gucci (Italy) Chanel (France). Here consumers are benefitting from choice, rather than the lowest price. Economists argue that international trade often fits the model of monopolistic competition. In this model, the important aspect is brand differentiation. For many goods, we want to buy goods with strong brands and reputations. e.g., popularity of Coca-Cola, Nike, Addidas, McDonalds etc

4. Specialisation and economies of scale – greater efficiency: Another aspect of new trade theory is that it doesn't really matter what countries specialise in, the important thing is to pursue specialisation and this enables companies to benefit from economies of scale which outweigh most other factors. Sometimes, countries may specialise in particular industries for no over-riding reason – it may just be a historical accident. But, that specialisation enables improved efficiency. For high value-added products, multinationals often split the production process into a global production system. For example, Apple designs their computers in the US but contract the production to Asian factories. Trade enables a product to have multiple country sources. With car production, the productive process is often even more global with engines, tyres, design and marketing all potentially coming from different countries.

5. Service sector trade: Trade tends to conjure images of physical goods import bananas, export cars. But, increasingly the service sector economy means more trade is of invisibles – services, such as insurance, IT services and banking. Even in making this website, I sometimes outsource IT services to developers in other countries. It may be for jobs as small as $50. Furthermore, I may export a revision guide for £7.49 to countries all around the world. A global economy with modern communications enables many micro trades, which wouldn't have been as possible in a pre-internet age.

6. Global growth and economic development: International trade has been an important factor in promopting economic growth. This growth has led to a reduction in absolute poverty levels – especially in south east Asia which has seen high rates of growth since the 1980s.

15.5 RICARDIAN THEORY: BALANCE OF PAYMENT, WTO, GTT

Introduction: The Ricardian Model of Trade is developed by English political economist David Ricardo in his magnum opus On the Principles of Political Economy and Taxation(1817). It is the first formal model of international trade. Before Ricardo, the benefit of has already been propounded by Adam Smith. Ricardo strengthens the case for free trade by giving it a theoretical framework based on the logic of comparative advantage. This concept is of such historical importance in the field of economics that when Nobel laureate Paul Samuelson was once questioned by a self-important mathematician to "name one proposition in all of the social sciences which is both true and non-trivial, he responded confidently, "comparative advantage."

The Ricardian Model:

Like all other economic theories, the Ricardian Model makes a number of basic assumptions to construct an imaginary world.

1. There are only 2 countries.
2. They produce 2 goods.
3. Production requires only 1 input, labor, which is limited in amount in both countries and is perfectly immobile (i.e. strict border control).
4. Opportunity cost between the goods is constant in each country. (Graphically, the production possibility frontier is a straight line.)
5. There is neither transaction cost nor transportation cost.

By definition, a country has absolute advantage over the other if it is more efficient at producing both goods than the other country. A country has comparative advantage in producing a certain good if the opportunity cost of producing that good is lower than in the other country. Ricardo observes that an absolute advantage does not necessarily imply a comparative advantage. As long as the relative cost of production is different in the 2 countries, comparative advantage exists.

Under autarky condition (no trade), each of the two countries produces some combination of the 2 goods. Once trade becomes possible, they are motivated to specialize fully in the production of the good in which they have a comparative advantage, thus allocating their scarce resources (labor) to its most productive uses. In the aggregate, people in both countries end up consuming more of both goods than they did in the absence of trade. Since more consumption means greater satisfaction (using economic jargon, equilibrium shifts to a higher indifference curve), trade allow both countries to improve their welfare. The Ricardian Model concludes therefore that international trade benefits all participants.

Limitations of the Model: The model is limited in several ways: 1. Having only 1 factor of production is way too simplistic a view of manufacturing. 2. In real world, almost no country produces only the goods in which they have a comparative advantage. 3. Opportunity costs between goods are unlikely to be constant, but should rather be increasing. 4. Most significantly, the model does not explain the source of comparative advantage: why can some countries produce some goods more cheaply than other countries?[3]

In addressing these problems, scholars of international trade after Ricardo would make adjustments on his model to come up with better models, the most notable being the Heckscher-Ohlin Model), which allows multiple factors of production and explains the source of comparative advantage by relative abundance of resources.

World Trade Organization) 1. INTRODUCTION The GATT discussions of the Uruguay Round ended in Marrakesh (Morocco) on 15 April 1994. In addition to the European Union countries, ministers from 123 countries signed the final act which included the eighth round of multilateral trade consultations. The final act is the FOO WTO agreement, which includes the birth of this institution and the rules of its functioning, and (2) ministerial decisions and announcements, including important agreements, trade in goods, services and intellectual property and plurilateral trade. It also includes rules for dispute settlement and review of business policy. In fact, the WTO Agreement is the Uruguay Agreement, through which the initial GAT is now a part of the WTO Agreement which came into force from 1 January 1995. 2.World TRADE ORGANIZATION is the successor of wro gait. GATT was a forum where member countries would gather from time to time and discuss and solve problems of world trade. But the WTO is a well organized and sustainable world trading institution. It has a legal status and occupies the same position as the World Bank and the International Monetary Fund. This includes (1) the GAT amended by the Uruguay Round, (2) all agreements and arrangements accepted under the GAT, and (3) the overall results of the Uruguay Round. As of January 1, 1995, the WTO had 77 members, whose number increased to 134 by August 1999. India is one of the founding countries. 3. Difference between GAT and World Trade Organization (DIFFERENCE BETWEEN GATT AND WTO) WTO GAT is not an extension, but its successor. He has completely replaced the gait and has a different look. The two have the following differences: 1. Gat had no legal status. WTO has legal status. It is born under an international treaty, which has been ratified by the governments and legislatures of the member countries. It has the same world status as the IMF and the World Bank. But on the contrary it is not a branch of the UN, although it has a 'cooperative relationship with the UN'. 2. GATT was a set of rules and systems regarding only a few selective multilateral agreements. There were separate agreements on different subjects which were not binding on the members. Any member could refuse to join any agreement. Only members who signed an agreement could be punished for not following it. But the agreements that have become part of the WTO are permanent and binding on all members. If a member does not follow the rules, all other member countries can take action against him.The Get Quarrel Settlement System was defiant and did not bind the members related to the quarrel. The WTO Quarrel Settlement System is automated, expeditious and fully applicable to members. The WTO's Dispute Settlement Board forced the powerful US to accept it by its first decision. Thus, the WTO is powerful, while Gat was extremely powerless. 4. GATT was a forum on which member countries met only once in a decade to consider and solve world trade problems. Long and long-term disputes resulted in several decades. On the other hand, the WTO is a well-established, regulated WTO where decisions on agreements are time bound. The date period can only be extended by the unanimous vote of the members. 5. Gat's rules were applicable only to the trade of goods. Trade in services was also included in the Uruguay era, but there was no agreement on it. The trade of goods and services not only comes under the WTO, but also the subject of trade in intellectual property rights and many more agreements. 6. Gat had a small office which was looked after by a director general. The WTO has a large office and vast staffing system. 10 4. STRUCTURE The structure or organization of the WTO is governed by a ministerial conference consisting of representatives of all members who meet at least once in two years. It runs the entire functionality of the WTO and takes necessary steps accordingly. It takes decisions on all matters under any multilateral agreement. The Ministerial Conference is the apex authority committee of the WTO. The General Council with representatives from all members regularly monitors the functioning of the WTO and the ministerial decisions. It also serves as the Dispute Settlement Body and the Trade - Policy Review Body, which has its own chairman. The General Council generates an average per month in Geneva. These institutions are also under the general council - Council for Trade in Goods, Council for Trade in Services, Council for Trade Related Subjects of Intellectual Property Rights (Council for Trade Related Aspects of Intellectual Property Rights - TRIPS) These councils have their own subsidiaries. These councils and their subsidiaries holdtheir own meetings as per their requirements. Then there is the Committee on Trade and Development, the Committee on Balance of Payments - Balance, and the

Committee on Budget, Finance and Administration that cite the work provided by the WTO Agreement, the Multilateral Trade Agreement, and the General Council. The WTO is the Director General at the top of the Secretariat. The Ministerial Conference selects the Director General and determines his powers, duties, terms of service and terms of office. The term of a Director General is 4 years with 4 assistants selected from different countries. The Director General appoints office personnel and determines their functions and rules of service, which are within the regulations set by the Ministerial Conference. The Director General gives the Budget, Finance and Administration Committee estimates and financial statements of the annual budget and recommends the final approval of the General Council. The General Council passes the annual budget estimates and financial statements by a two-thirds majority, comprising more than half of the WTO members. The ratio of contribution and the financial regulation of the budget are based on the rules and conventions of the GAT. The WTO follows a unanimous decision method, which was determined by Gatte 1947. When unanimously decided If not possible, then the question under consideration is resolved by a 2/3 majority on the basis of "one country one vote". But in the case of differences in interpretation of agreements and relaxation of obligations of a member, the majority of the members is 3/4. However general rules amendments such as MFN behavior can only be done with the consent of the members. The following objectives are described in the Preamble to the INTO Placement Agreement: Improvement in standard of living by the steady increase in real income and effective demand and the General Agreement on Trade in Production of Goods and Services and Services (GATS).

15.6 CONCLUSION

Under the international trade chapter, geographers first study from the economic point of view, looking at the possibilities of import and export of any commodity, sending its purchase and sale as a basis from one country to another or to states. Pricing by this depends on the mode of transport. The type of transport that will take place, there will be a difference in the price of the item at each location. We know this type of policy by trade name. That is, the sale or purchase of any item is trade. Most of the trade related tasks are done under the United Nations. This trade takes place up to the local regional international level in which local regional trade is government and international trade under the suzerainty of the central government. WTO has some degree of dominance in it as soon as it is international; it acts as a link between the trade from abroad to the international level. There are also some components of this trade, eg, physical component, economic component, population volume, transportation, national Income, national policy, interest, trade, agreements, terms of trade, trade factions, trade conventions, etc. Business cannot be balanced by any of these factors, so we can say that without international or national or without balancing regional trade, no nation can take this trade very far, it needs some kind of cooperation, and mutual harm is necessary in this process. That is the process for every national and international trade forward. Thrive and cooperate.

15.7 SUMMARY

The importing and exporting of goods is big business in today's global economy. When goods are produced in one country and sold in another, international trade occurs. It is so common to find items produced worldwide that people rarely even think about it. Not too long ago, countries consumed goods predominately produced within their borders. As transportation has become increasingly less expensive and telecommunications have improved, international trade has flourished.

In general, international trade allows countries to focus on the industries in which they can be most productive and efficient. In this way, trade often raises the standard of living of both producers and consumers. International trade also has a dark side.

This Spark Note will address many of the questions about international trade that are probably looming in your mind. Why should countries trade? How does trade work? What is the effect of international trade? How do exchange rates affect trade? Can the government interfere in free trade? What is the trade deficit?

The benefits and pitfalls of trade affect the economy at its core. Everything from output to standard of living to interest rates remains under the partial control of international trade. By understanding international trade, we will uncover one of the most important real life applications of macroeconomics.

15.8 GLOSSARY

- Telecommunication : The barnch of technology concerned wth telecommunica
- Macroeconomics : The branch of economics concened with large-scale or gene retes and national productivity.
- Trade : The action of buying and selling goods and services.
- Significance : The importance or meaning of something.

- Consumer : A person who buys things or uses services.

15.9 ANSWER TO CHECK YOUR PROGRESS

Q1. Explain the Internationl Trade?

Ans. International trade is the exchange of capital, goods, and services across internat because there is a need or want of goods or services. In most countries, such trade repre gross domestic product.

Q2.What is International trade and its importance?

Ans. International trade allows countries to exchange good and services with the use exchange. The benefits of international trade have been the major drivers of growth f century. So, it has a very important role for countries and their economy and industry.

Q3.What is the types of International trade?

Ans. There are three types of international trade: Export Trade, Import Trade and Entrepot Trade

Q4.What is the basis of International trade?

Ans .Basis of International Trade. A country specializes in a specific commodity due to mobility, productivity and other endowments of economic resources. This stimulates a country to go for international trade. The basis of international trade lies in the diversity of economic resources in different countries.

15.10 REFERENCES

1. Mamoriya, Chaturbhuj and Joshi, Ratan, Economic Geography.

2. Sharma, Bhajanlal Rajkumar, Economic Geography.

15.11 SUGGESTED READINGS

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15.12 TERMINAL QUESTIONS

Q1. Give a detailed description of international trade?

Ans. International trade is the exchange of capital, goods, and services across international borders or territories because there is a need or want of goods or services.

In most countries, such trade represents a significant share of gross domestic product (GDP). While international trade has existed throughout history (for example Uttarapatha, Silk Road, Amber Road, scramble for Africa, Atlantic slave trade, salt roads), its economic, social, and political importance has been on the rise in recent centuries.

Carrying out trade at an international level is a complex process when compared to domestic trade. When trade takes place between two or more nations factors like currency, government policies, economy, judicial system, laws, and markets influence trade.

To smoothen and justify the process of trade between countries of different economic standing, some international economic organisations were formed, such as the World Trade Organization. These organisations work towards the facilitation and growth of international trade. Statistical services of intergovernmental and supranational organisations and national statistical agencies publish official statistics on international trade.

Q2. Explain the purpose of WTO. What is the WTO.

Ans.After the economic slowdown of 1930, efforts were made in developed and developing countries to remove the recession that had come in the trade. As a result, after 1939, trade-related controls and restrictions were imposed in many countries. The International Trade Organization was established in 1940, but it was not successful in its work due to many restrictions, tariff policies and unfavorable terms of trade. On the basis of the experience of the Second World War, many treaties were made under statutory controls and agreements between many countries, according to which many countries now form a group for trade. They joined and started forming groups. The main examples of this are European Common Market, European Independent Trade Association, Council for Mutual Economic Cooperation, Latin America Free Trade Association, Association of Southeast Asian Nations, Organization of Petroleum Exporting Countries, etc. In addition to this, there are several agencies under the United Nations - General Agreement on Tariffs and Trade (GATT), United Nations Conference on Trade and Development and General System of Partisan Policy. The World Trade Organization (WORLD TRADE ORGANISATION - WTO) 'World Trade Organization' has been established since January 1, 1995 with the aim of regulating world trade. Earlier this work was done by 'GATT' (GATT), but World Trade Organization has been established as a more power-efficient organization than GATT. Pascal Lamy (France) is its Director General and is headquartered in Geneva. The World Trade Organization (WTO) implements 28 agreements related to international trade relations through various councils and committees that have been included in the Uruguay Round of negotiations and were passed in 1994 in Makish in Morocco. At the same time, this organization also implements several multilateral agreements which are mainly about the purchase of civil aircraft. The organization is also broader than 'GATT' and provides the institutional and legal basis for a multilateral trading system.

Objectives of the World Trade Organization The objectives of the World Trade Organization are as follows:

* To promote the production and trade of goods and services.
* Effective and comprehensive and effective increase in employment. * Optimum utilization of world resources. Accepting the concept of sustainable development.
* To raise the standard of living.
* Protection and protection of environment.

The major tasks of the World Trade Organization (WTO) are:

* Implementation of multilateral trade agreements included in the World Trade Organization agreements.
* To provide a platform for multilateral trade negotiations between its member countries.

★ Helping Member States to resolve trade related disputes.

* To monitor the national trade policies of its member countries.
* To cooperate with other international organizations related to the determination of international economic policy.
* Optimum utilization of world resources.

The WTO has a General Council for the conduct of business in which each member nation has a permanent representative. It usually meets once a month in Geneva.

Its 'Ministerial Conference', which has the highest authority for policy making, is held every two years. The highest functionary of the organization is the Director General to carry out day-to-day administrative tasks. The Director General is elected by the General Council for four years. At present its number of members has reached 155. In November - December 1999, the World Trade Organization Ministerial Meeting was held in Seattle. The meeting became a deadlock over the process of liberalization of trade in developed and developing countries. India, along with some other countries, strongly opposed the effort of the United States, under which a working group was formed on trade and partners. The WTO has one conference every two years. Commerce or trade ministers of member countries participate in it. The first conference was held in Singapore, the second conference in Geneva in May 1999, the third conference in Seattle from 30 November to 3 December 1999, the fourth conference in Doha (Qatar) on 9–13 November 2001, and the fifth conference on 10–14 September. Done in Cancun (Mexico). The fifth conference failed due to heavy differences between developed and developing countries. Disputed matters such as agriculture and Singapore issues could not be reached in developed and developing countries. Differences between developed and developing countries also emerged at the Doha Ministerial Conference. But the conference eventually took important decisions regarding the TRIPS Agreement, Public Health Intellectual Property Rights, Antidumping, Anti Subsidies and Resistant Arid Agreements. The eighth conference was held on 30 November - 2 December 2009 in Geneva (Switzerland). On 1 February 2009, The Dispute Settlement Body was formed to deal with the conflicts of world trade. Its members were representatives from Brazil, China, Italy, Japan, the Philippines, South Africa and the United States.

UNIT 16 - TRANSPORT

16.1 OBJECTIVES

After reading this unit you will be able:

1. To understand the meaning and concept of Transportation.
2. To study the modes of transportation.
3. To study the role of transportation in economic development.

16.2 INTRODUCTION

Movements of people, goods and information have always been fundamental components of human societies. Contemporary economic processes have been accompanied by a significant increase in mobility and higher levels of accessibility. Although this trend can be traced back to the industrial revolution, it significantly accelerated in the second half of the twentieth century as trade was liberalized, economic blocs emerged and the comparative advantages of global labour and resources were used more efficiently. However, these conditions are interdependent with the capacity to manage, support and expand movements of passengers and freight as well as their underlying information flows. Societies have become increasingly dependent on their transport systems to support a wide variety of activities ranging, among others, from commuting, supplying energy needs, to distributing parts between manufacturing facilities and distribution centres. Developing transport systems has been a continuous challenge to satisfy mobility needs, to support economic development and to participate in the global economy.

16.3 MEANING OF TRANSPORT

Transportation is concerned with mobility, particularly how this mobility is taking place in the context of a wide variety of conditions. Mobility is a geographical endeavour since it trades space for a cost. Technological and economic forces have changed this balance many times in the past, but in recent decades a growing amount of space has been made accessible at a similar cost. It is thus not surprising to realize that at the same time that technology permitted improvements in transport speed, capacity and efficiency, individuals and corporations have been able to take advantage of this improved mobility. A driving force of the global economy resides in the capacity of transport systems to ship large quantities of freight and to accommodate vast numbers of passengers. The world has become interconnected at several scales. This new geographical dimension transcends a more traditional perspective of transportation mainly focused on the city or the nation. At the beginning of the twenty-first century, the geography of transportation is thus fundamentally being redefined by global, regional and local issues.

The ideal transport mode would be instantaneous, free, have an unlimited capacity and always be available. It would render space obsolete. This is obviously not the case. Space is a constraint for the construction of transport networks. Transportation appears to be an economic activity different from the others. It trades space with time and thus money.

As the above quotation underlines, the purpose of transportation is to overcome space, which is shaped by a variety of human and physical constraints such as distance, time, administrative divisions and topography. Jointly, they confer a friction to any movement, commonly known as the friction of distance. However, these constraints and the friction they create can only be partially circumscribed. The extent to which this is done has a cost that varies greatly according to factors such as the distance involved and the nature of what is being transported. There would be no transportation without geography and there would be no geography without transportation. The goal of transportation is thus to transform the geographical attributes of freight, people or information, from an origin to a destination, conferring them an added value in the process. The convenience at which this can be done varies considerably.

Transportability, refers to the ease of movement of passengers, freight or information. It is related to transport costs as well as to the attributes of what is being transported (fragility, perishability, price). Political factors can also influence transportability such as laws, regulations, borders and tariffs. When transportability is high, activities are less constrained by distance.

IMPORTANCE OF TRANSPORT

Transport represents one of the most important human activities worldwide. It is an indispensable component of the economy and plays a major role in spatial relations between locations. Transport creates valuable links between regions and economic activities, between people and the rest of the world. Transport is a multidimensional activity whose importance is:

1.Historical: Transport modes have played several different historical roles in the rise of civilizations (Egypt, Rome and China), in the development of societies (creation of social structures) and also in national defence (Roman Empire, American road network).

2.Social: Transport modes facilitate access to healthcare, welfare, and cultural or artistic events, thus performing a social service. They shape social interactions by favouring or inhibiting the mobility of people. Transportation thus supports and may even shape social structures.

3.Political: Governments play a critical role in transport as sources of investment and as regulators. The political role of transportation is undeniable as governments often subsidize the mobility of their populations (highways, public transit, etc.). While most transport demand relates to economic imperatives, many communication corridors have been constructed for political reasons such as national accessibility or job creation. Transport thus has an impact on nation building and national unity, but it is also a political tool.

4.Environmental: Despite the manifest advantages of transport, its environmental consequences are also significant. They include air and water quality, noise level and public health. All decisions relating to transport need to be evaluated taking into account the corresponding environmental costs. Transport is a dominant factor in contemporary environmental issues.

16.4 CONCEPT OF DISTANCE

Distance, a core attribute of transportation, can be represented in a variety of ways, ranging from a simple Euclidean distance – a straight line between two locations – to what can be called logistical distance; a complete set of tasks required to be done so that distance can be overcome. Any movement must thus consider its geographical setting which in turn is linked to spatial flows and their patterns. Three major representations can be used for distance and the friction it imposes on transportation:

1. **Euclidean distance:** A simple function of a straight line between two locations where distance is expressed in geographical units such as kilometers. Commonly used to provide an approximation of distance, but almost never has a practical use.
2. **Transport distance:** A more complex representation where a set of activities related to circulation, such as loading, unloading and transhipment, are considered. Additional elements such as costs and time are also part of the transport distance. For example, the transport distance between locations A and B includes pickup, travel by mode 1, transhipment, travel by mode 2 and finally, delivery. The same applies to the circulation of people, although the activities involved will be different. For instance, someone using air travel between two locations will require going to an airport, may transit through an intermediate hub airport and will finally need to reach his/her destination from the airport terminal. Transport distance is jointly expressed in geographical units, in cost and in time.
3. **Logistical distance:** A complex representation that encompasses all the tasks required so that a movement between two locations can take place. Logistical distance thus includes flows, but also a set of activities necessary for the management of these flows. For freight movements, among the most significant tasks are order processing, packing, sorting and inventory management. Geographical distance units are less relevant in its assessment, but the factors of costs and time are very significant. Time not only involves the delay related to management and circulation, but also how it is used to
service the transport demand, namely the scheduling of pickups and deliveries. For example, the logistical distance between locations A and B, includes an order from B, which is processed, packed and scheduled to be picked up. At the intermediate transhipment location, sorting and warehousing are performed, and finally, at the destination the delivery will be unpacked and used. For the transportation of passengers, logistical distance also concerns a specific array of tasks. Taking again an air travel example, a ticket would first need to be purchased, commonly several weeks in advance. Other common time and cost tasks concern checking in, security checks, boarding and disembarking, and picking up luggage. Thus, a three- hour flight can in reality be a movement planned several weeks in advance and its full realization can take twice as much time if all the related logistical activities are considered.

Any movement must thus consider its geographical setting which in turn is linked to spatial flows and their patterns. The concept of flow has four major components:

Geographical- Each flow has an origin and a destination and consequently a degree of separation. Flows with high degrees of separation tend to be more limited than flows with low degrees of separation.

Physical- Each flow involves specific physical characteristics in terms of possible load units and the conditions in which they can be carried. Flows, depending on the transportation mode, can be atomized (smallest load unit) or massified (moving load units in batches).

Transactional- The realization of each flow has to be negotiated with providers of transport services, such as booking a slot on a container ship or an air travel seat. Commonly, a flow is related to a monetary exchange between provider of transportation and the user.

Distribution- Flows are organized in sequences where the more complex are involving different modes and terminals. Many transport flows are scheduled and routed to minimize costs or maximize efficiency, often through intermediary locations.

Urbanization, multinational corporations, the globalization of trade and the international division of labor are all forces shaping and taking advantage of transportation at different, but often related, scales. Consequently, the fundamental purpose of transport is geographic in nature, because it facilitates movements between different locations. Transport plays a role in the structure and organization of space and territories, which may vary according to the level of development. However, three central concepts to transport systems can be identified:

1. **Transportation nodes:** Transportation primarily links locations, often characterized as nodes. They serve as access points to a distribution system or as transhipment/ intermediary locations within a transport network. This function is mainly serviced by transport terminals where flows originate, end or are being transhipped from one node to the other. Transport geography must consider its places of convergence and transhipment.

2. **Transportation networks:** Considers the spatial structure and organization of transport infrastructures and terminals. Transport geography must include in its investigation the structures (routes and infrastructures) supporting and shaping movements.

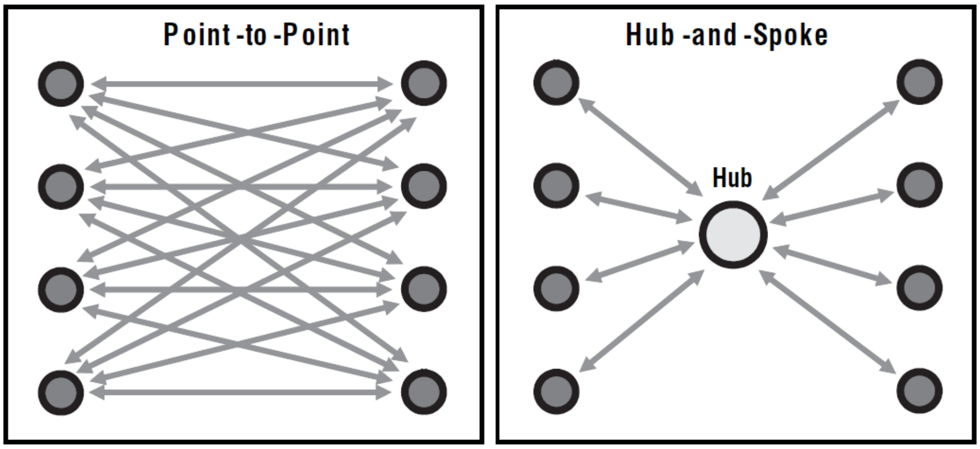

Figure 1: Transportation Network

3. **Transportation demand:** Considers the demand for transport services as well as the modes used to support movements. Once this demand is realized, it becomes an interaction which flows through a transport network. Transport geography must evaluate the factors affecting its derived demand function.

16.5 TRANSPORT NETWORK

Transport networks Transportation systems are commonly represented using networks as an analogy for their structure and flows. Transport networks belong to the wider category of spatial networks because their design and evolution are physically constrained, as opposed to non-spatial networks such as social interactions, corporate organization and biological systems. The term network refers to the framework of routes within a system of locations, identified as nodes. A route is a single link between two nodes that are part of a larger network that can refer to tangible routes such as roads and rails, or less tangible routes such as air and sea corridors.

The territorial structure of any region corresponds to a network of all its economic interactions. The implementation of networks, however, is rarely premeditated but the consequence of continuous improvements as opportunities arise, investments are made and as conditions change. The setting of networks is the outcome of various strategies, such as providing access and mobility to a region, reinforcing a specific trade corridor or technological developments making a specific mode and its network more advantageous over others. A transport network denotes either a permanent track (e.g. roads, rail and canals) or a scheduled service (e.g. airline, public transit, train). It can be extended to cover various types of links between points along which movements can take place.

The recent decades have seen the emergence of transport hubs, a strongly centripetal form, as a privileged network structure for many types of transport services, notably for air transportation. Although hub- and-spoke networks often result in improved network efficiency, they have drawbacks linked with their vulnerability to disruptions and delays at hubs, an outcome of the lack of direct connections. Evidence underlines that the emergence of hub- and-spoke networks is a transitional form of network development rationalizing limited volumes through a limited number of routes. When traffic becomes sufficient, direct point-to-point services tend to be established as they better reflect the preference of users. Hubs, as a network structure, allow a greater flexibility within the transport system, through a concentration of flows. For instance, on Figure 1, a point- to-point network involves 16 independent connections, each to be serviced by vehicles and infrastructures. By using a hub-and-spoke structure, only 8 connections are required. The main advantages of hubs are:

- Economies of scale on connections by offering a high frequency of services. For instance, instead of one service per day between any two pairs in a point- to-point network, four services per day could be possible.
- Economies of scale at the hubs, enabling the potential development of an efficient distribution system since the hubs handle larger quantities of traffic.

Economies of scope in the use of shared transhipment facilities. This can take several dimensions such as lower costs for users as well as higher quality infrastructures. Many transportation services have adapted to include a hub- and-spoke structure. The most common examples involve air passenger and freight services which have developed such a structure at the global, national and regional levels, like those used by parcel carriers such as UPS, FedEx and DHL. However, potential disadvantages may also occur such as additional transhipment as less point- to-point services are offered, which for some connections may involve delays and potential congestion as the hub becomes the major point of transhipment.

Transport networks are better understood by the usage level (e.g. number of passengers, tons, vehicles, capacity) than by their sole topology based on a binary state (i.e. presence or absence of links). Inequalities between locations can often be measured by the quantity of links between nodes and the related revenues generated by traffic flows. Many locations within a network have higher accessibility, which is often related to better opportunities. However, economic integration processes tend to change inequalities between regions, mainly through a reorientation of the structure and flows within transportation networks at the transnational level. The efficiency of a network can be measured through graph theory and network

analysis. These methods rest on the principle that the efficiency of a network depends partially on the layout of nodes and links. Obviously, some network structures have a higher degree of accessibility than others, but careful consideration must be given to the basic relationship between the revenue and costs of specific transport networks. Rates thus tend to be influenced by the structure of transportation networks; the hub- and spoke structure, particularly, has a notable impact on transport costs, namely through economies of scale.
Networks provide a level of transport service which is related to their costs. An optimal network would be a network servicing all possible locations but such a service would have high capital and operational costs. Transport infrastructures are established over discontinuous networks since many were not built at the same time, by the same entity or with the same technology. Therefore, operational networks rarely service all parts of the territory directly. Some compromise must often be found among a set of alternatives considering a variety of route combinations and level of service. Networks are also labelled depending on their overall properties:

Regular network - A network where all nodes have the same number of edges. In the same vein, a random network is a network that is formed by random processes. While regular networks tend to be linked with high levels of spatial organization (e.g. a city grid), random networks tend to be linked with opportunistic development opportunities such as accessing a resource.

Small-world network - A network with dense connections among close neighbours and few but crucial connections among distant neighbours. Such networks are particularly vulnerable to catastrophic failures around large hubs.

Scale-free network - A network having a strong hierarchical dimension, with few vertices having many connections and many vertices having few connections. Such networks evolve through the dynamic of preferential attachment by which new nodes added to the network will primarily connect larger nodes instead of being connected randomly.
There are many criteria that can be used to classify transportation network s (Figure 2). The level of abstraction can be considered with concrete network representations closely matching the reality (such as a road map) while conversely an abstract network would only be a symbolization of the nodes and flows (such as the network of an airline). Since transportation networks have a geographical setting, they can be defined according to their location relative to the main elements of a territory (such as the Rhine delta). Networks also have an orientation and an extent that approximates their geographical coverage or their market area.

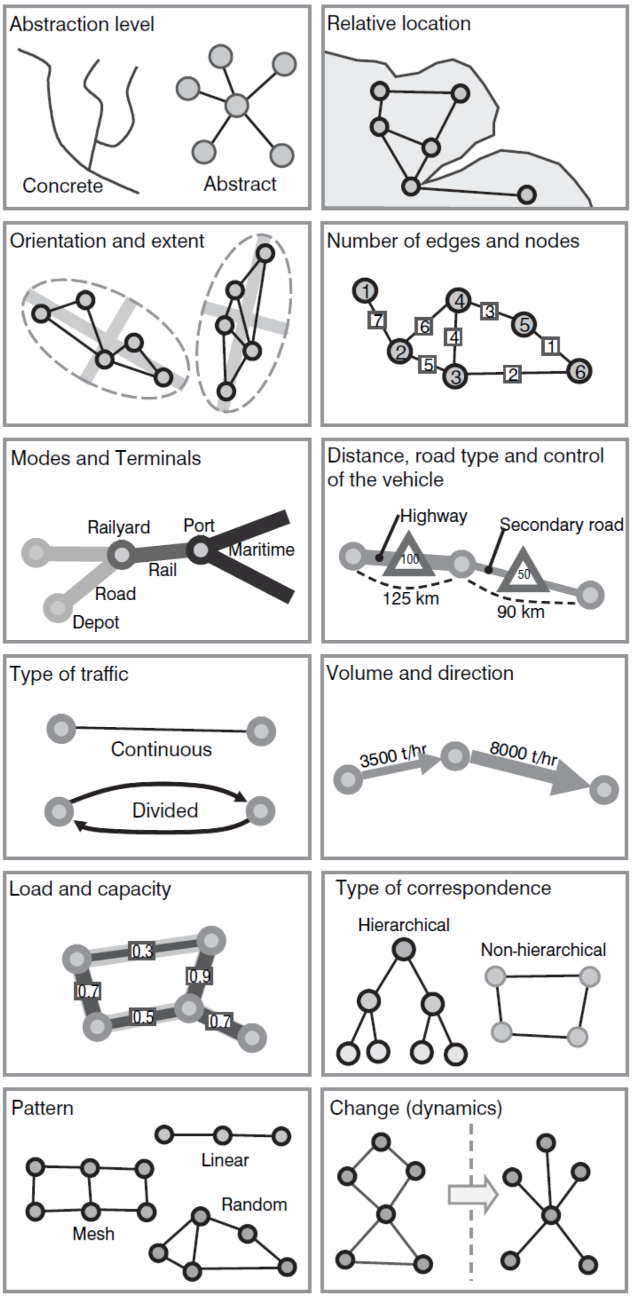

Figure 2: Topology of Transport Network

The numbers of nodes and edges are relevant to express the complexity and structure of transportation networks with a branch of mathematics, graph theory, developed to infer structural properties from these numbers. Since networks are the support of movements they can be considered from a modal perspective, their edges being an abstraction of routes (roads, rail links, maritime routes) and their nodes an abstraction of terminals (ports, railyards). Specific modes can further be classified in terms of types of road (highway, road, street, etc.) and level of control (speed limits, vehicle restrictions, etc.)..

Flows on a network have a volume and a direction, enabling to rank links by their importance and evaluate the general direction of flows (e.g. centripetal or centrifugal).

Each segment and network have a physical capacity related to the volume it can support under normal conditions. The load (or volume to capacity) is the relation between the existing volume and the capacity. The closer it is to a full load (a ratio of 1), the more congested it is. The structure of some networks imposes a hierarchy reflecting the importance of each of its nodes and a pattern reflecting their spatial arrangement. Finally, networks have a dynamic where both their nodes and links can change due to new circumstances

16.6 TRANSPORT COST

Transport costs and rates Transport systems face requirements to increase their capacity and to reduce the costs of movements. All users (e.g. individuals, enterprises, institutions, governments, etc.) have to negotiate or bid for the transfer of goods, people, information and capital because supplies, distribution systems, tariffs, salaries, locations, marketing techniques as well as fuel costs are changing constantly. There are also costs involved in gathering information, negotiating, and enforcing contracts and transactions, which are often referred to as the cost of doing business. Trade involves transaction costs that all agents attempt to reduce since transaction costs account for a growing share of the resources consumed by the economy. Frequently, enterprises and individuals must take decisions about how to route passengers or freight through the transport system. This choice has been considerably expanded in the context of the production of lighter and high value consumer goods, such as electronics, and less bulky production techniques. It is not uncommon for transport costs to account for 10 percent of the total cost of a product. This share also roughly applies to personal mobility where households spend about 10 percent of their income on transportation, including the automobile which has a complex cost structure. Thus, the choice of a transportation mode to route people and freight between origins and destinations becomes important and depends on a number of factors such as the nature of the goods, the available infrastructures, origins and destinations, technology, and particularly their respective distances. Jointly, they define transportation costs.

Transport costs are a monetary measure of what the transport provider must pay to produce transportation services. They come as fixed (infrastructure) and variable (operating) costs, depending on a variety of conditions related to geography, infrastructure, administrative barriers, energy, and on how passengers and freight are carried. Three major components, related to transactions, shipments and the friction of distance, impact on transport costs.

Transport costs have significant impacts on the structure of economic activities as well as on international trade. Empirical evidence underlines that raising transport costs by 10 percent reduces trade volumes by more than 20 percent. In a competitive environment where transportation is a service that can be bid for, transport costs are influenced by the respective rates of transport companies, the portion of the transport costs charged to users. Rates are the price of transportation services paid by their users. They are the negotiated monetary cost of moving a passenger or a unit of freight between a specific origin and destination. Rates are often visible to consumers since transport providers must provide this information to secure transactions. They may not necessarily express the real transport costs. The difference between costs and rates either results in a loss or a profit from the service provider. Considering the components of transport costs previously discussed, rate setting is a complex undertaking subject to constant change. For public transit, rates are often fixed and the result of a political decision where a share of the total costs is subsidized by society. The goal is to provide an affordable mobility to the largest possible segment of the population even if this implies a recurring deficit (public transit systems rarely make any profit). It is thus common for public transit systems to have rates that are lower than costs. For freight transportation and many forms of passenger transportation (e.g. air transportation) rates are subject to competitive pressure. This means that the rate will be adjusted according to the demand and the supply. They either reflect costs directly involved with shipping (cost-of-service) or are determined by the value of the commodity (value-of-service). Since many actors are involved in freight transportation private rates tend to vary, often significantly, but profitability is paramount.

Types of transport costs Mobility tends to be influenced by transport costs. Empirical evidence for passenger vehicle use underlines the relationship between annual vehicle mileage and fuel costs, implying the higher fuel costs are, the lower the mileage. At the international level, doubling of transport costs can reduce trade flows by more than 80 percent. The more affordable mobility is, the more frequent the movements and the more likely they will take place over longer distances. A wide variety of transport costs can be considered.

1. Terminal costs: Costs that are related to loading, transhipment and unloading. Two major terminal costs can be considered: loading and unloading at the origin and destination, which are unavoidable; and intermediate (transhipment) costs that can be avoided.

2. Linehaul costs: Costs that are a function of the distance over which a unit of freight or passenger is carried. Weight is also a cost function when freight is involved. They include labour and fuel and commonly exclude transhipment costs.

3. Capital costs: Costs applying to the physical assets of transportation, mainly infrastructures, terminals and vehicles. They include the purchase or major enhancement of fixed assets, which can often be a one-time event. Since physical assets tend to depreciate over time, capital investments are required on a regular basis for maintenance.

16.7 MODES OF TRANSPORT

1. Transport contributes in Growth of industries whose product requires quick marketing. Perishable articles like fish and green vegetables are carried to various consumers quickly even in distant markets through transport.
2. Transport helps in increase in the demand for goods. Through transport newer customers in newer places can be easily contacted and products can be introduced to them. Today markets have become national or international only because of transport.
3. Transport creates place utility. Geographical and climatic factors force industries to be located in particular places far away from the markets and places where there may not be any demand for the products. Transport bridges the gap between production and consumption centres.
4. Transport creates time utility. Of late transport has started creating the time utility also. It has been made possible by virtue of the improvements in the speed of transport. It helps the product to be distributed in the minimum possible time.
5. Transport helps in stabilization of price. Transport exerts considerable influence upon the stabilization of the prices of several commodities by moving commodities from surplus to deficit areas. This equalizes the supply and demand factor sand makes the price of commodities stable as well as equal.

6. Transport ensures even flow of commodities into the hands of the consumers throughout the period of consumption.
7. Transport enables the consumers to enjoy the benefits of goods not produced locally. This increases the standard of living, an essential factor for further development of marketing and economy.
8. Transport identifies competition, which in turn, reduces pries. Prices are also reduced because of the facilities offered by transport for large-scale production. Advantages op large-scale production is possible only due to transport.
9. Transport increases mobility of labour and capital. It makes people of one place migrate to other places in search of jobs. Even capital, machineries and equipment are imported from foreign countries through transport alone.

The means of transport are classified on the basis of the way, the vehicle, the motive power used and terminals.

LAND TRANSPORT

Land Transport may be classified as Pathways: In remote villages, forest and hilly areas pathways are still an important amongst the different modes of transport. It further be subdivided into Head loads (is also known as human transport. It is used in the hilly areas where even animals cannot reach) and Pack animals (is also known as animal transport. It is used in the backward areas. The animals like horse, pony, donkey, ass, buffaloes, camel, elephant, yak, sheep etc. are used for this purpose.

1. Roadways: Road Transport is one of the most important modes of transport. The history of Road Transport started from ancient civilizations. Gradually it becomes more and more popular means of transport. Road Transport further subdivided into Vehicular Transport (Cars, Trucks, Buses, Lorries, Autorickshaws, Bullock Carts, Tangas, Tumtums, and Hand Carts etc.) and Non-vehicular Transport (Hamals, Animals like Camel, Dogs, Elephant, Horse, Mules etc.)

2. Tramways: Tramway is one of the cheaper, longer, quicker and safer modes of Land Transport which is suitable in large cities. However due to certain limitations like slowly ness, huge investment, inflexibility etc. gradually it replaced by other means of Land Transport.

3. Railways: Railway has been the pioneer of modern mechanical transport. It has brought the greatest revolution in transport. It accelerated commercial and industrial development of various countries. Until the introduction of Motor Transport, Railway had the monopoly as the Land Transport. In India, it is the principal means of transport. It carries over 80 per cent of goods traffic and over 70 per cent of passenger traffic. It provides for more than 60000 kilometers of railways all over the country.

WATER TRANSPORT

Water transport is the cheapest and the oldest form of transport for heavy goods and bulk cargoes. Waterways are the natural gifts, hence it does not require large amount of capital expenditure for the construction of road and railway tracks, except canal transport, as in the case of land transport. In addition to that the cost of running is also very less. Water transport may be classified as under:

1. In Land Waterways: Inland waterways may be subdivided into River Transport:

Rivers are the water highways given by nature. River Transport is suitable for small boats and steamers. It was highly developed in the pre-railway days. But with the development of railways, river transport was neglected and decayed gradually.

Canal Transport: Canals are the artificial waterways constructed for the purpose of navigation and irrigation.

2. Oceans Water Transport: Ocean Transport or shipping may be subdivided into Coastal Shipping:

Coastal shipping is a cheaper, speedy, flexible and economical form of transport for the movement of bulky and heavy cargoes. Usually coastal shipping trade is reserved for the national shipping. In India also from 1951 and onwards the coastal shipping trade is extremely reserved for the national ships.

Overseas Shipping: On the basis of their working, overseas shipping may be divided into The Liner (those ships which follow defined routes with fixed places and fixed time table), The Tramps (those ships which have no set routes or fixed time table) and The Oil Tanker (special sea carriers of crude oil in very large quantity). The Liners may again be subdivided into Passenger Liners and the Cargo Liners.

An example of the first type is the St. Lawrence Seaway, while the Suez and Panama canals are examples of the latter. Thus, except for canals, shipping enjoys rights of way that are at no cost to the users. Complementing this advantage are the relatively low operating costs of ships. Ships have the ability to carry large volumes with small energy consumption and limited manpower requirements. Shipping, therefore, is a mode that can offer very low rates compared with other modes. Even if maritime transportation has experienced remarkable improvements in safety and reliability, maritime routes are still hindered by dominant winds, currents and general weather patterns. The North Atlantic and the North Pacifi c (50 to 60 degrees north) are subject to heavy wave activity during the winter that sometimes impairs navigation, and may cause ships to follow routes at lower latitudes, thereby increasing the route lengths (see Figure). During the summer monsoon season (April to October), navigation may become more hazardous on the Indian Ocean and the South China Sea. Rivers may not be useful for commercial navigation if their orientations do not correspond to the directions of transport demand. Thus, many of the major rivers of Russia flow north–south, while the main trade and passenger flows are east–west.

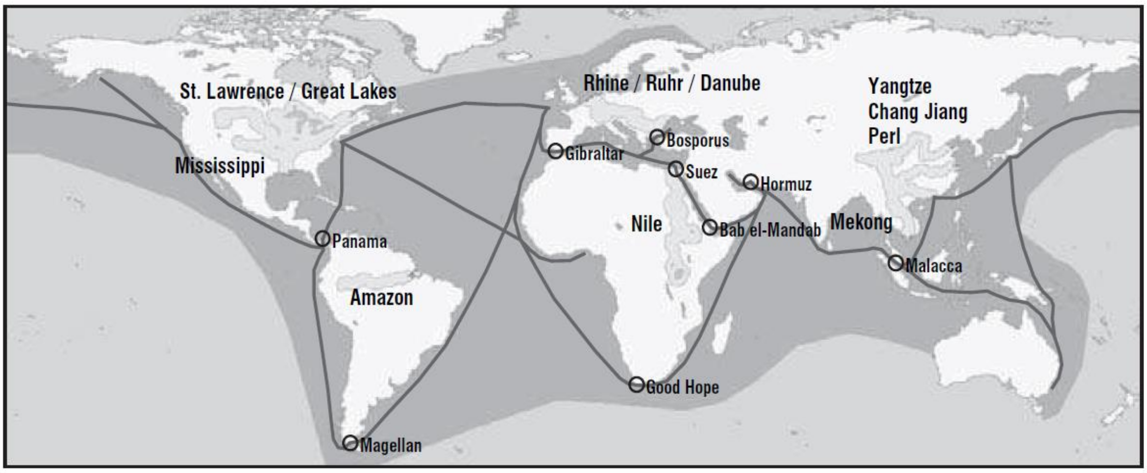

Figure 3: Domains of Marine time Transport

Shallow draught and extensive obstacles, such as rapids, may also limit navigation. However, many rivers, such as the Rhine or the Chang Jiang, are significant arteries for water transport because they provide access from the oceans to inland markets.

Shipping has traditionally faced two drawbacks. It is slow, with speeds at sea averaging 15 knots (26 km/h). Secondly, delays are encountered in ports where loading and unloading takes place. The latter may involve several days of handling. These drawbacks are particularly constraining where goods have to be moved over short distances or where shippers require rapid service deliveries. There are four broad types of ships employed around the world.

The countries with the largest registered fleets offer flags of convenience (Panama, Liberia, Greece, Malta, Cyprus and the Bahamas) and have very lax regulations (see Figure). Ship registry is a source of additional income for these governments. Even the landlocked country of Mongolia offers ship registry services. An important historic feature of oceanic liner transport is the operation of conferences. These are formal agreements between companies engaged on particular trading routes. They fix the rates charged by the individual lines, operating for example between Northern Europe and the East Coast of North America, or eastbound between Northern Asia and the West Coast of North America. Over the years in excess of 100 such conference arrangements have been established. While they may be seen as anti-competitive, the conference system has always escaped prosecution from national anti-trust agencies. This is because they are seen as a mechanism to stabilize rates in an industry that is inherently unstable, with significant variations in supply of ship capacity and market demand. By fixing rates, exporters are given protection from swings in prices, and are guaranteed a regular level of service provision (Brooks, 2000). Firms compete on the basis of service provision rather than price. A new form of inter-fi rm organization has emerged in the container shipping industry since the mid-1990s.

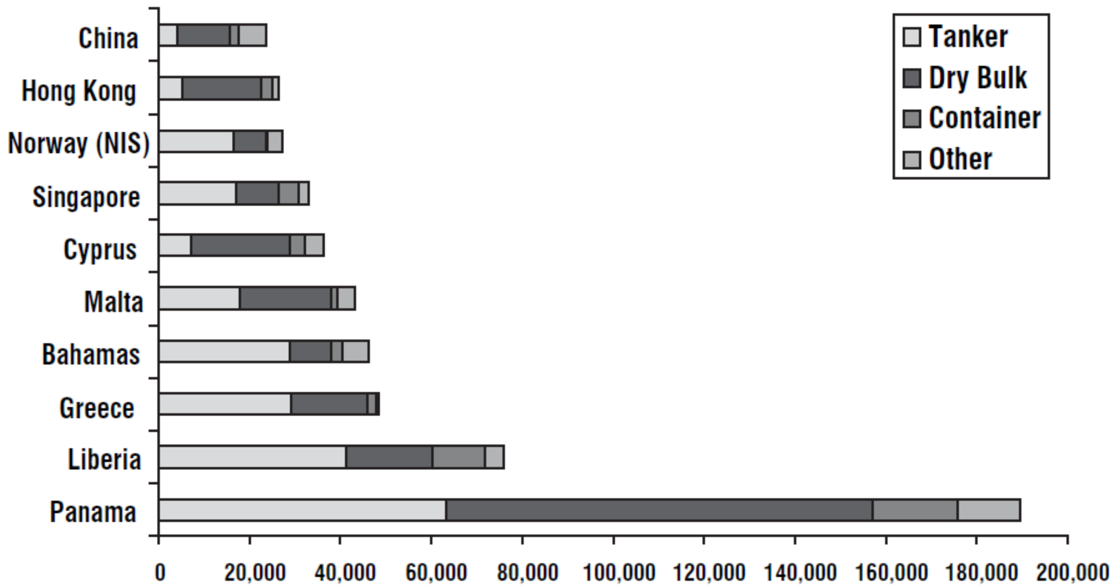

Figure 4: Tonnage by Country of Registry

Because the costs of providing ship capacity to more and more markets are escalating beyond the means of many carriers, many of the largest shipping lines have come together by forming strategic alliances with erstwhile competitors. They offer joint services by pooling vessels on the main commercial routes. In this way they are each able to commit fewer ships to a particular service route, and deploy the extra ships on other routes that are maintained outside the alliance. The alliance services are marketed separately, but operationally involve close cooperation in selecting ports of call and in establishing schedules. The alliance structure has led to significant developments in route alignments and economies of scale of container shipping.

AIR TRANSPORT

Air transport is the gift of twentieth century to the world. It is the latest means of transport. The first flight in the air was made in 1903 only for twelve seconds. Successfully it was used as a means of transport after the First World War (1914-1918). The first air service was started in 1919 between London and Paris. Since then it has made notable progress and provide tough competition to Railways. Air Transport can again be subdivided into passenger and cargo.

Regional: The airbus A320, with a range of 3,700 km, was designed to service destinations within a continent. From New York, most of North America can be reached. This range can be applied to the European continent, South America, East Asia and Africa. This type of aircraft is also used for high demand regional services needing several flights a day, enabling to improve the quality of service.

International. The Boeing 777-100, with a range of 7,400 km, can link one continent to another. From New York, it is possible to reach Western Europe and most of South America.

The Boeing 747-400, with a range of 11,400 km, can reach from New York any destination around the world except Australia, South and Southeast Asia. Japan is within range.

Like maritime transport, the airline industry is highly capital intensive. For instance, a new Boeing 747-400, used for high-volume and long-distance travel, costs approximately $200 million, depending on the configuration, and a new Boeing 737-800, used for regional flights, costs about $60 million. However, unlike the maritime sector, air transportation is labor intensive, with limited room to lower labor requirements, although many airlines are now trying to reduce labor costs by cutting salaries and benefits. The industry has become a powerful factor of development, generating globally more than $700 billion in added value and creating more than 21 million jobs. The initial development of air transportation took place in the 1920s and 1930s, not always for commercial reasons (Graham, 1995). It was seen as a means of providing a national air mail service (US) and of establishing long-haul air services to colonies and dependencies (UK and France). Airline companies were set up to provide these national goals, a trend that continued in the post-colonial period of the 1950s to the 1970s, as many African, Asian and Caribbean nations created their own airline companies while reserving them for specific markets and for specific routes. By convention, an air space exclusively belongs to the country under it, and this has led to significant government control over the industry.

Air routes today are primarily determined by: (i) adequate ground facilities for operation, and (ii) availability of traffic for economic working. Air transport is still, in general, costly. The high cost of air transport is largely the result of the expensiveness of the vehicle and the motive power. The total amount of freight moved by air is still small, less than 2 percent of the total world figure. Air transport is best suited for the carriage of commodities which are low in bulk but high in value. At the present time most of the air freight is actually carried in the holds of passengers' aircraft. But, the expansion of high-technology industries in the pacific rim, in North America and in Western Europe has generated a growing demand for air cargo services and the highest growth rates have been recorded on US Far East routes. The greatest development in air transport has been taken place in United States of America. USA is a country of long distances so that there are no political frontiers with all the customs formalities, to be crossed by aeroplanes. The Atlantic and the Pacific coasts of the United States are among the most developed parts of the country, and quickest way to connect these areas is by air. Because of this the number of people wishing to use this quick method of contact between the two far-flung borders of USA is very large. United States alone is served by about 9,000 air terminals, has over 1,50,000 registered civil aircrafts and accounts for almost half of the world's air passengers' traffic. In Europe, most of the countries have their own national airlines. After US, the greatest volume of air traffic is found in Europe. The major air terminals of Europe are London, Paris, Rome, Madrid, Warsaw, Vienna, Geneva, Moscow etc. England-Australia air route is one of the busiest and important air routes. Africa is served by international airlines following the East Africa route through London, Rome, Cairo, Khartoum, Nairobi, Johannesburg, Sri Lanka and South-East Asia. Most Asian countries have their own international airlines and many have domestic air service. Important international routes run across the monsoon fringe of Asia and Beirut, Tehran, Karachi, Mumbai, Delhi, Kolkata, Bangkok, Singapore, Hong Kong and Tokyo all are important international airport.

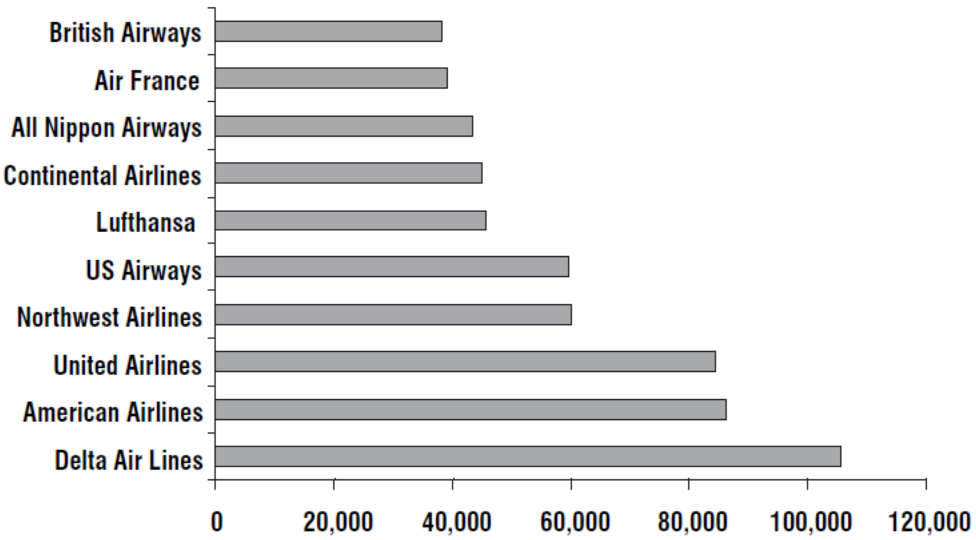

Figure 5: World 10 Largest Passenger Airlines

16.8 TRAFFIC FLOW; ROLE OF TRANSPORT IN ECONOMIC DEVELOPMENT

Roads and Highway are now visualized as the essential spatial veins of the nation. Road development accelerated in the first half of the twentieth century. By the 1920s, the first all-weather transcontinental highway, the Lincoln Highway, spanned over 5,300 km between New York and San Francisco. The Germans were, however, the first to build the modern highway (autobahn) in 1932 with specific cations such as restricted access, overpasses and road separation that would eventually become common characteristics of highway systems. The post-Second World War era represented a period of rapid expansion of road transportation networks worldwide. The most remarkable achievement is without doubt the

American Interstate highway system initiated in 1956. Its strategic purpose was to provide a national road system servicing the American economy and also able to support troop movements and act as air strips in case of an emergency. About 56,000 km was built from the 1950s to the 1970s, but between 1975 and 2006 only 15,000 km were added to the system, underlining growing construction costs and diminishing returns. Overall, about 70,000 km of four- lane and six- lane highways were constructed, linking all major American cities, coast to coast. A similar project took place in Canada with the Trans-Canada highway completed in 1962. By the 1970s, every modern nation had constructed a national highway system, which in the case of Western Europe resulted in a pan-European system. This trend now takes place in many industrializing countries. For instance, China is building a national highway system that expanded to 80,000 km in 2011, with construction taking place at a pace of about 2,000 km per year. An overview of the growth of the American and the Chinese highway systems underlines different sequences and rates. From its inception, the American Interstate highway system expanded substantially, but at a declining rate as the system neared its planned size (46,000 miles; 74,000 km). By 1991, after more than three decades of construction, the system was considered completed, with a total cost of about 129 billion dollars. Between 1954 and 2001, 370 billion dollars were invested by the federal government in the construction and the maintenance of the system. Close to three- quarters of the financing came from fuel taxes, which created a positive feedback loop as the more Interstate roads were available, the more fuel consumption and thus tax collection. However, the Interstate is facing diminishing returns due to high construction and maintenance costs, which is forcing many state governments to consider privatization of several highway segments. Construction costs went from four million dollars per mile in 1959 to 20 million dollars in 1979. Still, the system has returned more than six dollars in economic productivity for each dollar it cost, placing it at the core of American economic productivity gains in the second half of the twentieth century. The Chinese expressway system was developed later but at a much faster rate. Prior to 1989, there were no highways in China, but as the economy opened up, the development of a national system of expressways was seen as a priority. To facilitate the fast construction of the system almost all expressways are toll roads financed by private companies under contract from provincial governments, commonly as public–private partnerships. Debt contracted for expressway construction is expected to be recovered through toll collection. Unlike the United States, China did not implement a national fuel tax road financing mechanism. This mode of financing thus differs from the publicly funded highway systems built in Europe and North America. A significant landmark was achieved in 2011, when the length of the Chinese expressway system surpassed that of the American Interstate system. The planned length of the expressway system was set at 85,000 km. The construction of new expressways will likely slow down afterwards, underlining that at this point China will have achieved an important step in its motorization transition. It remains to be assessed in light of the significant urban population, raising levels on national production and consumption and the fast growth of car ownership, to what extent the national expressway network will be sufficient to effectively support China's socioeconomic mobility needs.

Pipelines are an extremely important and extensive mode of land transport, although very rarely appreciated or recognized by the general public, mainly because they are buried underground (or under the sea as in the case of gas pipelines from North Africa to Europe). In the USA, for example, there are 409,000 miles of pipelines that carry 17 percent of all ton/miles of freight. The longest oil pipeline is the Trans-Siberian, extending over 9,344 km to Western Europe from the Russian arctic oil-fields in eastern Siberia. Two main products dominate pipeline traffic: oil and gas, although locally pipelines are significant for the transport of water, and in some rare cases for the shipment of dry bulk commodities, such as coal in the form of slurry. The routing of pipelines is largely indifferent to terrain, although environmental concerns frequently delay approval for construction. In sensitive areas, particularly in arctic/sub-arctic areas where the pipes cannot be buried because of permafrost, the impacts on migratory wildlife may be severe, and be sufficient to deny approval, as was the case of the proposed McKenzie Valley pipeline in Canada in the 1970s. The 1,300 km long Trans Alaskan pipeline was built under difficult conditions and is above the ground for most of its path. Geo-political factors play a very important role in the routing of pipelines that cross international boundaries. Pipelines from the Middle East to the Mediterranean have been routed to avoid Israel, and new pipelines linking Central Asia with the Mediterranean are being routed in response to the ethnic and religious mosaic of the republics in the Caucasus.

Railway had a period of speedy growth since 1825 to early 20th century. By 1917, the world railways system had achieved one million-mile first train trackage. However, several developed economies like UK, USA and France and others had to drop certain uneconomic track, with the result that railway length reduced to 775,000 miles by 1980. However, several developing countries and Soviet Union meanwhile extended their system as China, India and some countries in Latin America and Africa. China increased from 34,000 to 55,000 km by 1980, and since then to several thousand km more to stand at 71th km. India added at least 7000 km. to have over 63th km net. In 1980, by countries, North America had 36% of global rail net, Europe 34%, Asia 12%, South America 8%, Africa 6% and Australia 4%. There has been some change now with many developing and CIS economies extending their routage. Britain was the first country in the world to have started railway construction by as early as 1825.

Air transport is the most recent and fastest although costliest, capital-intensive means of mobility for both passengers and goods, particularly with jet vintage large-body jumbo, or smaller Concorde, long-haul planes. It has really shrunken the earth space into a 'global village'. Air travel demand is naturally governed by economic development level of GDP, personal/family income, and disposable income. These factors lead persons/families increasing great tourism, and outdoor out-country recreation. US airlines are dominant from view of both domestic and international air transportation. They grab about 40% of global air traffic. However, some other leading industrialized nations hold to their well chalked out share (UK and Japan 5.3%) and France and Germany with 2.4% and 2.7% respectively.

The airline industry is highly capital intensive. For instance, a new Boeing 747-400, used for high-volume and long-distance travel, costs approximately $200 million, depending on the configuration, and a new Boeing 737-800, used for regional flights, costs about $60 million. However, unlike the maritime sector, air transportation is labor intensive, with limited room to lower labor requirements, although many airlines are now trying to reduce labor costs by cutting salaries and benefits. The industry has become a powerful factor of development, generating globally more than $700 billion in added value and creating more than 21 million jobs. The initial development of air transportation took place in the 1920s and 1930s, not always for commercial reasons (Graham, 1995). It was seen as a means of providing a national air mail service (US) and of establishing long-haul air services to colonies and dependencies (UK and France). Airline companies were set up to provide these national goals, a trend that continued in the post-colonial period of the 1950s to the 1970s, as many African, Asian and Caribbean nations created their own airline companies while reserving them for specific markets and for specific routes. By convention, an air space exclusively belongs to the country under it, and this has led to significant government control over the industry.

As in the case of ocean shipping, there has been a significant development of alliances in the international airline industry. The alliances are voluntary agreements to enhance the competitive positions of the partners. Members benefit from greater scale economies, a lowering of transaction costs and a sharing of risks, while remaining commercially independent. The first major alliance was established in 1989 between KLM and North West Airlines. The "Star" alliance was initiated in 1993 between Lufthansa and United Airlines. In 1996, British Airlines and American Airlines formed the "One World" alliance. Other national carriers have joined different alliance groupings. They cooperate on scheduling, code sharing, equipment maintenance and schedule integration. It permits airlines that may be constrained by bi-lateral regulations to offer a global coverage.

Shipping exploits the water routes that cross oceans as well as rivers and lakes. Many of the oceanic routes are in international waters and are provided at no cost to the users. In many coastal and inland waters too, shipping lanes are "free", although national regulations may exclude foreign vessels from cabotage trade. Even if maritime transportation has experienced remarkable improvements in safety and reliability, maritime routes are still hindered by dominant winds, currents and general weather patterns. The North Atlantic and the North Pacific (50 to 60 degrees north) are subject to heavy wave activity during the winter that sometimes impairs navigation, and may cause ships to follow routes at lower latitudes, thereby increasing the route lengths. During the summer monsoon season (April to October), navigation may become more hazardous on the Indian Ocean and the South China Sea. The countries with the largest registered fleets offer flags of convenience (Panama, Liberia, Greece, Malta, Cyprus and the Bahamas) and have very lax regulations. Ship registry is a source of additional income for these governments. Even the landlocked country of Mongolia offers ship registry services.

16.9 MORPHOLOGY AND PERIODICITY OF MARKET

In a global economy, no nation is self-sufficient. Each is involved at different levels in trade to sell what it produces, to acquire what it lacks and also to produce more efficiently in some economic sectors than its trade partners. As supported by conventional economic theory, trade promotes economic efficiency. The globalization of production is concomitant to the globalization of trade. Even though international trade took place centuries before the modern era, as ancient trade routes such as the Silk Road can testify, trade occurred at an ever-increasing rate over the last 600 years to play an even more active part in the economic life of nations and regions. This process has been facilitated by significant technical changes in the transport sector. The scale, volume and efficiency of international trade have continued to increase over the last 30 years. As such, a point has been reached where a large amount of space can be traded for a decreased amount of time, and this at lower costs. It has become increasingly possible to trade between parts of the world that previously had limited access to international transportation systems. Further, the division and the fragmentation of production that went along with these processes also expanded trade. Trade thus contributes to lower manufacturing costs. The economic benefits of international or inter-regional trade are numerous. Without trade, each unit must produce a set of basic goods to satisfy the requirements of the national economy. In the example in Figure, four countries are each producing four different goods. National markets tend to be small, impairing the potential economies of scale, which results in higher prices. Product diversity also tends to be limited because of the market size and standards (such as safety or component size) may even be different.

With trade, competition increases and a redistribution of production often takes place as comparative advantages are exploited. In the above example, the outcome of trade liberalization involves a specialization of production of one good in each country and the trade of other goods between them. Greater economies of scale that are achieved through specialization result in lower prices. A situation of interdependency is thus created. Without international trade, few nations could maintain an adequate standard of living. With only domestic resources, each country could only produce a limited number of products and shortcomings would be prevalent. Global trade allows for an enormous variety of resources – from Persian Gulf oil to Chinese low-cost labor – to be made more widely accessible. It also facilitates the distribution of many different manufactured goods that are produced in different parts of the world. Wealth becomes increasingly derived through regional product specialization. In this way, production costs are lowered, productivity rises and surpluses are generated, which can be transferred or traded for commodities that would be too expensive to produce domestically. As a result, international trade decreases the overall costs of production worldwide. Consumers can buy more goods for the wages they earn, and standards of living should, in theory, increase. International trade consequently demonstrates the extent of globalization with increased spatial interdependencies between elements of the global economy and consequently their level of integration. Interdependencies imply numerous relationships where exchanges of capital, goods, raw materials and services are established between regions of the world. Trade has also been facilitated by growing levels of economic integration, the outcome of processes such as the European Union or the North American Free Trade Agreement. Thus, the ability to compete in a global economy is dependent on the transport system as well as a vast array of supporting service activities.

16.10 ROLE OF MARKET IN ECONOMIC DEVELOPMENT

Like many economic activities that are intensive in infrastructure, the transport sector is an important component of the economy impacting on development and the welfare of populations. When transport systems are efficient, they provide economic and social opportunities and benefits that result in positive multiplier effects such as better accessibility to markets, employment and additional investments. When transport systems are deficient in terms of capacity or reliability, they can have an economic cost such as reduced or missed opportunities. Efficient transportation reduces costs, while inefficient transportation increases costs. The impacts of transportation are not always intended, and can have unforeseen or unintended consequences such as congestion. Transport also carries an important social and environmental load, which cannot be neglected. The added value and employment effects of transport services usually extend beyond employment and added value generated by that activity; indirect effects are salient. For instance, transportation companies purchase a part of their inputs from local suppliers.

The production of these inputs generates additional value added and employment in the local economy. The suppliers in turn purchase goods and services from other local firms. There are further rounds of local re-spending which generate additional value added and employment. Similarly, households that receive income from employment in transport activities spend some of their income on local goods and services. These purchases result in additional local jobs and added value. Some of the household income from these additional jobs is in turn spent on local goods and services, thereby creating further jobs and income for local households. As a result of these successive rounds of re-spending in the framework of local purchases, the overall impact on the economy exceeds the initial round of output, income and employment generated by passenger and freight transport activities. Thus, from a general standpoint the economic impacts of transportation can be direct, indirect and related:

1. Direct impacts (also known as induced): the outcome of accessibility changes where transport enables employment, added value, larger markets, and time and cost savings.
2. Indirect impacts: the outcome of the economic multiplier effects where the price of commodities, goods or services drop and/or their variety increases. Indirect value-added and jobs are the result of local purchases by companies directly dependent upon transport activity. Transport activities are responsible for a wide range of indirect value added and employment effects, through the linkages of transport with other economic sectors (e.g. office supply, firms, equipment and parts suppliers, maintenance and repair services, insurance companies, consulting and other business services).
3. Related impacts: the outcome of economic activities and firms partly relying on efficient transport services for both passengers and freight. For instance, the steel industry requires cost-efficient import of iron ore and coal for blast furnaces, and export activities for finished products such as steel booms and coils. Manufacturers and retail outlets and distribution centres handling imported containerized cargo rely on efficient transport and seaport operations.

Mobility is one of the most fundamental and important characteristics of economic activity as it satisfies the basic need of going from one location to the other, a need shared by passengers, freight and information. All economies and regions do not share the same level of mobility as most are in a different stage in their mobility transition towards motorized forms of transport. Economies that possess greater mobility are often those with better opportunities to develop than those with scarce mobility. Reduced mobility impedes development while greater mobility is a catalyst for development. Mobility is thus a reliable indicator of development. Providing this mobility is an industry that offers services to its customers, employs people and pays wages, invests capital and generates income. The economic importance of the transportation industry can thus be assessed from both a macroeconomic and a microeconomic perspective: At the macroeconomic level (the importance of transportation for a whole economy), transportation and the mobility it confers are linked to a level of output, employment and income within a national economy. In many developed countries, transportation accounts for between 6 and 12 percent of GDP. At the microeconomic level (the importance of transportation for specific parts of the economy) transportation is linked to producer, consumer and production costs. The importance of specific transport activities and infrastructure can thus be assessed for each sector of the economy. Transportation accounts on average for between 10 and 15 percent of household expenditures while it accounts for around

4 percent of the costs of each unit of output in manufacturing, but this figure varies greatly according to subsectors. Transportation links together the factors of production in a complex web of relationships between producers and consumers. The outcome is commonly a more efficient division of production by an exploitation of geographical comparative advantages, as well as the means to develop economies of scale and scope. The productivity of space, capital and labour is thus enhanced with the efficiency of distribution and personal mobility. It is acknowledged that economic growth is increasingly linked with transport developments, namely in infrastructures, but also managerial expertise is crucial for logistics. The following impacts can be assessed,

Networks: Setting of routes enabling new or existing interactions between economic entities.

Performance: Improvements in cost and time attributes for existing passenger and freight movements.

Reliability: Improvement in the time performance, notably in terms of punctuality, as well as reduced loss or damage.

Market size: Access to a wider market base where economies of scale in production, distribution and consumption can be improved.

Productivity: Increases in productivity from access to a larger and more diverse base of inputs (raw materials, parts, energy or labour) and broader markets for diverse outputs (intermediate and finished goods).

Cycles of economic development provide a revealing conceptual perspective about how transport systems evolve in time and space as they include the timing and the nature of the transport impact on economic development. Transport, as a technology, follows a path of experimentation, introduction, adoption and diffusion and, finally, obsolescence, each of which has an impact on economic development. Succinctly, transport technology can be linked to five major waves of economic development where a specific mode or system emerged:

Seaports- Linked with the early stages of European expansion from the sixteenth to eighteenth centuries. They supported the development of international trade through colonial empires, but were constrained by limited inland access.

Rivers and canals- The first stage of the industrial revolution in the late eighteenth and early nineteenth centuries was linked to the development of canal systems in Western Europe and North America, mainly to transport heavy goods. This permitted the development of rudimentary and constrained inland distribution systems.

Railways- The second stage of the industrial revolution in the nineteenth century was intimately linked to the development and implementation of rail systems enabling a more flexible inland transportation system.

Roads- The twentieth century saw the development of road transportation systems and automobile manufacturing. Individual transportation became a commodity available to the masses, especially after World War II. This process was reinforced by the development of highway systems.

Airways and information- The later part of the twentieth century saw the development of global air and telecommunication networks in conjunction with the globalization of economic activities. New organization, control and maintenance capacities were made possible. Electronic communications have become consistent with transport functions, especially in the rapidly developing realm of logistics and supply chain management.

16.11 CONCLUSION

Integrated transportation system development is a prerequisite along with ICTs for economic and social development unifying integration of the resource use, their transfer, production, trading and distribution and consumption at local, meso-and-macro and international levels of the global space economy. The humanity has developed now multi-model transport system, in which men, animals, waterways, and roads system play their respective role to argument the process of all-round human development. However, transport system has great spatial unevenness, because of topographical, climatic and other physical barriers, and differential levels of development of socio-economy, which demand as well as create transport development.

16.12 SUMMARY

Transport is essentially a type of service involving spatial interaction. It forms a very important component of the geography of world space economy. Although the provision of a good, efficient, competitive, transportation system is expensive and time taking slow affair, yet these costs are investment in future growth of the economy.

In this unit, concept of transportation, distance and transportation cost, means of transportation and its impact on economic development. Transport systems are closely related to socioeconomic changes. The mobility of people and freight and levels of territorial accessibility are at the core of this relationship. Economic opportunities are likely to arise where transportation infrastructures are able to answer mobility needs and ensure access to markets and resources. From the industrial revolution in the nineteenth century to globalization and economic integration processes of the late twentieth and early twenty-first centuries, regions of the world have been affected differently by economic development. International, regional and local transportation systems alike have become fundamental components of economic activities. A growing share of the wealth is thus linked to trade and distribution. However, even if transportation has positive impacts on socioeconomic systems, there are also negative consequences such as congestion, accidents and mobility gaps. Transportation is also a commercial activity derived from operational attributes such as transportation costs, capacity, efficiency, reliability and speed. Transportation systems are evolving within a complex set of relationships between transport supply – mainly the operational capacity of the network – and transport demand – the mobility requirements of an economy.

16.13 GLOSSARY

1. Air Transportation - Includes companies that provide domestic and international passenger and freight services, and companies that operate airports and provide terminal facilities.

2. Costs (Transport) - Monetary measure of what the transport provider must pay to produce transportation services; comes as fixed (infrastructure) and variable (operating). They depend on a variety of conditions related to geography, infrastructure, administrative barriers, energy, and on how passengers and freight are carried. Three major components, related to transactions, shipments and the friction of distance, impact on transport costs.

3. Cost–benefit Analysis - A tool employed to evaluate a project by providing a set of values that are useful to determine its feasibility from an economic standpoint.

4. Hub - Central point for the collection, sorting, transhipment and distribution of goods and passengers for a particular area. This concept comes from a term used in air transport for passengers as well as freight. It describes collection and distribution through a single point such as the "Hub- and-Spoke" concept. Hubs tend to be trans modal (transfers within the same mode) locations.

5. Infrastructure - Capital goods that are not directly consumed and serve as support to the functions of a society (individuals and corporations). (1) In transport systems, all the fixed components, such as rights of way, tracks, signal equipment, terminals, parking lots, bus stops, maintenance facilities, etc. (2) In transportation planning, all the relevant elements of the environment in which a transportation system operates.

6. Integrated Carriers - Carriers that have both air and ground fleets; or other combinations, such as sea, rail and truck. Since they usually handle thousands of small parcels an hour, they are less expensive and offer more diverse services than regular carriers.

7. Intermodal Transport - The movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes. Enables cargo to be consolidated into economically large units (containers, bulk grain rail cars, etc.), optimizing the use of specialized intermodal handling equipment to effect high- speed cargo transfer between ships, barges, rail cars and truck chassis using a minimum of labour to increase logistic flexibility, reduce consignment delivery times and minimize operating costs.

1. Network - Framework of routes within a system of locations, identified as nodes. A route is a single link between two nodes that are part of a larger network that can refer to tangible routes such as roads and rails, or less tangible routes such as air and sea corridors.

2. Railroad - All forms of non-highway ground transportation that run on rails or electro-magnetic guideways, including: (1) Commuter or other short-haul rail passenger service in a metropolitan or suburban area, and (2) high speed ground transportation systems that connect metropolitan areas, without regard to whether they use new technologies not associated with traditional railroads. Such a term does not include rapid transit operations within an urban area that are not connected to the general railroad system of transportation.

3. Terminal Costs - Costs of loading and unloading. They do not vary with distance shipped.

4. Transport Geography - Sub discipline of geography concerned with movements of freight, people and information. It seeks to link spatial constraints and attributes with the origin, the destination, the extent, the nature and the purpose of movements.

16.14 ANSWER TO CHECK YOUR PROGRESS

1. What do you understand by Transportation? Explain its various means of transportation in details.
2. How transport is connected with economic development, elaborate.

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16.17 TERMINAL QUESTIONS

1. Elaborate concept of Transportation with reference to distance and transportation flow.
2. Describe transport cost in detail with suitable examples.
3. Explain transportation, trade and market relationship with illustration.
4. Comment on the economic significance of transportation networks.
5. Discuss the role of transportation in the development of any particular economy in the world.

LAB WORK

BLOCK 1: TECHNOLOGY AND ITS APPLICATION IN GEOGRAPHY

UNIT 1: AERIAL PHOTOGRAPHY

1.1 OBJECTIVES

The objective of this chapter is to understand the technology of an aerial photography in the field of remote sensing and their use in mapping and updating the maps. Students have to understand how to plan for aerial photography. They can also understand the types of an aerial photograph and their use. The students has to understand about the photo-interpretation and photogrammetry.

1.2 INTRODUCTION

The term an 'Aerial photography' means a process of taking photographs from an airborne platform, in general, photography from the air by the mean of an aircraft. It gives a *bird's eye view* of the earth surface because photo has been taken from a certain height. Basically, the term 'photography' derived from a Greek word *photos* means *light* and *graphy* means *writing w*hich means, '*Drawing with Light'*. Photograph is a picture which is formed by the action of light on a base material coated with an emulsion which is sensitive to light. The base material may be a plastic or a paper. It may be positive or negative image recorded, permanently on a sensitised material through the action of light by the camera. The electro-magnetic spectrum, ranges between 0.3µm and 1.2µm wavelength is used for photography is also known as photographic region. The importance of an aerial photography increased in the inaccessible areas where the ground survey is very difficult such as high mountain ranges, forest area, big water bodies, desert area. The traditional field survey on the ground is very tedious and time consuming but in an aerial photography it can be happened within few hours. It also provides base for mapping and updating the large area especially urban environment because it provides detail pictorial view about an area photographed.

There is also some limitation in an aerial photography due to bad weather condition when the flight cannot be taken place to perform an aerial photography. Another issue is to identify the feature on an aerial photo. There is no symbology available on the photograph as well as it provides the top view of the earth features, so the interpreter must have the knowledge of the elements by which they can identify the features on the photograph. On the map, the scale is uniform throughout the map but in the photograph it is not uniform because of the central projection system so photogrammetric knowledge is must before making the quantitative analysis of an aerial photograph. But, the conjunction with field work, existing topographic map and an aerial photography technology are complementary to each other for understanding the changing nature of our earth features.

Purpose of photograph:

There are two basic purposes of photograph; one is photogrammetry and another is photo-interpretation. Photogrammetry is a science of obtaining reliable measurements by means of photograph in order to primarily determine geometric characteristic such as position, size, and form of the object in photograph. The term photogrammetry is derived from Greek words photos (light), Gramma (written), and Metron (measure), means measuring from a photograph. The photogrammetry is a technique of taking quantitative measurements by using an aerial photographs. When the photograph is used in such a way to get descriptive information about the photographed object such as built-up area, agricultural area, forest etc., then the photo-interpretation term is used in different disciplines such as geography, geology, forestry, urban planning etc. An act of examining an aerial photographs for the purpose of identifying objects and judging their significance is process of photo-interpretation.

1.3 METHODS & TYPES OF AERIAL PHOTOGRAPHY

Flight planning for vertical aerial photograph:
The planning of flight is depends on the objective of the study. There are various important issues should be checked as follows:

Study area delineation*:* This is the most important to delineate the study area accurately in terms of size and shape before flying the aircraft.

Flight lines*:* It should be parallel, oriented in the correct direction. For the maximum efficiency of the aircraft, the flight line should be parallel along the axis of the study area.

Film*:* The camera film is determined by the use of the photograph. It can be panchromatic, natural colour and infrared.

Overlap and side lap *:* For the stereo-pair, overlap should be 60 per cent along the flight line and 20 per cent should be side lap between adjacent flight line. At the beginning and end of the each flight line at least two photographs should be added as a margin for assurance of total coverage.

Scale of photography*:* The scale of the photograph that determine the height of the flight. It is the ratio between focal length and flying height.

Required time and season*:* Depends on the user need, the season and time is decided. The acceptable cloud cover also should be specified by the user.

Type of an aerial photograph:
There are different criteria to classify an aerial photographs, depending upon the following:
1. On the basis of *frame,*an aerial photograph can be single or multi-frame. The single frame photograph is a common type of photograph when single camera lens is used for photography such as vertical and oblique photography. The multi-frame photograph is a composite type of photographs taken with two cameras with single lens or one camera having two or more lenses. The photographs are combinations of two or four, eight obliques around a vertical. The obliques are rectified to permit assembly as verticals on a common plane. This type of photograph can be used to make 3-D models for emergency work. Trimetrogon and convergent type of photography

produce multi-frame photographs. The trimetrogon type of photography is an assemblage of three photographs taken at the same time, out of three one vertical view and two high oblique camera in a direction of the flight line at right angle are used for photography as shown in figure 1.1. The combination these three camera produce horizon to horizon composite photograph with two side obliques and one vertical.

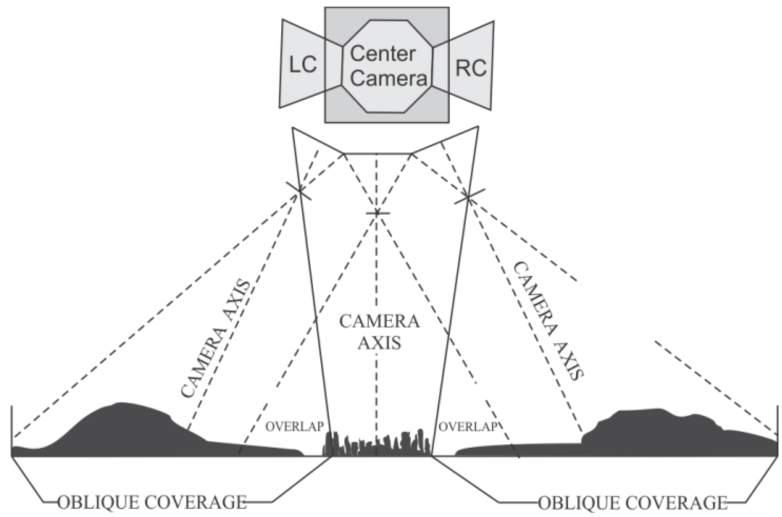


Figure 1.1: Trimetrogon photography

Another, multi-frame type photography is convergent photography. This is combination of a single twin-lens wide-angle camera, or two single-lens, wide-angle cameras which are parallel to the flight line as shown in figure 1.2. Both camera are intentionally tilted around 15^0 to 20^0 from vertical and exposed at the same time. This is used for reconnaissance survey.

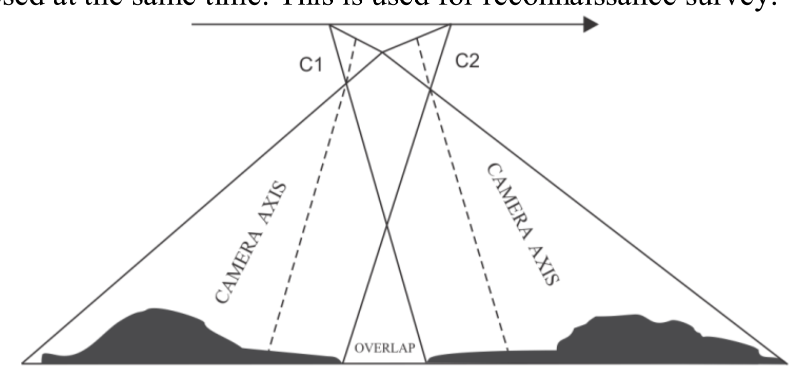
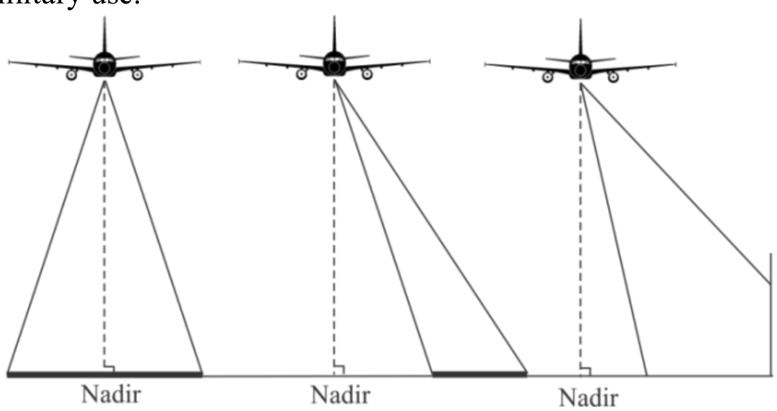


Figure 1.2: Convergent photography

2. On the basis of *scale,*an aerial photograph can be small, medium and large scale. In the small scale of an aerial photograph, the RF are larger than 1: 50,000; medium scale the RF are in between 1:20,000; and 1:50,000; in large scale the RF between 1: 20,000 or less. The scale factor is basically a relative concept, for example 1:100,000 are small scale and 1:50,000 is large scale.
3. On the basis of *tilt,*an aerial photograph can be divided into two part i.e. vertical aerial photograph and oblique aerial photograph (Figure 1.3). Tilt is an intentionally inclination of the camera axis. The angle subtended at the perspective centre between the optical axis of the

camera and the vertical. The direction of tilt is represented by swing. Vertical air photograph are taken with the axis of an aerial camera vertical or near vertical which is less than 3 degree. The vertical photographs are taken directly above the object or phenomena and closely resemble a map. It is normally used for cartographic use and photo-interpretation. The shape of the vertical aerial photograph is almost square and it covers smaller area than oblique photograph. The camera lens axis is directly perpendicular to the earth surface so the relief is not visible. On the uniform surface, direction and distance is more precisely measure (Table 1.1).

When the photograph is taken the side of an aircraft with the optical axis of an aerial camera intentionally tilted from the vertical are known as oblique photographs. These photographs cover large areas of ground but clarity of detail diminishes towards the far end of the photograph. Oblique aerial photograph is basically two type one is low oblique and another is high oblique. In the low oblique photograph taken with the camera which is inclined about 30° from the vertical axis. The shape of the ground coverage is trapezoid, although in the vertical aerial photographs it is square or rectangular. It seems the top view of a high rise building or the hill top. The scale of the entire low oblique is not uniform so measurement is not correct. In this low oblique photograph the horizon is not visible due to low inclination, it shows only ground at far. The basic application of low oblique is for reconnaissance survey for damage assessment due to natural calamities such as flood, drought, and defense use as well as it is used as map substitute. The high oblique is a photograph taken with the camera inclined about 60° from the vertical axis and horizon is always visible. The relief feature of earth is visible due to high inclination of camera axis. The major application of this type of photograph is for making the aeronautical charts and some military use.



(a) (b) (c)

Figure 1.3: (a) Vertical, (b) low oblique and (c) high oblique photography

Table 1.1: *Characteristics of vertical, low oblique and high oblique photography*

Sl. No.	Type of photograph	Vertical	Low oblique	High oblique
1.	Characteristics	Tilt smaller than 3°	No horizon	horizon
2.	Coverage	Least	Less	Greater
3.	Area	Rectangular	Trapezoidal	Trapezoidal
4.	Scale	Uniform, if flat	Decreases from foreground to background	Decrease from foreground to background
5.	Difference in comparison with map	Least	Less	Greater
6.	Advantage	Easiest to map	Economical and illustrative	Economical and illustrative

4. Based on *Angular coverage* of the camera lens, an aerial photograph can be narrow, normal, wide, and super wide angle. In the narrow angle photography, the focal length of the camera is more than 60 mm and coverage angle is less than 50 degrees. The normal angle coverage is 60 to 75 degrees where the focal length is around 30-35 mm. In the wide angle the coverage is 75 to 100 degree and focal length is less than 15 mm. In the super wide angle, the coverage is more than 100 degree and the focal length is 8.5 mm. There is an inverse relationship between the focal length and coverage angle (Figure 1.4).

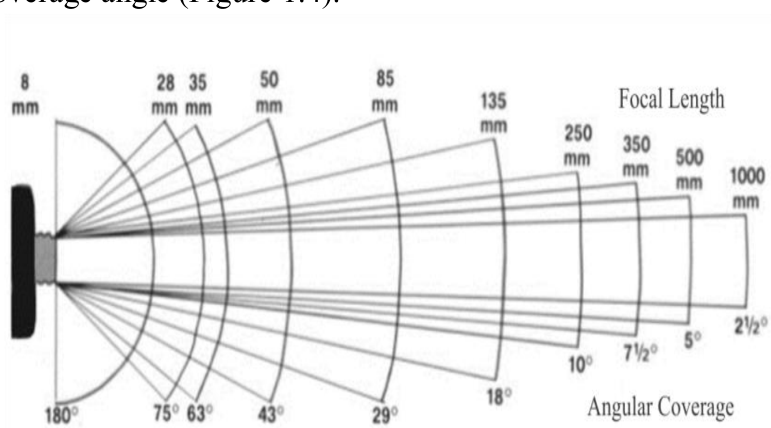
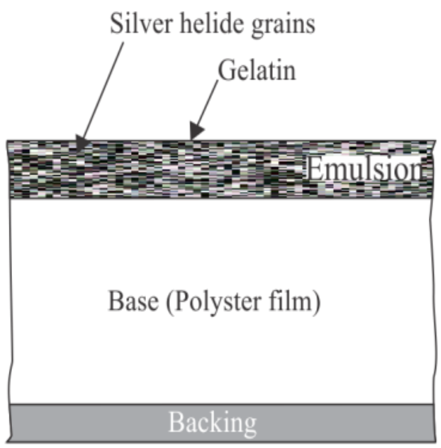


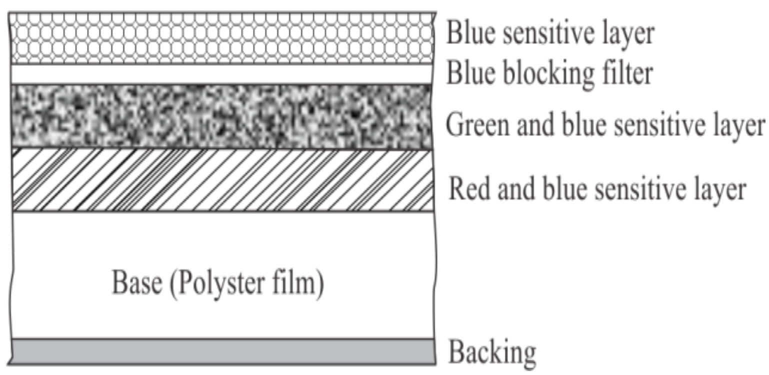
Figure 1.4: Focal length and angular coverage of camera lens

5. Based on *camera film,* an aerial photograph can be categories into four i.e. panchromatic black and white, infrared black and white, aero-colour (true colour) and acro-crome infrared (false colour). The light sensitive emulsion of silver halide crystals on a base of paper, plastic film or glass, which is exposed in a camera to form images (Figure 1.5). The black and white

panchromatic records the amount of light reflected from objects in tones of gray running from white to black and most of an aerial photography is taken with panchromatic film. Infrared black and white film is sensitive to infrared waves. It can be used to detect artificial camouflage materials and to take photographs at night if there is a source of infrared radiation. This is very much use in military purpose. The true colour of an aerial photography is limited in its use because of the time required to process it and its need for clear, sunny weather for photography. The acro-crome or false colour is a special type of film that records natural vegetation in a reddish color. When artificial camouflage materials are photographed, they appear bluish or purplish colour. This film is also known as camouflage detection film.



Black & White



Colour

Figure 1.5. Film Structure

Panoramic photography: This is a scanning type of camera that sweeps the area of interest from side to side in the direction of flight line as shown in figure 1.6. The coverage of the panoramic photograph is very wide used for reconnaissance survey. It is different from the frame camera which is exposed in such a way that gives sufficient overlap between successive frames.

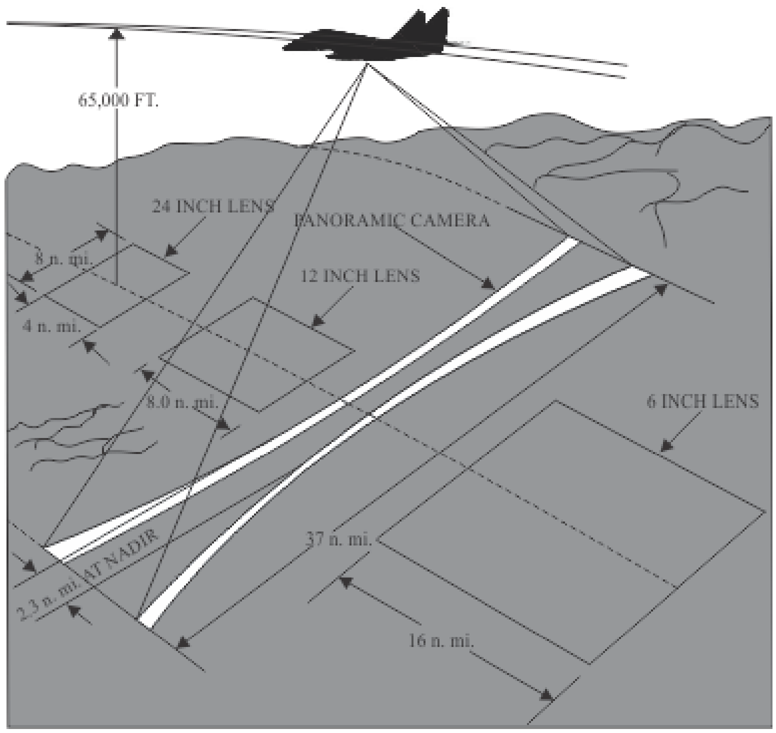


Figure 1.6: Panoramic photography

Elements of an aerial Photo/Image Interpretation:

Tone: It refers to the relative brightness or tonal variation on a photographic film and photograph represents the radiance value received by the sensor from the object of the earth's surface. Some objects appear darker and crispier than others. Light tones represent areas with a high radiance and dark tones represent areas with low radiance. The nature of the materials on the earth's surface affects the amount of light reflected. The terms light, medium and dark are used to describe the tonal variation. For example, the area of laterite soil is dark grey in tone and the areas of salt affected soil are light grey in tone; dry soil has light tone and wet soil has dark tone in photograph.

Colour: The objects are easily identified in first instant by the colour. In the multispectral imagery, colour is most important element to discriminate two features which cannot be easily identified by tonal variation in panchromatic imagery. For example, in the true colour image healthy vegetation represented by green colour but I panchromatic, it is represented in grey colour, even in standard false colour composite, it will represent red in colour. The tone and colour is the basic and primary elements of the interpretation(Figure 1.7).

Size: Some features are easily identified by the size of the objects. It is with reference to the length, width, perimeter and area in the context of the scale of the photograph. The size is a relative term which may be small, medium and big, varying according to the scale of the photograph/imagery. The size of the water body will help to determine a small pond or a big lake. National highways can be easily distinguished from smaller roads. Long rivers can be distinguished from smaller tributaries. Residential area is easily distinguished from industrial area in urban environment.

Shape: Shape refers to the geometric shapes such as linear, curvilinear, circular, elliptical, radial, square, rectangular, triangular, hexagonal, star, elongated, etc. Consolidated agricultural areas tend to have geometric shapes like rectangles and squares. Streams are linear (line) features that can have many bends and curves. Canals, roads, railway line frequently have fewer curves than streams. Stadium may be circular or elliptical shape. Some objects can be identified almost solely on the basis of their shapes such as Pyramid in Egypt, Pentagon building in USA.

Texture: This is the roughness and smoothness of the features in an aerial photograph/imagery. It is the arrangement of tonal variation or repetitions of tone and colour in an aerial photograph/imagery. The textural classes may be smooth (uniform, homogeneous), intermediate, and rough (coarse, heterogeneous) represent relatively. The grass appears smoother than the forest. Paddy field appears smoother than sugarcane field. The water in the lake and cemented area appears smoother than ploughed agricultural land. The size, shape and texture are the secondary element for interpretation.

Pattern: The feature of the earth surface produces regular, linear, systematic, irregular or randomly spatial arrangement. It may be natural or the man-made features. The difference between planned (systematic) and unplanned (random) cities. Chandigarh city has checkerboard pattern while Connaught Place in New Delhi is radial pattern. The pattern of the drainage such as radial, trellis, dendritic, etc.The difference between forest, forest plantation and orchards. The pattern formed by the feature in the photograph/imagery can be used to identify the objects.

Shadow: The shadow is a clue to identify an object which is cast by the object on the vertical aerial photograph. These shadows provide more information than the object themselves in the photograph particularly height determination. For example the shadows cast by hill or mountain to identify physiographic information, QutubMinar, Eiffel tower, bridge or sign board are often more informative. It also helps to determine the height of the features such as high rise building in an aerial photograph. The pattern and shadow are the tertiary element of interpretation.

Site or Location: It is refers to geographical location. This characteristic of photograph/imagery is more important in identifying the feature located in particular area or region such as various vegetation types and landforms. For example, some tree species are found more commonly in one geographic location than in others such as evergreen forest, mangrove, etc; some landforms are found in particular location such as sand dunes, alluvial fans, river delta, large circular depressions in the ground are identified as sinkholes in central Florida; some cultural features such as brick-klins, thermal power plant, nuclear power plant.

Association: Some objects on the earth surface are always found in association with other objects. These associated features provide clue to identify the object such as sugar mill associated with surrounded by sugarcane agriculture field, molasses tank, storage godown, etc. A vegetated area within an urban setting may be a park. Commercial centers will likely be located next to major roads, rail, or waterways. Industrial areas are associated with several clustered. Some structures may also help us determine the precise nature of enterprises such as combination of one or two tall chimneys, a large central building, along water way, cooling towers and solid fuel piles point to correct identification of a thermal power station.

Resolution: Resolution of a sensor system may be defines as its capability to discriminate two closely spaced objects from each other. It may be high, medium and low resolution, relatively.

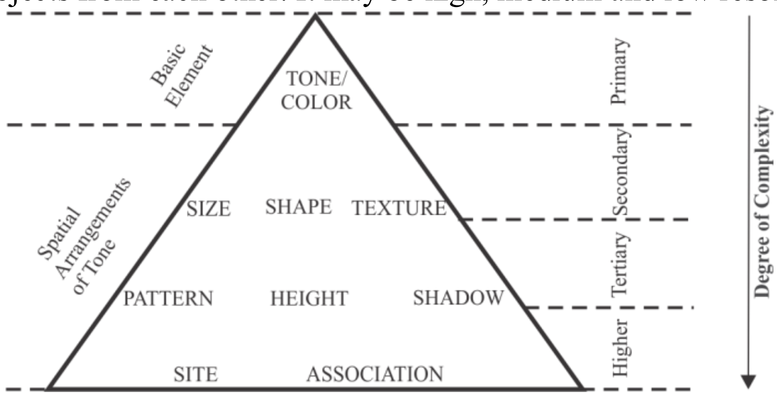
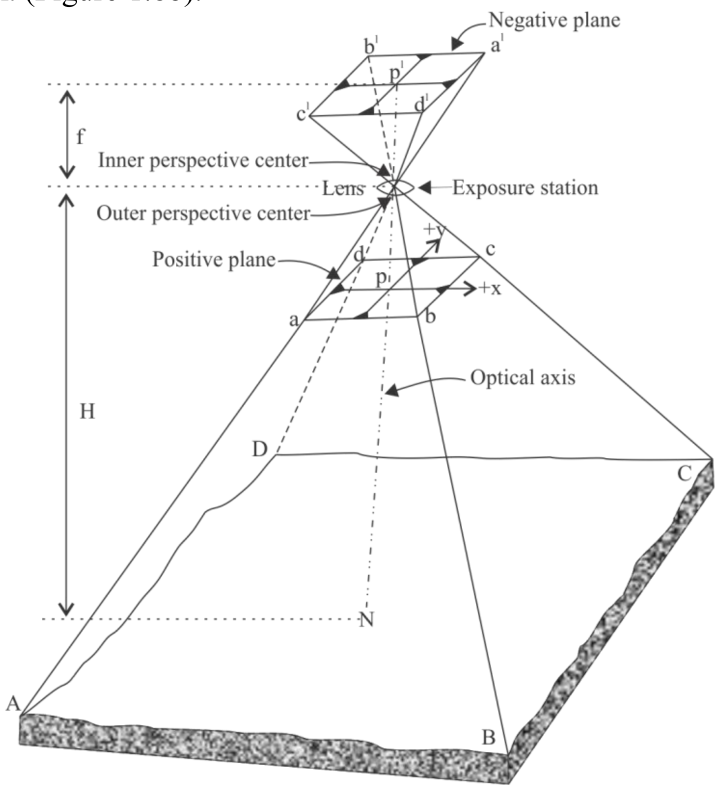


Figure 1.7: Elements order for feature identification

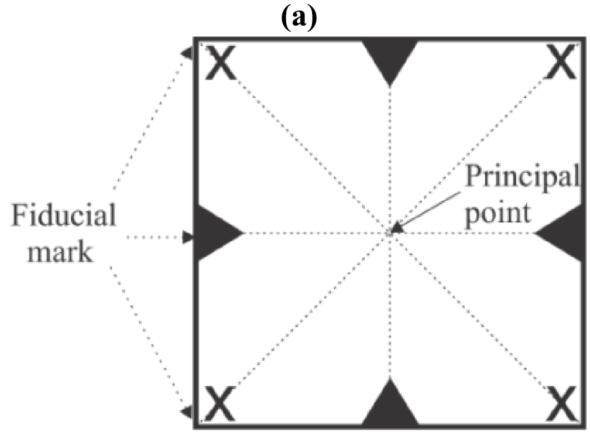
The small features can be identified from the high resolution imagery. For example cadastral level or infrastructure mapping needs the high resolution imagery where individual plots or houses can be drawn. The regional level mapping requires comparatively low resolution imagery.

Geometry of an aerial photograph

The vertical aerial photographs taken from an exposure station of an aircraft with the axis of an aerial camera is true vertical (without any tilt) or near vertical where unintentional tilt is less than 3 degree. The extent of an area A, B, C, D (Figure 1.8a) is photographed from exposer station and impression is made on negative plane a’, b’, c’ and d’. The exposure station is basically the centre of the camera lens, where all light from the ground are converge and diverge to the negative plane of the camera known as perspective centre. It is the point of origin (inner perspective centre) or termination (outer perspective centre) of perspective rays. In a distortion free lens camera system, perspective rays from the interior perspective centre to the photographic images form the same angles, as do the corresponding rays from the exterior perspective centre to the objects photographed. The distance between the camera lens and ground (datum), usually mean sea level is known as *flying height* (H), and the distance between camera lens to negative plane is called *focal length* (f). It is the perpendicular distance from the interior perspective centre to the plane of the photograph. The negative plane has a reversal of tone and geometry of the feature on ground and the positive (tone and geometry are similar as ground feature) can be obtained by the contact printing (a, b, c and d) (same focal length) of the negative photo. The point on the ground surface vertically below the camera centre at the time of exposure is known as *nadir point* (N) and the same location on photograph is known as *principal point* (p' on negative plane and p on positive plane). It is the foot of the perpendicular from the interior perspective centre to the plane of the photograph. On photograph corner or side, there are four to eight crosses or arrow marks known as *fiducial marks*and by intersecting these fiducial marks to get the principal point (Figure 1.8b).



(a)



(b)

Figure 1.8 (a), (b): Geometry of vertical aerial photograph.

The stereo-pairs photographs are taken continuously and maintaining overlaps (60 per cent) between consecutive aerial photographs. This pair of photograph known as a stereo-pair can be used for flight line determination and three-dimension visualization with the help of stereoscope (Figure 1.9 a, b).

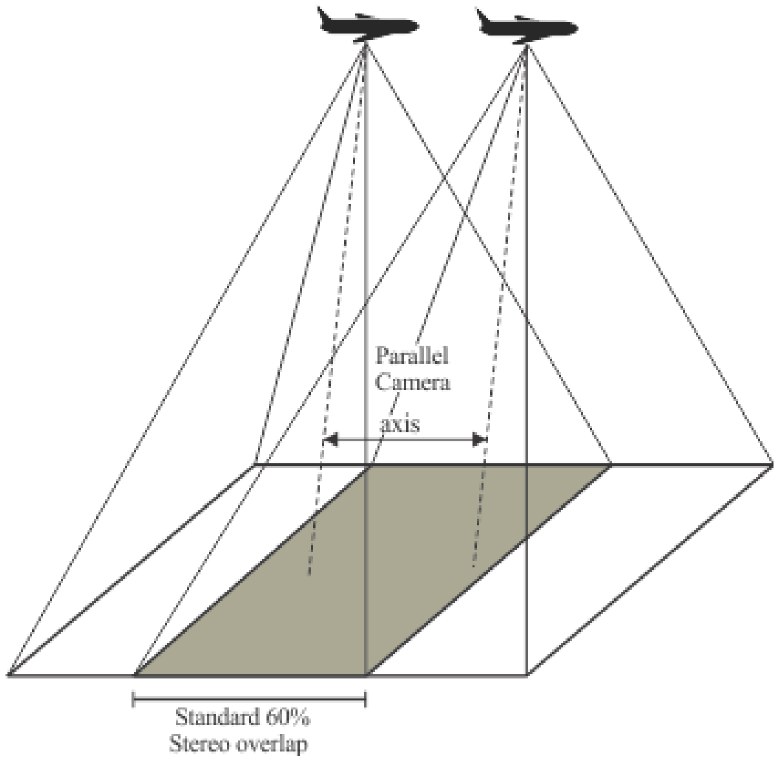


Figure 1.9 (a): Stereo-Photography

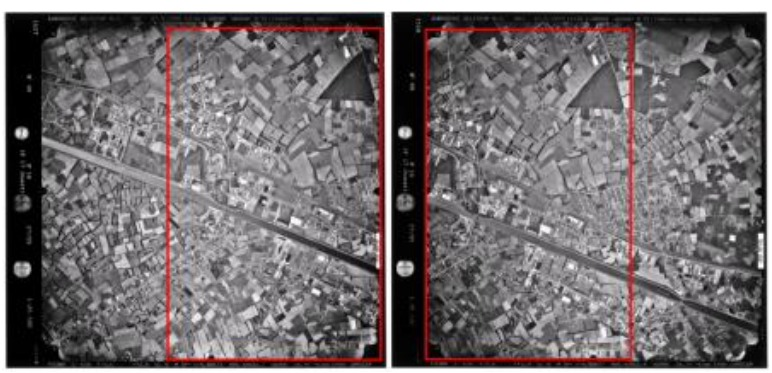


Figure 1.9(b): Stereo-pair (source: ims.seos-project.eu)

Stereoscope is a device by which stereo-pair are viewed to depth perception or three-dimensional (3D) views. It can be pocket or mirror stereoscope. The pocket stereoscope, sometimes known as a lens stereoscope, consists of two magnifying lenses mounted in a metal frame as shown in figure 1.10a. Because of its simplicity and ease of carrying, it is the type used most frequently by military personnel. The mirror stereoscope is larger, heavier, and more subject to damage than the pocket stereoscope. It consists of four mirrors mounted in a metal frame as shown in figure 1.10b.

Figure 1.10(a): Pocket stereoscope

Figure 1.10(b): Mirror stereoscope

Orientation of Stereo Model:

The stereo-pair can use for the orientation of stereo model under stereoscope by preparing the instrument base line about of 50 cm length as shown in figure 1.11. Mark a point C about 15 cm from A and draw a perpendicular line of 25 cm. Put the mirror stereoscope in such a way that the left eye looks straight on point C, then mark the point D on base line by fusing the both point (C,D). In this way the instrument base is prepared. The next step is to find the principal point (P1 and P2) on both stereo-pair by intersecting the fiducial mark on it and transfer the principal point of first photograph to second photograph and mark TP1 and similarly, transfer the principal point of second photograph to first photograph and mark TP2 with the help of mirror stereoscope. Fix the first photograph in such a way that the principal point coincide over C at flight line. The successive photograph is fixed at point D in such a way that the TP1 coincide over the D point. In this way the principal point and conjugate principal point (TP1 and TP2) are in straight line that shows the flight direction and stereo-pair is ready for the stereoscopic view with the help of mirror stereoscope.

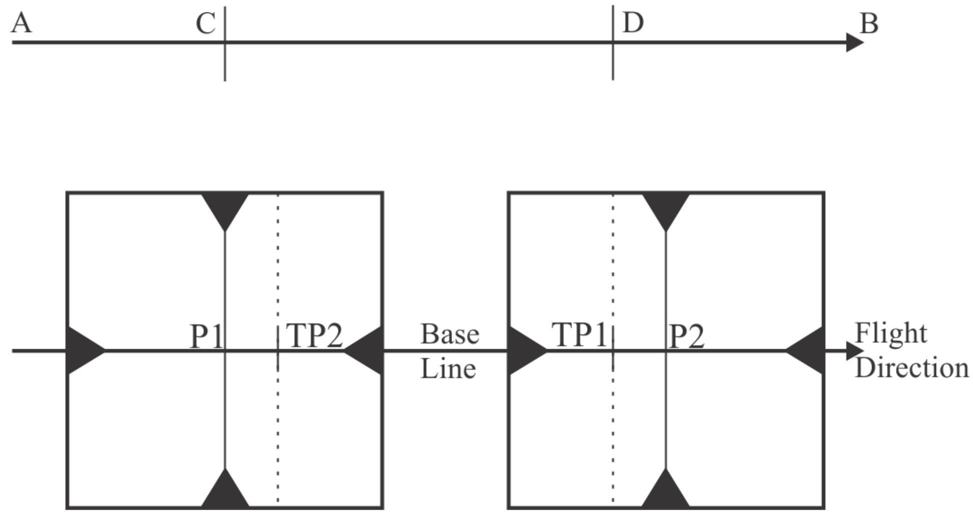


Figure 1.11: Orientation of Stereo-pair for Stereoscopic View

Scale of an aerial Photograph

Scale is the ratio of the distance measure on a map to the corresponding ground distance. The scale of an aerial photograph, hence, show relationship between the distance on the photograph and the corresponding ground distance. Conventional methods of expressing scale include the use of fraction and also the statement in different units. The scale of an aerial photograph is determined by a number of ways. In order of decreasing accuracy there are three major methods to establish relation to ground, map and focal length.

1. Establishing the relation of an aerial photograph to ground: If the corresponding distances of an aerial photograph and ground are known, the photo-scale can be determined by using the formula

$$SP = \frac{DP}{DG}$$

Example 1: If the distance between two points on an aerial photograph is 2cm and corresponding distance on ground is 200 mtrs. Find the scale of an aerial photograph.

Solution: DP (Distance on photograph) = 2 cm

DG (Distance on ground) = 200mtrs.

$$Scale\ of\ the\ aerial\ photograph\ = \frac{DP}{DG} = \frac{2\ cm}{200\ metre}$$

$$= \frac{1\ cm}{100\ metre} = \frac{1\ cm}{10{,}000\ cm}$$

The scale of an aerial photograph is 1:10,000

Establishing the relation of an aerial photograph to map scale: the scale of an aerial photograph can be determined if a reliable map of the area is available. The photo-scale can be determined by using the formula

$$SP = \frac{DP}{DM} \times MAP\ SCALE$$

Example 2: If the distance between two points on an aerial photograph is 10centimetre and corresponding distance on map is 5centimetre. calculate the scale of an aerial photograph when the scale of the map is 1:50000

Solution: DP (Distance on photograph) = 10 centimetre

DM (Distance on map) = 5 cm

Map Scale 1 : 50000

$$Scale\ of\ the\ aerial\ photograph = \frac{10cm}{5cm} \times \frac{1cm}{50{,}000cm}$$

$$= \frac{10cm}{2{,}50{,}000cm} = \frac{1cm}{25{,}000cm}$$

The scale of an aerial photograph is 1:25,000

Establishing the relation between focal length of the camera and flying height. There are three equations to calculate the scale of an aerial photograph at different terrain condition.

In the vertical aerial photograph of the uniform terrain at mean sea level then the scale of an aerial photograph is the ratio between focal length and flying height.

$$SP = \frac{f}{H}$$

Example 3: If the focal length of the camera lens is 15cm and the flying height of the aircraft is 5000 metre as shown in figure 1.12, then calculate the scale of an aerial photograph.

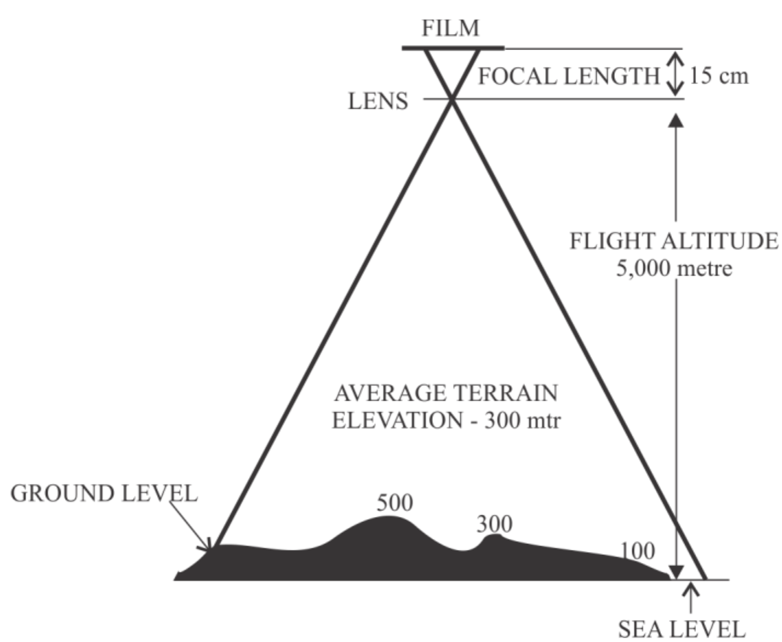


Figure: 1.12: Geometry of an aerial photograph

Solution: Focal length (f) = 15cm

Flying height (H) = 5000 metre

$$Scale\ of\ the\ aerial\ photograph = \frac{15\ cm}{5{,}000\ mtrs.} = \frac{15\ cm}{5{,}00{,}000\ cm} = \frac{1\ cm}{33333.33\ cm}$$

The scale of an aerial photograph is 1:33,333.33 (Approx.). However, if the ground terrain is a table-land or ground above sea level, then the scale of an aerial photograph is determined by using formula:

$$SP = \frac{f}{H - h}$$

Example 4: If the focal length of the camera lens is 15cm and the flying height of the aircraft is 5000 metre, then calculate the scale of an aerial photograph when terrain height is 500 metre above mean sea level (msl).

Solution: Focal length (f) = 15cm

Flying height (H) = 5000 metre

Terrain height (h) = 500 metre

$$Scale\ of\ the\ aerial\ photograph = \frac{15\ cm}{5{,}000\ metre - 500\ metre}$$

$$= \frac{15\ cm}{4{,}500\ metre}$$

$$= \frac{15\ cm}{4{,}50{,}000\ cm} = \frac{1\ cm}{30{,}000\ cm}$$

The scale of an aerial photograph is 1:30,000 (Approx.).

If the ground terrain is not uniform, then the scale of an aerial photograph is determined by using formula:

$$SP = \frac{f}{H - h(avg)}$$

Example 5: If the focal length of the camera lens is 15cm and the flying height of the aircraft is 5000 metre, then calculate the scale of an aerial photograph when terrain height is 100, 300 and 500 metre above mean sea level (msl).

Solution: Focal length (f) = 15cm

Flying height (H) = 5000 metre

Terrain height (h) = 100, 300 and 500 metre

$$h\ average\ (avg.) = \frac{100 + 300 + 500\ metre}{3} = \frac{900}{3}$$

$$= 300\ metre$$

$Scale\ of\ the\ aerial\ photograph$

$$= \frac{15\ cm}{5{,}000\ metre - 300\ metre}$$

$$= \frac{15\ cm}{4{,}700\ metre}$$

$$= \frac{15\ cm}{4{,}70{,}000\ cm} = \frac{1\ cm}{31{,}333.33\ cm}$$

The scale of an aerial photograph is 1:31,333.33 (Approx.).

Mosaic:

Mosaic is an assemblage of two or more overlapping photographs by cutting, matching and pasting to form a continuous photography over a large area. The process of mosaic is known as mosaicking. In the large scale mapping, the study area is not cover in a single photograph, so there is a need to mosaic the continuous overlap photograph to make single map for updating or preparing new map. There are three types of mosaic based on compilation method, controlled mosaic, semi-controlled and uncontrolled mosaic. The controlled mosaic is the assemblage of scaled and rectified photograph to fulfill certain map accuracy specifications. They are the good map substitutes for calculating distance and area of a feature. The semi-controlled mosaic is an assemblage of without rectified photograph or utilizing ground control points to fulfill some rough specifications of accuracy of the map. Uncontrolled mosaic is an assemblage of without any ground control point photograph. The photographs are oriented in position by matching corresponding features on adjacent photographs. There is an advantage of mosaic by substituting maps which may be not available or out of date. In mosaic, the details of surface features are not lost as compare to the map where few details are available. The mosaic presents a large area for study in a composite form for the planning purpose.

1.4 CONCLUSION

The aerial photography is an art of taking photograph from camera with several heights by using aerial platform in good weather condition. It is one of the tools to get the spatial database of our earth surface in few days of planning. Basically, the image is form on a emulsion coated paper or film which is sensitive to light, so photograph is a writing of light. An aerial photography has five criteria for their classification such as frame, scale, tilt, angle and colour. The different type of an aerial photography can use for different purposes. The main use of aerial photograph is photo-interpretation and photogrammetry. In photo-interpretation, we are identifying the features on the photograph and judging their significance for their existence on a single or stereo-pairs and photogrammetry solve the geometry of an aerial photograph by calculation such as scale, distance, etc. The consecutive photograph can be cut and paste to make a large map by the process of mosaic. The aerial photography conjunction with fieldwork and existing map can be complementary to each other for understanding he changing nature of our earth features.

1.5 SUMMARY

Basically, an aerial photography is an act of taking photograph from an airborne platform by the means of usuallyan aircraft. It provides a photograph of large surface area in a single frame. Photograph is a picture which is formed by an action of light on a base material coated with chemical, known as an emulsion that is very much sensitive to light. An aerial photography has a remarkable importance when area is inaccessible for ground survey such as flooded area assessment and it can be planned and implement in few days, as compare to satellite launching.

Due to the low height of the aircraft it provides a detailed picture of the ground surface which is very much useful in large area planning, especially an urban planning. The bad weather condition is an enemy of an aerial photography because a flight cannot be takeoff in a bad condition.

An aerial photograph can be classified by different criteria; one is on the basis of a frame, it can single-frame photograph and multi-frame photograph; on the basis of scale, it can be large-scale, medium-scale and small-scale; on the basis of tilt of camera axis, it can be vertical photograph and oblique photograph; on the basis of angular coverage of the camera lens, it can be very narrow-angle, narrow-angle, wide-angle and super-wide-angle; on the basis of camera film, it can be panchromatic black and white photograph, infrared black and white photograph, true colour photograph and false colour photograph. The act of taking an aerial photograph by different criteria is also known as that kind of photography for example, colour photography can produce colour photograph and oblique photograph is produced by oblique photography.

However, an aerial photograph can be utilized for two purposes one is photo-interpretation and another is photogrammetry. The photo-interpretation is an act of identifying and judging their significance of the features in an aerial photograph. The photo-interpretation of an aerial photograph can be done on single or stereo-pair photograph. The cutting and pasting of stereo-pair can make a mosaic for large area mapping. The photo-interpretation can be done by using the photo elements such as tone, colour, size, shape, texture, pattern, shadow, location, association and resolution.

Initially, photogrammetry of an aerial photograph can be understood by the geometry of vertical aerial photograph. There are various methods of calculating scale from aerial photograph by establishing the relation between photograph and ground; photograph and map; focal length of camera lens and flying height of an aircraft. Before going for aerial photography, the perfect planning is required according the objective of the flight. The few issues must be checked such as delineation of the study area, number of flight lines, type of films, percentage of overlaps, scale, time, season, etc. The aerial photography conjunction with fieldwork and existing map can be complementary to each other for understanding he changing nature of our earth features.

1.6 GLOSSARY

- Aerial photograph : A picture formed by the action of light on a emulsion coated material such as film or paper which is sensitive to light.
- Aerial photography : An act of taking photograph from airborne platform.
- Convergent photography : The combination of two single-lens camera which is parallel to the flight line.
- Fiducial mark : The 4 or 8 marks on sides or corner of an aerial photograph, which is used to get the principal point by intersection these marks diagonally.
- Flight line : The uniform flying height of an aircraft where aerial camera exposes successively.

- Flying height : The height between the mean sea level and camera lens which is mounted of an aircraft.
- Focal length : The distance between camera lens and photo plane
- Forward overlap : The overlap of photograph in the successive direction on flight line.
- Nadir point : The point on the ground surface vertically below the camera centre at the time of exposure is known as *nadir point*
- Oblique aerial photograph : The photograph is taken from an aircraft with the optical axis of an aerial camera intentionally tilted from the vertical are known as oblique photographs.
- Perspective centre : The centre of the camera lens, where all lights from the ground are converge and diverge to the negative plane of the camera isknown as perspective centre.
- Photogrammetry : It is a science of measurement from an aerial photograph.
- Photographic Camera film : It is strip of transparent plastic coated with emulsion on one side of film that is sensitive to light.
- Photographic Emulsion : It is a light sensitive silver halide and gelatin coated on the film or paper to record light.
- Photographic region : The electro-magnetic spectrum, ranges between 0.3µm and 1.2µm wavelength is used for photography is also known as photographic region.
- Photo-interpretation : It is an act of identifying objects and judging their significance in the aerial photograph
- Principal point : The center of an aerial photograph which is marked by intersecting fiducial marks.
- Reconnaissance survey : It is an examination of study area in general by the means of road or aircraft.
- Sidelap : The overlap between the photograph of two adjacent flight line.
- Stereo-pair : It is a pair of aerial photograph of same area taken from two different positions for stereoscopic view.
- Stereoscope : It is an instrument to view stereo-pair to depth perception or three-dimensional view (3D view).
- Tilt : Tilt is an intentionally inclination of the camera axis.
- Trimetrogon photography : The combination 3 camera, assemble in a way that one camera looks true vertical and two camera looks high oblique to take photograph at the same time.
- Vertical aerial photograph : When the photograph is taken with the axis of an aerial camera vertical or near vertical where tilt is less than 3 degree.

1.7 ANSWER TO CHECK YOUR PROGRESS

Q1. Define stereoscope.

Q2. Define mosaic.

1.8 REFERENCES

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1.10 TERMINAL QUESTIONS

Q1. What do you understand by aerial photography? Define types of an aerial photograph.

Q2. Discuss in detail an elements of image interpretation.

Q3. Write a short note on panoramic photography?

UNIT 2: REMOTE SENSING

2.1 OBJECTIVES

The main objective of this chapter is to understand and develop a skill among the students to learn the concept of remote sensing to create near real time database for mapping.

2.2 INTRODUCTION

The term 'remote sensing' simply means 'sensing remotely'. The term 'remote' means distance, it could be one metre to thousands metre or more. Another term 'sensing' means acquiring knowledge. So remote sensing means acquiring knowledge from a distance. The literal meaning of remote sensing is not only the sensing but it includes the complete processes in which the data about the earth surface is recorded through electromagnetic energy, processing in the laboratory to make data usable for different application and analysis of rectified data in multidisciplinary approach.

Colwell (1966) define the term 'remote sensing' in its broadest sense merely means 'reconnaissance at a distance'. He also defined (1983) 'The measurement acquisition of information of some property of an object or phenomenon, by a recorded device that is not in physical or intimate contact with the object or phenomenon under study'. Further, he defined (1997) 'The art, science, and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring, and interpreting imagery and digital representations of energy patterns derived from non-contact sensor systems'.

Fussell (1986) defines 'Remote sensing is the acquiring of data about an object without touching it'.

According to *Robert A. Schowengerdt (1997)*'Remote sensing is the measurement of object properties on the earth's surface using data acquired by sensors on board aircraft and satellite'.

According to *Thomas M. Lillesand and Ralph W. Kiefer (2000)* 'Remote sensing is the science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation'.

According to *James B. Campbell (2003)*, 'Remote Sensing is the practice of deriving information about the earth's land and water surfaces using images acquired from an overhead perspective, using electromagnetic radiation in one or more regions of the electromagnetic spectrum, reflected or emitted from the earth's surface'.

According to *John. R. Jensen (2007)*, 'Remote sensing is the process of collecting data about objects or landscape feature without coming into direct physical contact with them'.

Remote sensing is a multidisciplinary activity which deals with the inventory, monitoring and assessment of natural resources through the analysis of data obtained by observations from a remote platform. So remote sensing can be defined as an art, science and technique of collecting real information, without being physical contact with an object or phenomena through the sensor or camera from the various platforms over the wide range of electromagnetic energy by the means of tripod, aircraft or spacecraft or satellite for multidisciplinary activity.

Platforms and sensors

In remote sensing, platforms may be moving or static place where sensor can mount to collect the images or photo. In general, platform is a mean of holding the sensor aloft. It is a stage to mount the camera or sensor to acquire the information about the target under investigation. The moving platforms such as balloon, kite, pigeon, aircraft and spacecraft/satellites. The static platforms are high rise building, tripods, etc., used for collecting ground information (ground truth) or laboratory simulation or experimental purposes. On the basis of altitude above the earth surface, platform may be classified as, ground borne, airborne and spaceborne.

Type of platforms:

Groundborne : As the term imitate that, the sensor is positioned near to the ground by the means of tripod, building top, hand held or moving vehicle is a groundborne platform, to collect the information is known as groundborne remote sensing. The ground based remote sensing system for earth resources studies are mainly used for collecting the ground truth or field work or for laboratory simulation studies before sensor mounting on the airborne or spaceborne platform. It may be static or moving. E.g. camera or radiometer mounted to a pole or tripod or moving vehicle to assess the reflectance behavior of an object or phenomenon or a specific crop during day or season.

Airborne : when camera or sensor are mounted on an aircraft to collect the information about the earth is known as airbourne remote sensing. Earlier pigeon, balloons or kites was used for airborne remote sensing. This platform providesdifferent altitude (platform) and convenient to acquire the data in terms of time and requirements. Airborne observations are possible from 100 metres to35-30 km height above ground. The speed of the aircraft can vary between 140 – 600 km/hrs. In India the task of aerial photography is carried out by three agencies: Indian Air Force, Air Survey Co. (Pvt.) Ltd., Dum Dum, Kolkata and National Remote Sensing Centre (NRSC), Hyderabad.

Spaceborne : when the sensor is mounted on the satellite and placing with the help of satellite launching vehicle in the circular space orbit in spaceborne platform. The spaceborne platform provide the high speed of the satellite, large field of view and more spatial coverage due to continuous observations of the earth surface. This platform is not affected by the earth's atmosphere as in found in airborne platform. Depending upon the altitude, there are two types of orbit i.e. polar orbit and geostationary orbit, are used to place the satellites, depending on the objectives of the mission. The polar orbiting satellite moving north-south direction and cover the whole earth, placed at the height of around 700 km. Polar orbit satellites is also known as sun-synchronous satellite because it is synchronised with the local sun-time at same latitude or it passes over all the places on earth having the same latitude at the same local sun-time. For example, if satellite passes at 10.30 am on equator, then every local time satellite passes on equator at 10.30 am at different longitude. All the remote sensing resource satellite is the polar orbit. This orbit covers whole globe periodically and gives repetitive coverage. For example, Landsat, SPOT, IRS.

Geostationary orbit ***: As*** name suggests, it is stationary with respect to earth. The geostationary satellite also has a motion from west to east direction and the speed of satellite is synchronised with the speed of the earth. The coverage of the satellite is near hemispheric i.e. 70^0 north to 70^0 south and it can view only one-third of the earth over the same area day and night. The view the whole earth requires at least three geostationary satellites. The geostationary orbits are also concentric but it has zero inclination, placed at height of 36000 km. The main use of this orbit is in the field of telecommunication and meteorology. E.g. GOES, METEOSAT, INSAT and GSAT series or telecommunication relay satellites.

Sensor:

The It measures reflected, scattered or emitted electromagnetic energy from the area of interest. Our eyes are also act as a sensor to see the object or phenomena but it has some limitations. The photographic camera, as we commonly use, is also a type of sensor that provide the photographs in digital as well as analog.

Type of sensor - Depending upon the *source of light*, sensor can be passive or active.
Passive sensor: If the sensor receiving the external source of energy, generally by the sun (reflected energy) as well as from the earth surface (emitted energy) emission, is a *passive sensor*. These sensors don’t have their own source of energy and used in the day time by solar energy and at the night-time uses the emitted energy from earth i.e. thermal energy sensed by the thermal sensors.

Active sensor: If the sensor using their own source of energy then it is known as ***active sensor***. Flash gun with camera is act as active sensor by providing light to the target and reflected energy us received by the sensor. For example, RADAR (RAdio Detection And Ranging).
Depending upon the *sensor system,* sensor may be imaging and Non-imaging sensor system.

Non-imaging sensor: This includes sounders and altimeters for measuring of high accuracy locations; and topographic profiles, spectrometer and spectro-radiometer for measurement of high spectral resolution along-track lines or swath; and radiometers, scatterometers and polarimeters for high accuracy intensity measurements and polarisation changes measurements along-track line or wide swath.

Imaging sensor system: The sensor that provides image, are two types, one is framing system and another is scanning system. The photo of an area taken by the camera, frame by frame is known as framing system. It can be stored in photo sensitive film or digital media. This includes images from photographic film cameras, digital camera and Return Beam

Sensor's Resolution:

Resolution means resolving power. It is measure of the ability of an optical system or sensor to distinguish between signals that are spatially near or spectrally similar. Ability to separate closely spaced objects on an image or photograph. Resolution is defined as the ability of the sensor to render the information at the smallest discretely separable quantity in terms of*Distance (Spatial resolution), Wavelength band (Spectral resolution), Radiation quantity (Radiometric resolution) and Time (Temporal resolution).*

Spatial resolution: It is sensor capability to sense the ground segmentat any instant. It is also called ground resolution element (GRE). It can be defined as the Instantaneous Field of View (IFOV) which can be defined as the field of a scanner with the scan motion stopped. If one pixel is a ground cell sample of 5.8 by 5.8 metre then no objects smaller than 5.8 metre can be distinguished from their background. This does not mean that the object cannot be detected. Examples are IRS-1A / 1B, LISS-I sensor has 72.5 metre, LISS-II sensor has 36.25 metre, IRS-1C/1D, LISS-III sensor has 23.5 metre, IRS-P6 (Resourcesat) LISS-IV sensor has 5.8 metre spatial resolution.

Spectral resolution : The specific wavelength intervals in the electro-magnetic spectrum that a sensor can record. Spectral resolution of a remote sensing instrument (sensor) is determined by the bandwidths of the Electro-magnetic radiation of the channels used. High spectral resolution, thus is achieved by narrow bandwidths collectively, are likely to provide a more accurate spectral signature for discrete objects than broad bandwidth. Examples are IRS-1A/1B, LISS-I and II has 4 bands, LANDSAT 1-2 has 3 bands, TM has 7 bands,SPOT 3-4 multispectral has 5 bands, IRS-P6 (Resourcesat) PAN has 1 band.

Radiometric resolution: The number of digital levels (colour) used to express the data collected by the sensor. Number of discrete levels into which a signal strength may be divided or quantisation. In general, the greater the number of levels the greater the detail in information. For example 6 bit data has 64 levels (0 – 63), 7 bit data has 128 levels (0–127), 8 bit has 256 levels (0 – 255), 9 bit data has 512 levels (0 – 511) and so on.

Temporal resolution: It is a revisit period of the satellite over the same area or time between successive image acquisitions over same area. Temporal resolution is also called the repeativity of the satellite in the case of satellites. For example, IRS-1A/1B, 1C/1DLISS-I and II has 22 days, LISS-III has 24 days, PAN has 5 days; LANDSAT MSS has 18 days, TM has 16 days; SPOT has 5/26 days.

2.3 PRINCIPLES OF REMOTE SENSING

The remote sensing is totally depending upon electromagnetic energy, refers to all energy that moves with the speed of light in a harmonic wave pattern and broadly, includes lights, heat, and radio waves. It is propagating through the space in a sine wave with constant speed which has two fields, one is electrical and another is magnetic, called electro-magnetic energy (figure 2.1).

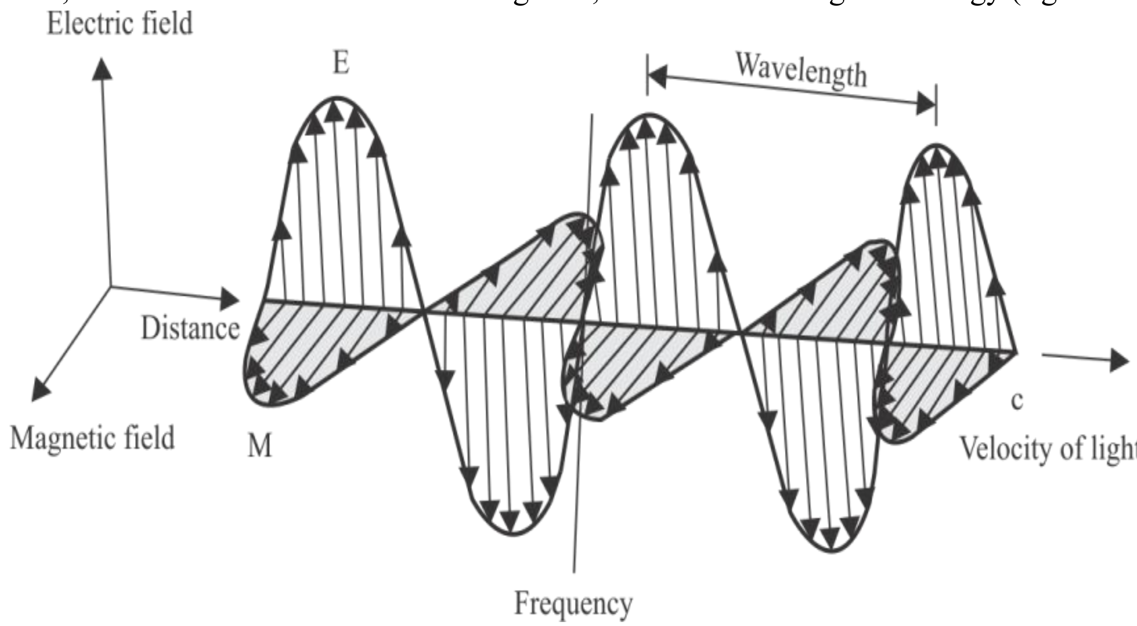

Figure 2.1: Electromagnetic energy

There are three measurements used to describe electromagnetic wave such as wavelength, frequency and velocity. The wavelength is distance between successive wave crests or troughs and it is denoted by *lamda* (λ), measured in metre (m), nanometer (nm or 10^{-9} m) and micrometer (µm or 10^{-6} m). The frequency (υ) is the number of cycles of a wave passing through a fixed point. It is measured in hertz (Hz), corresponding to one cycle per second. The speed or velocity (c) of the electromagnetic energy is equal to the speed of light i.e. 3 x 10^{8} metre/second (3,00,000 km/second or 186000 miles/second). There is a relationship between the wavelength, frequency and energy in the electromagnetic energy radiation (Figure 2.2). Shorter the wavelength, high the frequency and energy. Conversely, longer the wavelength, low frequency and energy. There is inverse relationship between wavelength and frequency. For example, gamma rays (< 10^{-9} m) has more energy, high frequency and short wavelength whereas, radio waves (>1m) has less energy, low frequency and long wavelength. In remote sensing, it is very difficult to detect the long wavelength than short wavelength.

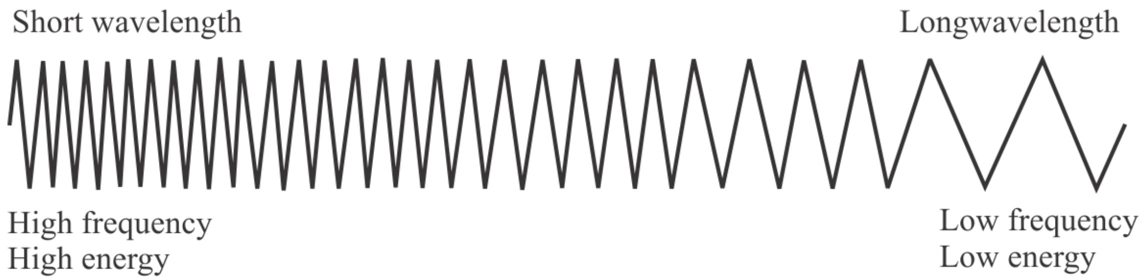

Figure 2.2: Relation between wavelength, frequency and energy

Electromagnetic Spectrum:

Theelectromagnetic energy is categories on the scale of wavelength is called the Electromagnetic spectrum (Figure 2.3). It is extending from the gamma rays (smallest wavelength) to radio waves (largest wavelength). It is categories into various spectral regions also known as spectral bands. The electromagnetic spectrum is divided into two parts, one is optical region and another is microwave region. Optical region of the electromagnetic spectrum refers to that part of the spectrum in which optical laws can be applied. These relate to phenomena, such as reflectance and refraction that can be used to focus the radiation. The optical ranges from X-rays (.02 µm) through the visible part of the electromagnetic to far infrared (1000 µm) region. The microwave region is extending from 1mm to 1 metre.

Gamma rays (shorter than 0.03 nm) and X-rays (0.03 nm to 0.3 µm): This region have been used to an even lesser extent because of atmospheric opacity. Their use has been limited to low-flying aircraft platforms or to the study of planetary surfaces with no atmosphere (e.g., the Moon). This spectral region is used mainly to sense the presence of radioactive materials.

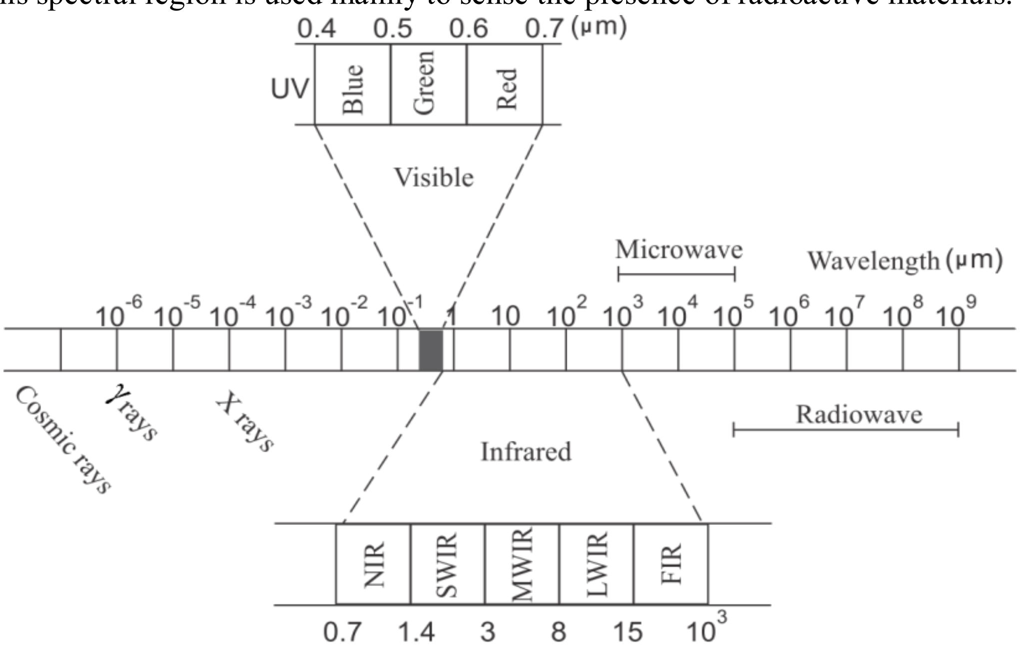

Figure 2.3: Electromagnetic spectrum

The ultraviolet region (0.3 µm to 0.4 µm): Ultraviolet sensors have been used mainly to study planetary atmospheres or to study surfaces with no atmospheres because of the opacity of gases at these short wavelengths. An ultraviolet spectrometer was flown on the voyager spacecraft to determine the composition and structure of the upper atmosphere of Jupiter, Saturn and Uranus.

The visible region (0.4**µm** – 0.7**µm**): This region plays an important role in remote sensing because it has maximum illumination by sun and widely available sensor to detect this energy. This is also known as 'light'. It occupies a relatively small portion in the electromagnetic spectrum but it only region that is associated with the concept of colour, i.e. blue, green and red which are known as primary colours.

Infrared region (0.4µm - 10^3µm): This region is sub-divided into sub-regions called reflected infrared, thermal infrared and far infrared. The reflected infrared divided into near infrared (NIR), wavelength is 0.7 µm to 1.4 µm and Short Wave Infrared (SWIR), wavelength is 1.4 µm to 3.0 µm. The thermal infrared also categories into Mid Wave Infrared (MWIR), wavelength is 3.0 µm to 8.0 µm and Long Wave Infrared (LWIR), wavelength is 8.0 µm to 15.0 µm. the far infrared sub-region wavelength is 15.0 µm to 1000 µm or 1mm.

The microwave region (1mm – 1metre): It covers the neighboring region, down to a wavelength of 1 mm (300 GHz frequency). In this region, most of the interactions are governed by molecular rotation, particularly at the shorter wavelengths. This region is mostly used by microwave sensors such as radiometers and radar systems.

The radio wave region (more than 10 cm): It covers the region of wavelengths longer than 10 cm (frequency less than 3 GHz). This region is used by active radio sensors such as imaging radars, altimeters, and sounders, and, to a lesser extent, passive radiometers.

Interaction of electromagnetic radiation with atmosphere:

The atmosphere is never completely transparent to electromagnetic radiation. However, at some wavelengths it has good transparency or absorbing characteristics. The atmospheric constituents restrict the interactions of the direct solar radiation and reflected radiation with the target called atmospheric effects. The atmosphere is interacting with electromagnetic radiation by Atmospheric refraction, scattering, absorption and reflection.

Refraction : It means the bending of light when it passes from one medium to another. Refraction occurs because the different density of atmospheric layers in which electromagnetic radiation passes through it. The amount of refraction is depending on the distance between source and target as well as density of the air. The locational error is occurring in the image due to refraction.

Scattering : The multiple reflections of electromagnetic energy by particles and surfaces is known as scattering. It is an 'unpredictable' reflections. (i*n reflection the direction of reflection is predictable).* Thereare three types of scattering occurs in the atmosphere such as rayleigh, mie and non-selective, depending on the size of the scatterers (atmospheric constituents) in relation to the wavelength of radiation being scattered.

(a) Rayleigh scattering: When radiation interacts with atmospheric constituents such as molecules and other tiny particles that are much smaller in diameter than the wavelength of the interacting radiation, causing the sky to appear blue, otherwise black. It also causes the sky to appear orange to red at sunrise and sunset because the sun rays travel through a longer atmospheric path length than during noon. It effects on imagery to become hazy and reduce the crispness or contrast of the image.

(b) Mie scattering: when particle size is equal to the wavelength such as water vapor and fine dust particles in the atmosphere, fulfill this condition for Mie scattering. It also effects the visibility in the imagery by heavy atmospheric haze

(c) Non-selective: When particles size is larger than wavelength such as water droplets, fine dust particles and cloud with diameters ranging from 5 – 100 μm, that scatters allwavelengths of visible and near to mid infrared region.The fog and cloud appear whitish because the mixture of all the visible light, produces the white light.

Atmospheric absorption: The atmosphere is not open for all electromagnetic radiations to reach the earth's surface, some are absorbed by the constituents such as various gas molecules available in the atmosphere. The most efficient absorbers of solar radiation in this regard are water (H_2O), carbon dioxide (CO_2), ozone (O_3), oxygen (O_2) and nitrous oxide (CO_2). The cumulative effect of the absorption by the various constituents cause the atmosphere to close down completely in certain regions of the spectrum called atmospheric absorption band. There is no energy is available to be sensed by sensor. The absorption and scattering act to reduce the amount of radiation received by satellite and the combined effect of these two is called attenuation, the energy loss caused by the atmosphere.

Interaction of Electromagnetic Radiation with Earth Surface's Feature:

When electromagnetic energy is incident on any given earth surface feature, three fundamental energy interactions with them i.e. reflected, absorbed and transmitted (Figure 2.4).There is a close relationship between these three energy interactions as

$E_I (l) = E_R (l) + E_A (l) + E_T (l)$

$E_R (l) = E_I (l) – [E_A (l) + E_T (l)]$

Where

E_I = Incident Energy

E_R = Reflected Energy

E_A = Absorbed Energy

E_T = Transmitted Energy

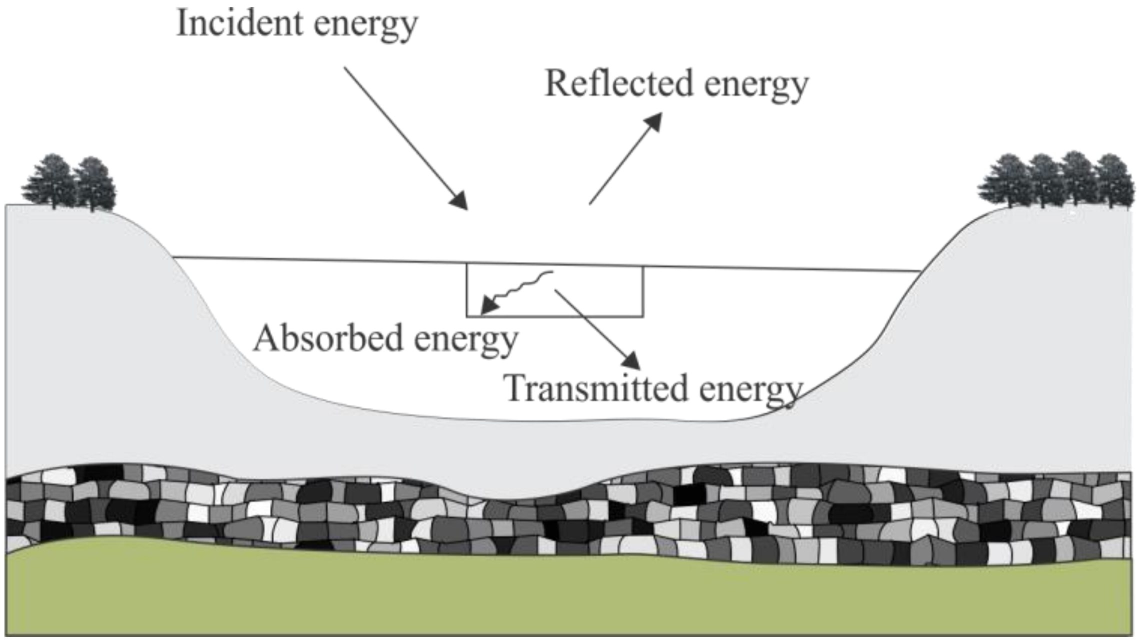

Figure 2.4: Interaction of Electromagnetic Radiation with Earth Surface's Feature

The proportions of energy reflected, absorbed and transmitted from earth features is depend upon the material type, condition and wavelength. These differences permit us to distinguish different features on an image. Thus, two features may be indistinguishable in one spectral range and easily distinguishable in another wavelength band. Many remote sensing systems operate in the wavelength regions in which reflected energy predominates, so the reflectance properties of earth features are most important to identify features in image (Table 2.1).

Table 6.1: *Atmospheric windows for remote sensing.*

	Spectral Regions	Spectral Bands
1.	VIS (Visible)	0.4–0.70 µm
2.	NIR (Near Infrared)	0.7–1.10 µm
3.	SWIR (Short wave Infrared)	1.1–1.35 µm 1.1–1.80 µm 2.0–2.50 µm
4.	MWIR (Mid wave Infrared)	3.0–5.00 µm 4.5–5.00 µm
5.	TIR (Thermal Infrared)	8.0–9.50 µm 10.0–14.0 µm
6.	Microwave	0.1–100 µm

Reflectance: It is a ratio of the reflected light spectrum to the incident light spectrum. The process by which a beam of particles or a wave in collision with an opaque surface may be deviated or reversed in direction. Reflectance may be s*pecular* or *diffuse*. Specular reflectors are flat surfaces that apparently mirror like reflections, where the angle of reflection is equals to the angle of incidence such as calm water or very smooth surface. The diffuse or Lambertian reflectors are rough surfaces that reflect uniformly in all directions (Figure 2.5). Most of the earth surfaces are neither perfectly specular nor diffuse reflectors. So, their characteristics are in between the two extremes which is very much useful in remote sensing.

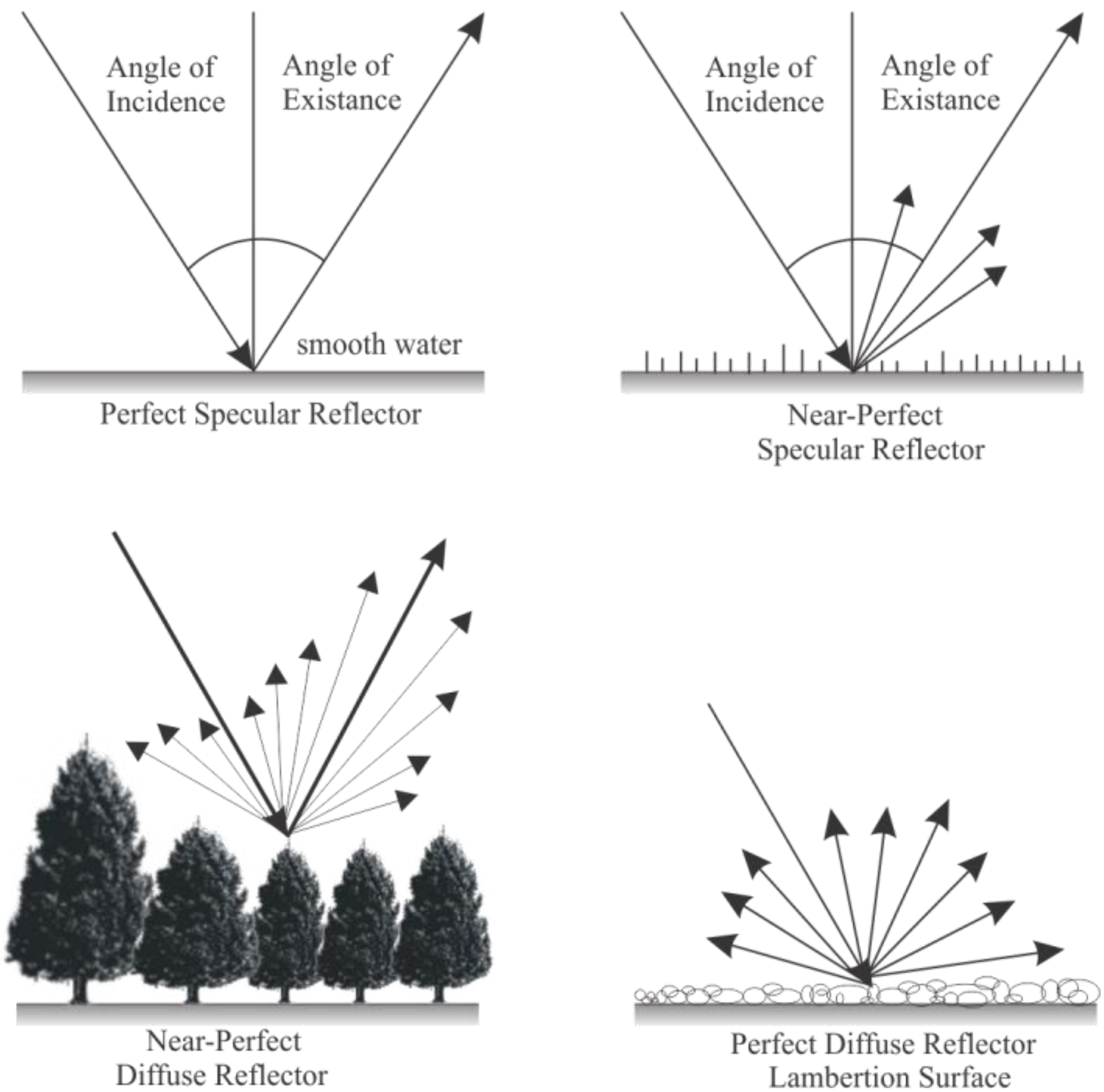

Figure 2.5: Reflectance behavior of specularand defuse energy

When the wavelength of incident energy is much smaller than the surface particle size that make up a surface, the reflection from the surface will diffuse. For example, in relatively long wavelength radio range, a sandy beach can appear smooth texture to incident energy, whereas, in the visible portion of the spectrum, it appears rough texture. In remote sensing, diffuse reflectance from the surface is most important because it contains spectral information or the 'colour' of the reflecting surface, whereas, specular reflection do not contain any colour, it appears bright or dark in the imagery.

The reflectance characteristics of earth surface features may be quantified by measuring the portion of incident energy that is reflected. This is measured as a function of wavelength called spectral reflectance. A graph of the spectral reflectance of an object as a function of wavelength is termed as a spectral reflectance curve (Figure 2.6).

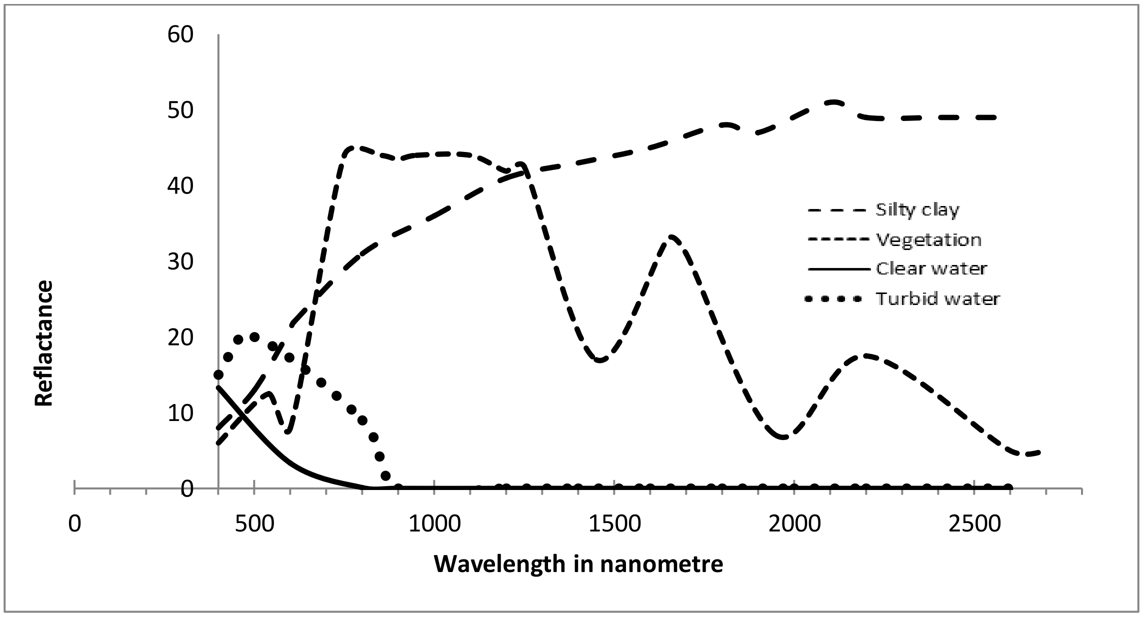

Figure 2.6: Spectral reflectance curve

Interaction of Electromagnetic radiation with soil : The various characteristic of the soil such as soil moisture, texture, surface roughness, minerals and organic matter,interact differently with the electromagnetic energy. Coarse texture of sandy soils are usually well drained, resulting low moisture content and relatively high reflectance of electromagnetic energy. Poorly drained fine-textured soil will generally have lower reflectance of electromegnetic energy. The absence of water in the soil will show the reverse tendency, coarse-textured soils will appear darker in the imagery than fine-textured soils. Surface roughness and organic matter like iron oxide in the soil decreasesoil reflectance.

Interaction of Electromagnetic radiation with vegetation : The vegetation is mostly consisting of leaf, contains pigment, chlorophyll, structure and moisture. Our eyes perceive healthy vegetation as green in color because of the very high absorption of blue and red energy by plant leaves and the very high reflection of green energy. The blue and red bands are the chlorophyll absorption region. The stress on plant decrease chlorophyll production, resulting less chlorophyll absorption in blue and red bands. The structure of the leaf is highly variable between different plant species such as banyan leaf, mango leaf, banana leaf, etc., near-infrared region can be useful to discriminate tree species, even if thy look same in visible region. There is a water absorption at 1.4, 1.9 and 2.7 µm is referred as water absorption bands and 1.6 and 2.2 µm wavelength has peak reflectance between absorption bands, used to identify the moisture condition.

Interaction of Electromagnetic radiation with water: As you know stagnent water surface is act as specular reflection. But the suspended material in the water and the bottom of the shallow water body interact differently with the electromagnetic energy. Clear deep water is act as a blackbody for the near infrared and beyond energy, that is absorbed by the water. The suspended material of water increases the reflectance of the energy. The chlorophyll concentration in the water tend to decrease reflectance in blue region and increase reflectance in green region, used to monitor the concentration of algae through remote sensing data. The snow has very high reflectance in visible region, but it drops in near-infrared region. The mid-infrared (SWIR) region is used to identify snow and cloud due to low reflectance by snow and comparatively high reflectance from cloud.

Atmospheric Window

The atmosphere interacts differently with the wide range of electromagnetic energy and selectively transmits energy of certain wavelengths of energy. These wavelengths offer maximum transmission and minimal attenuation through a particular medium with the use of a specific sensor. The spectral bands for which the atmosphere is relatively transparent are known as atmospheric windows. In another word, a portions or wavelength intervals of the spectrum that transmit radiant energy effectively are called atmospheric windows. These windows play important role in remote sensing of the earth resources from satellite platforms.

2.4 ELEMENTS OF REMOTE SENSING

In the remote sensing process, various mechanism/activities are involved while supplying the final data to the user community. The mechanism/activities are as follows (Figure 2.7).

(a) **Source of energy:** There are two natural sources of energy i.e. sun and earth. The sun is major source of energy in the form of electromagnetic energy that illuminate the object. The other sources energy is flash gun, radar, geo-thermal energy etc. which is interacting with an object.

(b) **Interaction of electromagnetic radiation with an atmosphere:** The electromagnetic energy travels through the different thickness of the atmospheric layer to reach the target. It travels twice a time in the atmosphere when it reaches to the sensor.

(c) **Interaction of electromagnetic radiation with an earth surface:** The energy is interacting with earth surface features such as land, water and vegetation. Depending upon the properties of the various features on earth, the electromagnetic energy interacted differently.

(d) Electromagnetic energy received by the sensor: After interacting the energy with an object on the earth surface, is reflected back to atmosphere. That reflected energy is acquired by the sensor. The amount of energy received by the sensor is depends on the object behavior and the atmospheric condition.

(e) Transmission to the ground station: The electromagnetic energy, received by the sensor is converted into signals and transmitted to ground receiving station located at various part of the world. In India, Hyderabad and many more cities has a facilities to receiving these signals.

(f) Rectification of data: These received signals are converted into the picture elements and make image data. These image data, in raw form supplied by the sensor, is not useful to the common user community. These data are rectified according to the need of the user requirement.

(g) Supply to the user: The rectified image data called imagery is supplied to the user for their requirement in the form of digital or analog. These data are finally digitally or visually analyses and drawing the conclusion that can be applied to the various fields or application.

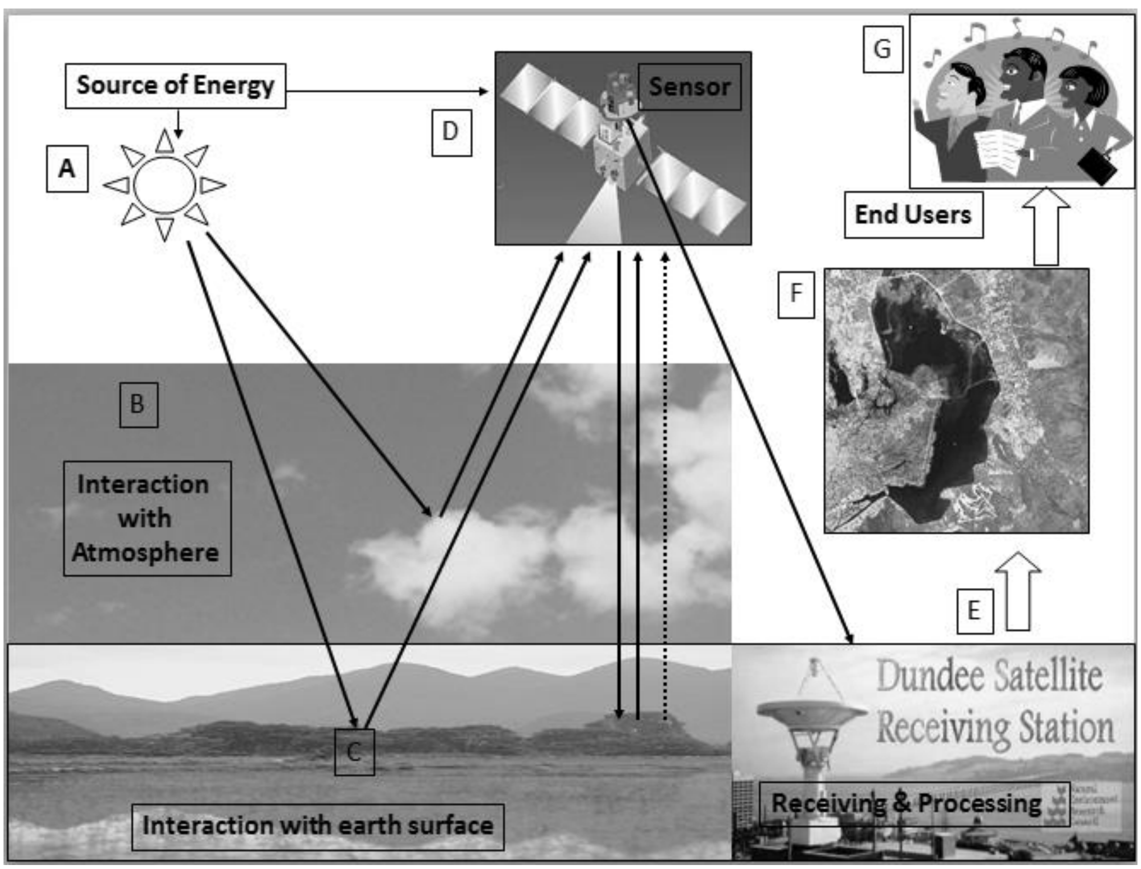

Figure 2.7: Stages of remote sensing

DIGITAL IMAGE PROCESSING:

The satellite image in the form of raw image which is not useful to the user community, requires a significant amount of processing. So, digital image processing in general involves the use of computers for manipulating digital image to improve their quality and/or modify their appearance (Wolf and Dewitt, 2000). It is a task of processing and analyzing the digital image using some image processing algorithm to perform an interpretation according to certain conditions defined by the operator. Digital image is a two-dimensional rectangular array of cell or picture element known as pixel (Figure 2.8). Each pixel has numerical value, represents the energy reflected or emitted from the earth's surface which is measured by the sensor, known as digital numbers (DNs) or pixel value or grey level. The range of the DNs is varying according to the radiometric characteristics of the sensor, for example in 8-bit quantification data has a range of 0 to 255 = 256 grey levels, where 0 represent *black* and 255 represent *white* colour in the image.The coordinates of the digital image are represented by row and column number and it is calculated from upper left corner to upper right corner represent column and upper left corner to lower left corner represent row. Depending upon on the sensor characteristics, digital image can be single band or multi-band. The coordinates of all the bands are common and overlay as layer stack.The single band image is display by grey level of black to white. The colour images are composition of the three-band can display in real colour or the false colour composite (FCC).The standard false colour composite which is generally used for image processing is infrared band to red channel, red band to green channel and green band to blue channel. The combination of false colour composite is depends on the application by the user.The main processes are preprocessing, enhancement and image classification. Before understanding the process, we much understand about the digital image.

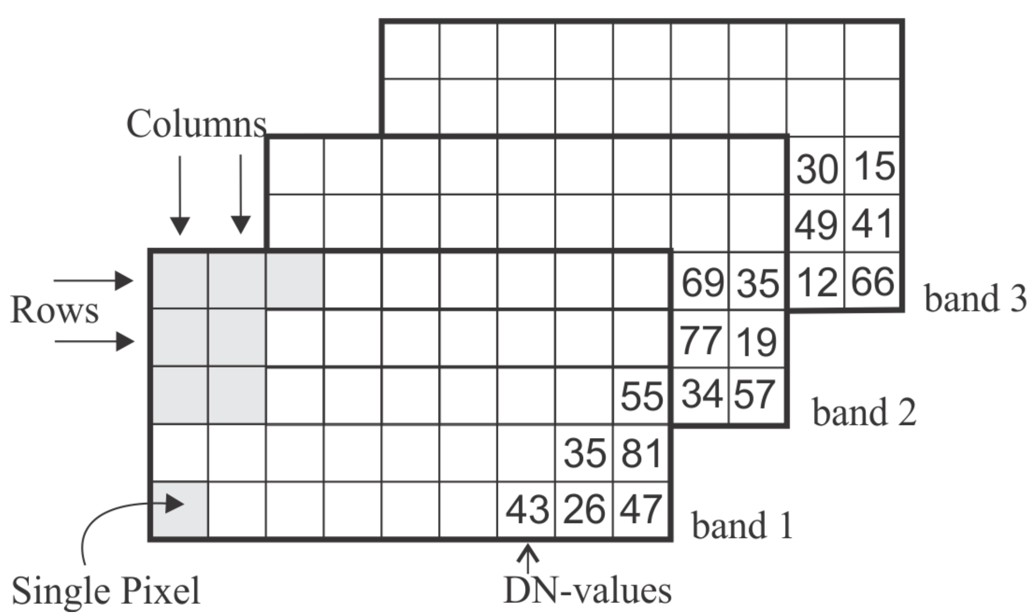

Figure 2.8: Structure of Image

Pre-processing:

It is a process of image rectification and restoration to correct the distorted or image to create a more faithful representation of the original image. Typically, geometric correction, radiometric correction and noise correction is applied. Geometric correction means the repositioning of the pixels from their original locations in the data array into a specified reference grid or providing geographical coordinates to the image by using the various projection parameters. The radiometric correction means alter the pixel value. In the raw image there are various problems in the visibility in the imagery due to different noise and line dropout where information is missing, which can be rectified by various algorithms.

Image Enhancement:

Image enhancement involves techniques for increasing the visual distinctions between features in a scene. It can be divided into two parts, one operate on individual pixels and enhance the individual value of pixel without reference to their spatial context, also known as radiometric enhancement e.g. contrast enhancement, histogram equalization; and another, use of spatial information deals with the average value of neighboring pixels known as spatial enhancement. e.g. spatial filtering. Contrast enhancement is a conversion of original digital range into full range of display. It is only intended to improve the visual quality of a displayed image because of low visibility in the raw image. Spatial filtering changes the image data according to the pixel values in its neighborhood. Spatial averaging is one of the spatial filtering, which is used to reduce noise or speckle in the data. spatial filtering is a means of improving image by suppressing (low pass filtering) or enhancing (high pass filtering) certain spatial frequencies, directions and textures. Low pass filter: Low pass filter would pass low frequencies and block high frequencies. It preserves the local mean (the sum of their weight is one) and smooth in the output layer resulting the blurring effect in the output image. High pass filter: The high pass filter remove the local mean (the sum of their weight is zero) and produce an output which is measure of the deviation of the input signal from the local mean (figure 2.9).

Image = low pass + high pass
Low pass = image – high pass
High pass = image – low pass

0	0	0
0	0	0
0	0	0

Original image

1	1	1
1	1	1
1	1	1

Low pass filter

-1	-1	-1
-1	+9	-1
-1	-1	-1

High pass filter

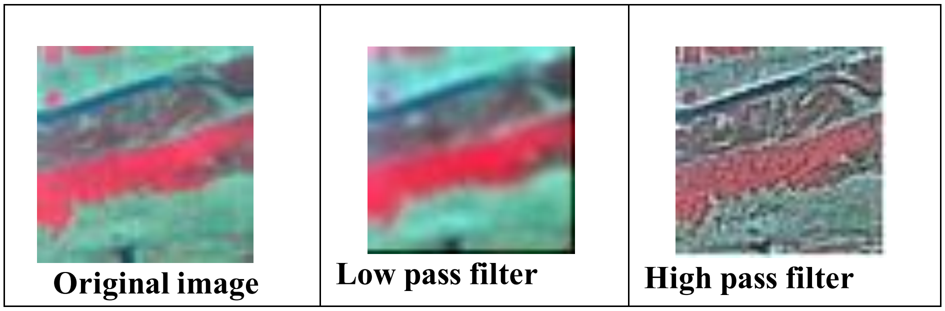

Figure 2.9: Low and high pass filtering

IMAGE CLASSIFICATION:

The rectified image can be used for extracting the information by two methods, one is visual image interpretation by taking the hardcopy printout of the rectified image and another is digital image classification. Image classification is process of generating thematic map by categorisation of the similar pixels. The level of classes is depending on the resolution of the sensor by which the image has been taken. There are various classification systems with different level are available as given by Anderson (Table 2.2). It is generally accepted that the Anderson level I categories can be reliable mapped using Landsat MSS imagery, and level II categories with TM and SPOT multispectral imagery (Lillesand and Kiefer, 1987). Level III and further requires SPOT, IRS LISS IV or higher resolution imagery for classification.

Table 2.2:*Land use and land cover classification system for use with remote sensor data (Anderson at al., 1976)*

Level I	**Level II**
1 Urban or Built-up Land	11 Residential 12 Commercial and Services 13 Industrial 14 Transportation, Communications, and Utilities 15 Industrial and Commercial Complexes 16 Mixed Urban or Built-up Land 17 Other Urban or Built-up Land
2 Agricultural Land	21 Cropland and Pasture 22 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas 23 Confined Feeding Operations 24 Other Agricultural Land
3 Rangeland	31 Herbaceous Rangeland 32 Shrub and Brush Rangeland 33 Mixed Rangeland

4 Forest Land	41 Deciduous Forest Land 42 Evergreen Forest Land 43 Mixed Forest Land
5 Water	51 Streams and Canals 52 Lakes 53 Reservoirs 54 Bays and Estuaries
6 Wetland	61 Forested Wetland 62 Non-forested Wetland
7 Barren Land	71 Dry Salt Flats. 72 Beaches 73 Sandy Areas other than Beaches 74 Bare Exposed Rock 75 Strip Mines Quarries, and Gravel Pits 76 Transitional Areas 77 Mixed Barren Land
8 Tundra	81 Shrub and Brush Tundra 82 Herbaceous Tundra 83 Bare Ground Tundra 84 Wet Tundra 85 Mixed Tundra
9 Perennial Snow or Ice	91 Perennial Snowfields 92 Glaciers

Visual Image Interpretation:

It is defined as an act of examining image to identify the object or phenomenon and judging their significance by interpreter. It is an interpreter ability to extract the information visually with the help of various characteristics present in the image known as elements of image interpretation such as colour, tone, texture, pattern, site, shadow, etc. With the help of this element or a set of elements, interpreter prepares the interpretation key, a reference material which provides the logical rules to identify the feature or objects on the image such as forest, waterbodies, settlement, agriculture, etc. The visual interpretation has certain disadvantage i.e. it requires intensive labour work for delineation and evaluation of each theme. Our eyes cannot discriminate certain feature due to poor tonal characteristics of some feature, resulting entire spectral characteristic cannot be utilised by the interpreter. It is also difficult to incorporate into the GIS environment for further analysis in compare to digital classification.

Digital Image Classification:

There are basically, two methods for digital image classification, one is supervised and another is unsupervised, but hybrid classification is done by combination of both methods. The ultimate aim of the digital image classification is to increase the accuracy of the classified image.

Supervised classification: This method is performed when the interpreter has a priori knowledge about an image area. There are few steps, should be follow while applying supervised classification method like selection of training samples, evaluation of selected samples, appropriate classification algorithms. The training samples are sets of pixels selected to represent the individual land use/cover class (feature class). The samples must be the pure and representative of the class. The accuracy classification of an image is totally depending on the training samples, needs to evaluate and to estimate the expected error in the classification for various feature combination as well as band combination.

Unsupervised classification: Unlike supervised classification, unsupervised classification does not use the training sample to classify the image. An algorithm determines the internal structure of the data not the training sample. The classification of classes is based on clusters or natural grouping of data value known as spectral classes. These classes or cluster are initially unidentified, needs to be identify with the help of knowledge of the interpreter.

Hybrid: The main objective of the image classification is to produce the accurate thematic map from the image. In this regards, sometime supervised and unsupervised classification technique individually, do not produce the desire level of accuracy. For example, in supervised classification, user may not able to delineate the signature or in results, the class signature is not statistically separable in feature space. In the case of unsupervised classification, this algorithm only considers the internal structure of the data and sometime produces insignificant classes to the user. The combined approach can eliminate both classification drawbacks and produce satisfactory results. In this approach, initially unsupervised classification is applied with approximately 5 to 10 times more desired clustering. Then these clusters must be evaluated by various field data, resulting some cluster may be combined or sub-divide. Finally, the evaluated classes can be utilizing for the supervised classification.

Accuracy Assessment

Once the image is classified, there is a need to assess the accuracy of the classification that can represent the true information about an area. It is not possible to check each pixel of an image to verify. The sampling method is one of the best methods to collect the samples in the classified image for accuracy assessment. These collected samples can be verified with the field work or other ancillary data known as reference data. The overall verification of the sample data is known as ground truthing. It is an acquisition of knowledge about the study area by various sources may be primary or secondary like, field work, analysis of previous image or photograph, personal experiences, etc. Ground truth data are the most accurate data available about the area of study. They should be collected at the same time as the remotely sensed data, so that correspond as much as possible.

2.5 CONCLUSION

Remote sensing is an art science and technology of collection information without being physical contact with an object or phenomena. It an unbiased tool to collect the information for the mapping the earth features. It is a multi-disciplinary activity which is utilized by many people such as geographer, geologist, agriculturist, planner, etc.

2.6 SUMMARY

The term 'remote sensing' simply means 'sensing remotely'. The term 'remote' means distance, it could be one metre to thousands metre or more. Another term 'sensing' means acquiring knowledge. So remote sensing means acquiring knowledge from a distance. So remote sensing can be defined as an art, science and technique of collecting real information, without being physical contact with an object or phenomena through the sensor or camera from the various platforms over the wide range of electromagnetic energy by the means of tripod, aircraft or spacecraft or satellite for multidisciplinary activity.

In remote sensing, platforms may be moving or static place where sensor can mount to collect the images or photo. It is a stage to mount the camera or sensor to acquire the information about the target under investigation. Based on altitude above the earth surface, platform may be classified as, ground borne, airborne and spaceborne. Ground borne platform is used for field verification and laboratory simulation. By the mean of aircraft airborne platform is used but it has effected by the local weather condition. The spaceborne platform is not affected by the earth's atmosphere as in found in airborne platform. Depending upon the altitude, there are two types of orbit i.e. polar orbit and geostationary orbit, are used to place the satellites, depending on the objectives of the mission. The polar orbiting satellite moving north-south direction and cover the whole earth, placed at the height of around 700 km. Polar orbit satellites is also known as sun-synchronous satellite because it is synchronised with the local sun-time at same latitude or it passes over all the places on earth having the same latitude at the same local sun-time. The geostationary satellite also has a motion from west to east direction and the speed of satellite is synchronised with the speed of the earth, placed at height of 36000 km.

Sensor measures reflected, scattered or emitted electromagnetic energy from the area of interest which is mounted on platforms. There are basically two type of sensor on the basis of source of light, one is passive sensor and another is active sensor. Depending upon the *sensor system,* sensor may be imaging and Non-imaging sensor system. The major characterstics of sensor is their resolution. So sensor resolution is measure of the ability of an optical system or sensor to distinguish between signals that are spatially near or spectrally similar. Ability to separate closely spaced objects on an image or photograph. Resolution is defined as the ability of the sensor to render the information at the smallest discretely separable quantity in terms of *Distance (Spatial resolution), Wavelength band (Spectral resolution), Radiation quantity (Radiometric resolution) and Time (Temporal resolution).*

Basically, remote sensing is totally depending upon electromagnetic energy, refers to all energy that moves with the speed of light in a harmonic wave pattern and broadly, includes lights, heat and radio waves. It is propagating through the space in a sine wave with constant speed which has two fields, one is electrical and another is magnetic, called electro-magnetic energy.

There are three measurements used to describe electromagnetic wave such as wavelength, frequency and velocity. There is a relationship between the wavelength, frequency and energy in the electromagnetic energy radiation. Shorter the wavelength, high the frequency and energy. Conversely, longer the wavelength, low frequency and energy. There is inverse relationship between wavelength and frequency. In remote sensing, it is very difficult to detect the long wavelength than short wavelength. The electromagnetic energy is categories on the scale of wavelength is called the Electromagnetic spectrum. It is extending from the gamma rays (smallest wavelength) to radio waves (largest wavelength). It is categories into various spectral regions also known as spectral bands. The electromagnetic spectrum is divided into two parts, one is optical region and another is microwave region. Optical region of the electromagnetic spectrum refers to that part of the spectrum in which optical laws can be applied. These relate to phenomena, such as reflectance and refraction that can be used to focus the radiation. The optical ranges from X-rays (.02 μm) through the visible part of the electromagnetic to far infrared (1000 μm) region. The microwave region is extending from 1mm to 1 metre.

The atmosphere is never completely transparent to electromagnetic radiation. However, at some wavelengths it has good transparency, known as atmospheric windows; and some wavelength has absorbing characteristics. The atmosphere is interacting with electromagnetic radiation by Atmospheric refraction, scattering, absorption and reflection. When electromagnetic energy is incident on any given earth surface feature, three fundamental energy interactions with them i.e. reflected, absorbed and transmitted, depend upon the material type, condition and wavelength. These differences permit us to distinguish different features on an image. Thus, two features may be indistinguishable in one spectral range and easily distinguishable in another wavelength band.

The reflectance characteristics of earth surface features may be quantified by measuring the portion of incident energy that is reflected. This is measured as a function of wavelength called spectral reflectance. A graph of the spectral reflectance of an object as a function of wavelength is termed as a spectral reflectance curve.

There are various characteristic of the soil such as soil moisture, texture, surface roughness, minerals and organic matter, interact differently with the electromagnetic energy. The vegetation is mostly consisting of leaf, contains pigment, chlorophyll, structure and moisture. Our eyes perceive healthy vegetation as green in color because of the very high absorption of blue and red energy by plant leaves and the very high reflection of green energy. The blue and red bands are the chlorophyll absorption region. Clear deep water is act as a blackbody for the near infrared and beyond energy, that is absorbed by the water. The suspended material of water increases the reflectance of the energy. The chlorophyll concentration in the water tend to decrease reflectance in blue region and increase reflectance in green region, used to monitor the concentration of algae through remote sensing data.

In the remote sensing process, various mechanism/activities are involved while supplying the final data to the user community. The mechanism/activities such as Source of energy, Interaction of electromagnetic radiation with an atmosphere, Interaction of electromagnetic radiation with an earth surface, Electromagnetic energy received by the sensor, Transmission to the ground station, Rectification of data and Supply to the user community.

The satellite image in the form of raw image which is not useful to the user community, requires a significant amount of processing. So, digital image processing in general involves the use of computers for manipulating digital image in order to improve their quality and/or modify their appearance. The main processes are preprocessing, enhancement and image classification. Once the image is classified, there is a need to assess the accuracy of the classification that can represent the true information about an area.

2.7 GLOSSARY

- Active sensor: If sensor is using own source of energy such as camera flash or RADAR to illuminate the earth feature is known as active sensor.
- Airborne platform: when camera or sensor are mounted on an aircraft to collect the information about the earth is known as air bourne remote sensing.
- Atmospheric absorption band: the atmosphere to close completely in certain regions of the spectrum called atmospheric absorption band.
- Atmospheric window: A portions or wavelength intervals of the spectrum that transmit radiant energy are called atmospheric windows.
- Digital image processing: It is a task of processing and analyzing the digital image using some image processing algorithm to extract information.
- Digital image: Digital image is a two-dimensional rectangular array of cell or pixel that represents the energy reflected or emitted from the earth’s surface which is measured by the sensor,
- Electro-magnetic energy: The energy moves with the speed of light in a harmonic wave pattern and broadly, includes lights, heat and radio waves, that is propagating through the space in a sine wave with constant speed,

which has two fields, one is electrical and another is magnetic, called electro-magnetic energy.

- Electro-magnetic spectrum: The electromagnetic energy is categories on the scale of wavelength is called the Electromagnetic spectrum. It is extending from the gamma rays (smallest wavelength) to radio waves (largest wavelength).
- Geometric correction: The repositioning of the pixels from their original locations in the data array into a specified geographical coordinates to the image.
- Groundborne platform: when the camera or sensor mounted on tripod, building top or moving vehicle to collect the ground information, is known as groundborne platform.
- Image classification: It is a process of generating thematic map by categorizing similar pixel.
- Image enhancement: it is a technique for increasing the visual interpretability between feature in an image by contrast-brightness increase.
- Passive sensor: If sensor is using natural source of energy such as solar energy or geo-thermal energy to illuminate the earth feature is known as passive sensor.
- Radiometric correction: when the altering the pixel value of the image is known as radiometric correction.
- Radiometric resolution: this the sensor capability to quantify the signal strength into grey levels. It is measured in bit. In general, greater the grey-level more detail information.
- Reflectance: It is a ratio of the reflected light spectrum to the incident light spectrum.
- Refraction: The bending of light when it passes from one medium to another.
- Remote sensing platform: Remote sensing platform is a place where camera or sensor are mount.
- Remote sensing: the art, science and technique of collecting information without being physical contact with the object or phenomena.

- Scattering: The multiple reflections of electromagnetic energy by particles and surfaces is known as scattering which is an 'unpredictable' reflections.
- Sensor resolution: It is an ability of the sensor to distinguish different feature in terms of distance, wavelength, radiation quantity and time.
- Sensor: sensor is a device, that measures and records electro-magnetic energy by converting it into a signal and presents it in a form of either digital or an image about the target under investigation.
- Spaceborne platform: when the sensor is mounted on the satellite that is placing with the help of satellite launching vehicle in the circular space orbit is known as spaceborne platform.
- Spatial resolution: it is a sensor capability to distinguish two feature spatially.
- spectral reflectance curve: A graph of the spectral reflectance of an object as a function of wavelength is termed as a spectral reflectance curve.
- Spectral resolution: This is a sensor capability to sense number of wavelength bands.
- Temporal resolution: The revisit period of the satellite over the same area.

2.8 ANSWER TO CHECK YOUR PROGRESS

1. Define remote sensing.
2. What are the components of remote sensing?
3. What are the types of resolution?
4. What is electromagnetic spectrum?
5. What is the wavelength of Near IR?

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2.11 TERMINAL QUESTIONS

1. Describe the electromagnetic spectrum with neat sketch for remote sensing data.
2. Explain the atmospheric interaction with electromagnetic radiation.
3. Explain the spectral reflectance characteristics for soils, water & vegetation.
4. What are types of scattering signature? Explain.
5. Write short note on spectral signature concepts

UNIT 3: GIS: PRINCIPLES AND APPLICATION

3.1 OBJECTIVES

After reading this unit you will be able to know:

- GIS objectives, Concept and Definition.
- GIS Need, Scope, and Importance.
- GIS History.
- Components of GIS and GIS types.

3.2 INTRODUCTION

In the previous units you have studied about the basics of remote sensing, electromagnetic radiation, platforms, sensors, resolution types, remote sensing data interpretation, and analysis. Remote sensing techniques provide you very quick, timely and reliable information about the land surface features based on your requirement and objectives. That information facilitates various kinds of planning, management and developmental activities for socio-economic development and prudent/judicious use of natural/cultural resources. The temporal remote sensing data highlights the changes and dynamism of earth surface cover types and land uses which is utmost essential for future planning and taking precautionary measures about the danger/alarming/crucial situations if those are showing negative trends but if positive the planning will be followed accordingly. But in most of the cases, the collection or obtaining information/data itself does not prove the complete solution until and unless we integrate, analyses it and make modeling for the required purposes. For example, you have the information about the availability of land or kind of resources but you do not know about their suitability or fitness for a particular kind of use or management and planning towards their development. Therefore the GIS (Geographical Information System), which is the most powerful computerized tool for collection, storage, analysis, manipulation, modeling and retrieval of information, is equally essential like remote sensing, for successful planning, management and optimization of land uses/resource utilization. In fact, remote sensing-based data/information and its analysis and modeling through GIS tools and techniques are complementary to each other for all kinds of developmental planning.

GIS is a multi-disciplinary subject that includes a variety of technologies and concepts. In order to understand the capabilities of GIS, it is important to learn cartography, mapping, spatial and statistical analysis, different types of database, database management, and programming. All of them will be discussed in the next units except GIS objectives, concept, definitions, need, scope, importance, history, components of GIS and GIS types which are being described/explained in this unit.

3.3 PRINCIPALS OF GIS

GIS Objectives:

- To improve the efficiency of decision-making processes and planning.
- Provide efficient means for data distribution and handling.
- Eradication of the duplicated data,
- Integration of information from many sources.
- Analysis of queries involving geographical reference data for generation of new information, update data quickly and at the minimum cost.

Concepts and Definition:

People around the world may like to know the geographic, social, economic, political, and environmental information in digital form for their practical knowledge, academics, services, responsibilities etc. To explore geo-referenced digital information, electronic tools designed for acquiring, presenting, and interacting with information that links location with measured values are needed. One such tool is called a geographic information system, better known as GIS. GIS technology powers solutions for telecommunications, utilities, agriculture, defense, oil, health care, transportation, mining, environmental management, petroleum, water/wastewater, and many other industries as well as local, state, and federal government agencies. The following points highlight the concepts and definitions of GIS:

- A geographic information system (GIS), also known as a geospatial information system, is a system for capturing, storing, analyzing, and managing data and associated attributes which are spatially referenced to the Earth.
- GIS provides Geographic/geospatial information about the places on earth`s surface, knowledge about "what, where, when, how, how far etc within the spatial domain and the Geographic/ geospatial synonym.
- It is an Information System capable of integrating, storing, editing, analyzing, sharing, and displaying Geographically Referenced information.
- Generally, GIS is a tool that allows users to create interactive queries, data editing, analyses the spatial information, creation of maps, and presentation of results.
- GIS and its location-based intelligence applications become the base for many of the other location-enabled services that rely on analysis and visualization.
- GIS makes relationships with unrelated information by using location as the key index variable.
- All Earth-based spatial–temporal location and extent references should be relatable to one another and ultimately to a "real" physical location or extent.

Generally, GIS is based on an integrating technology consisting of:

- Remote Sensing

- Cartography and Mapping
- GPS
- Computers
- RDMS
- Information Technology
- Communication technology
- Survey and field data collection

GIS is a type of software which consists of a computer system that allows us to handle information about the location of features or phenomena on the Earth's surface. It has all the functionality of a conventional DBMS plus much of the functionality of a computer mapping system. GIS as a DBMS that allows us to explicitly handle the spatial data. Common examples are QGIS, ArcGIS and MapInfo.

NEED, SCOPE, AND IMPORTANCE OF GIS:

Geographic information systems are among the most exciting and powerful geomatics decision-making tools in the world. A GIS uses computer technology to integrate, manipulate and display a wide range of information to create a picture of an area's geography, environment, and socio-economic characteristics. Beginning with a computerized topographic map as its base, a GIS *overlays and integrates* graphic and textual information from separate databases. The end result is a customized and reliable tool that can support decision making and problem solving and provide almost instantaneous answers to complex questions (Geomatics Canada Web Site, 2000). The following lines highlight this sub-title:

- Geographic information system technology can be used for scientific investigations, resource management, asset management, Environmental Impact Assessment, Urban planning, etc. For example, GIS might allow emergency planners to easily calculate emergency response times in the event of a natural disaster.
- GIS is used to find wetlands that need protection from pollution, or GIS can be used by a company to site a new business to take advantage of a previously underserved market.
- In the modern concept of Information technology, GIS is termed as Geo-Information technology. The technology is involved with the integration of Surveying and Mapping techniques, Remote sensing and Satellite Imagery, Photogrammetry, Geography, Geology, Geomorphology, Cartography and Global Positioning Systems (GPS).
- The scope of using GIS techniques is a well-known aspect in the sectors of forestry and forest management, land suitability classification, agricultural and horticultural land optimisation, irrigation, rural development, industrial land uses and industries, minerals, energy, transport, communications, Science, Technology and Environment. GIS can be used for scientific investigations, resource management, and development planning.
- GIS used in Computer Science, Civil Engineering, Mathematics, Statistics and Operations Research. With GIS, we can create new approaches that help us understand the relationship

between man and the environment. This calls for more integrated tools that build a holistic and comprehensive approach to resolving planning problems.

- GIS includes the merging of cartographical data, statistical analysis, and database technology. As GIS can be thought of as a system, it digitally creates and "manipulates" spatial areas that may be jurisdictional, purpose or application oriented for which a specific GIS is developed. Hence, a GIS developed for an application, jurisdiction, enterprise, or purpose may not be necessarily interoperable or compatible with a GIS that has been developed for some other application, jurisdiction, enterprise, or purpose.
- Any organization, government private is in some way or another strongly linked to the geography in which it operates. A GIS that has been designed in a proper manner has the capability of providing quick and easy access to large volumes of data of these Geographical features.

GIS has a great role in the organizational benefits and in almost every industry. There is a growing interest and awareness of the economic and strategic value of GIS because of more standards-based technology demonstrated by its users. The number of GIS enterprise solutions and it strategies that include gis are growing rapidly. The importance of GIS generally fall into the following five basic categories:

i) Efficiency based cost saving

This is associated with automating or improving a workflow and improvements in the mission itself. GIS functions as a repository of information associated with fixed assets. Municipal GIS captures information about the city's assets – typically land use information (such as parcel number, parcel owner, permits and zoning) and physical items (such as street lights, traffic signals, utility meters, water pipes, sewer infrastructure, street trees, pavement, curbs and sidewalks). What makes GIS different from traditional databases is that it associates geographic placement, in latitude and longitude, with each asset. Consequently it's possible to make decisions based not only on a type of asset but also on the asset's location.

According to a study carried out in California, by using GIS to automate the notification process, the city reduced by 90 percent the amount of staff time needed to do the job. Here the GIS-based process had been simple and concerned to the following points:

a) Identify the parcel containing the planned development;
b) Instruct the GIS system to identify all parcels whose boundaries cross or are inside a specific radius; and
c) Generate mailing labels to the parcel owners.

The cost and time savings associated with even this simple GIS operation paid for the system deployment.

ii) **Prompt and the Best Decision Making**

This typically has to do with making better decisions about location. Common examples include real estate site selection, route/corridor selection, zoning, planning, conservation, natural resource extraction, etc. People are beginning to realize that making the correct decision about a location is strategic to the success of an organization.

iii) **Improved communication**

GIS-based maps and visualizations greatly assist in understanding situations and storytelling. They are a new language that improves communication between different teams, departments, disciplines, professional fields, organizations, and the public.

iv) Better geographic information recordkeeping

Many organizations have a primary responsibility of maintaining authoritative records about the status and change of geography (geographic accounting). Cultural geography examples are zoning, population census, land ownership, and administrative boundaries. Physical geography examples include forest inventories, biological inventories, environmental measurements, water flows. GIS provides a strong framework for managing these types of systems with full transaction support and reporting tools. These systems are conceptually similar to other information systems in that they deal with data management and transactions, as well as standardized reporting (e.g., maps) of changing information. However, they are fundamentally different because of the unique data models and hundreds of specialized tools used in supporting GIS applications and workflows.

v) Managing geographically

In government and many large corporations, GIS is becoming essential to understand what is going on. Senior administrators and executives at the highest levels of government use GIS information products to communicate. These products provide a visual framework for conceptualizing, understanding, and prescribing action. Examples include briefings about various geographic patterns and relationships including land use, crime, the environment, and defence/security situations.

GIS is increasingly being implemented as enterprise information systems. This goes far beyond simply spatially enabling business tables in a DBMS. Geography is emerging as a new way to organize and manage organizations. Just like enterprise-wide financial systems transformed the way organizations were managed in the ‗60s, ‗70s, and ‗80s, GIS is transforming the way that organizations manage their assets, serve their customers/citizens.

Any organization, government private is in some way or another strongly linked to the geography in which it operates. A GIS that has been designed in a proper manner has the capability of providing quick and easy access to large volumes of data of these geographical features. The user can access & select information by area or by theme to merge one data set with another, to analyze spatial characteristics of data, to search for particular features, to update quickly and cheaply and asses alternatives.

In simpler terms, GIS allows the user to understand geographic information in an easy manner without having to go through large volumes of confusing data that is in tabular form. Visualizing the geography of a particular location is no doubt easier that trying to analyze raw data. The use of modern GIS offers many advantages over paper maps. The important characteristics of GIS is having its tool-kit which highlights the following important functional characteristics:

- Use either SI or CGS as primary units. (SI units

- **Manipulate spatially:**
  - ☐ Calculate distances and adjacencies
  - ☐ Change projections and scales
  - ☐ Integrate disparate sources

- **Analyse spatially:**
  - ☐ Quantitative analysis
  - ☐ Exploratory spatial data analysis
  - ☐ Qualitative analysis

- **Visualise data:**
  - ☐ Maps!
  - ☐ Tables, graphs, etc.
  - ☐ Animations
  - ☐ Virtual landscapes

- More robust and resistant to damage
- Faster and more efficient
- Requires less person time and money

The importance of GIS is also based on the facts that this system collects and stores information about the world as a collection of thematic layers that can be linked together by geography. This simple but extremely powerful and versatile concept has proven invaluable for solving many real-world problems from tracking delivery vehicles, to recording details of planning applications, to modeling global atmospheric circulation.

3.4 ELEMENTS OF GIS

COMPONENTS OF GIS

A GIS system in working order integrates the following five key components:

- Data
- Hardware
- Software
- Users/People
- Methods

Data:

Data is a set of values of subjects with respect to qualitative or quantitative variables. Data and information or knowledge are often used interchangeably. You may also define data as a collection of facts, such as numbers, words, measurements, observations or even just descriptions of things.

Data may be classified as i) qualitative and ii) quantitative. Qualitative data is descriptive information whereas Quantitative data is numerical information. For example slope of the hill is <u>very steep</u> is a qualitative information whereas slope of the hill is in between the slope range of <u>30 - 40%</u> is quantitative information.

Geographic data refers to information about the earth's surface and the objects found on it. This information comes in three basic forms: spatial data, tabular data, and image data. Spatial data contains the locations and shapes of map features. Tabular data is collected and compiled for specific areas and is the descriptive data that GIS links to map features. Image data includes such diverse elements as satellite images, aerial photographs, and scanned data--data that's been converted from printed to digital format. Data can be created or bought.For example, a GPS receiver can be used to identify sites in an agricultural field where weed data is collected.A table can be created in the GIS showing location as well as species and number of weeds present in the measured area. Alternatively, data can be purchased. In most cases, images are bought from satellite or aircraft companies that used cameras to collect images of the Earth’s surface.

a. Map Data

Map is an essential tool for execution of various kinds of activities. Maps or GPS based ground coordinates act as input coordinate system in GIS spatial data domain. Geo-referenced remote sensing data is also equally helpful in creating spatial information. It becomes more realistic approach if you take the help of all three data types to prepare the spatial database. Map data provides information about location (Figure 3.1). Figure 3.1 represent the latitude and longitude points (graticules) on the polygon graphics formed by digitizing the feature from map.

b. Attribute Data

It provides you the information about what can be found at a particular location. The attributes of a river, for example, might include its name, length, average depth, rate of flow, water quality, how many dams are on it, and how many bridges cross it. Figure 3.2 represent both map and attribute data.

c. Hardware

Hardware is a Computer on which GIS software runs. There are a different range of computers like Desktop or server based. ArcGIS, ArcInfo and Arcview GIS softwre servers are server based computers where GIS software runs on network computer. The good computer hardware components must have high capacity. Examples of hardware components are: server, digitizer, PC, Printer, plotter, Hard driver, processor, graphics card, etc. These all component function together to run a GIS software smoothly. A mini hardware system of GIS is shown in figure 3.3

d. Software

Software is a GIS component, a technology for storing and analyzing location and attribute data. GIS Software) is designed to store, retrieve, manage, display, and analyze all types of geographic and spatial data. Figure 3. 4 represent the spatial and attribute data within the computer software. Examples of GIS software are ArcGIS and ArcView for desktop, Web GIS, ArcInfo as server GIS etc.

e. GIS User/People/Personnel

GIS technology may have many limitations without the involvement of people who manage the system and develop plans for applying it to real world problems. GIS users range from technical specialists who design and maintain the system to those who use it to help them perform their everyday work. GIS user/people/personnel's specifically include the following categories of working environment:

- Project coordinators
- Data analysts
- Programmers
- Data and knowledge managers
- Librarians Types of GIS

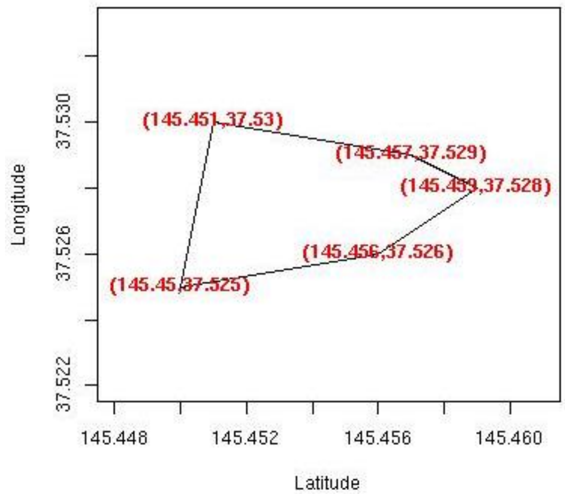

Figure 3. 1: Map data of GIS showing the Graticules after digitization of a particular feature from hard copy of a map.

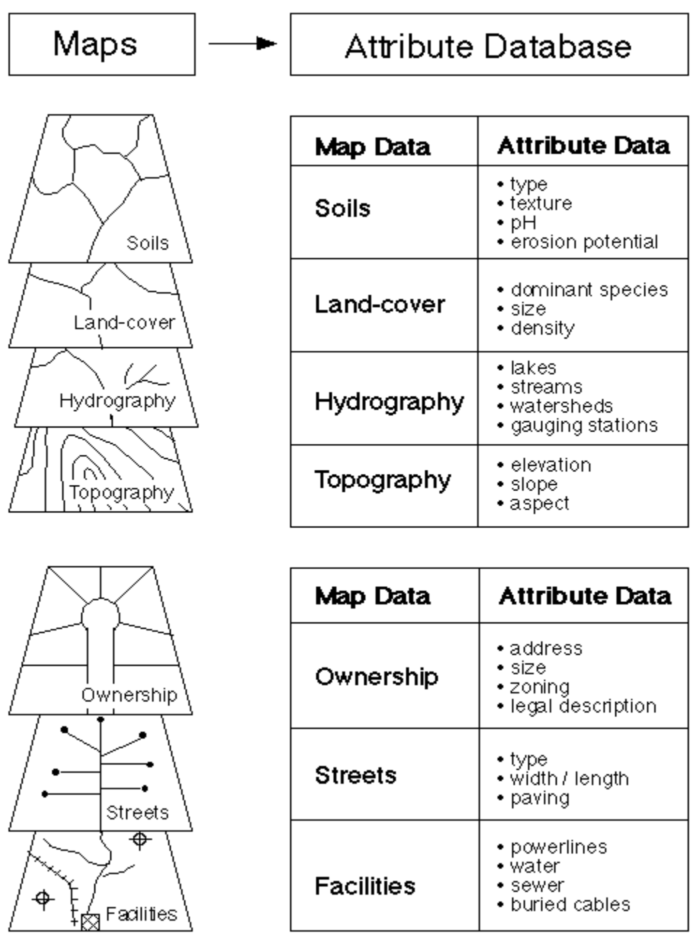

Figure 3.2 GIS Map showing Map and Attribute Data

Figure 3.3: GIS Hardware consists of CPU, Monitor, Plotter, and Printer

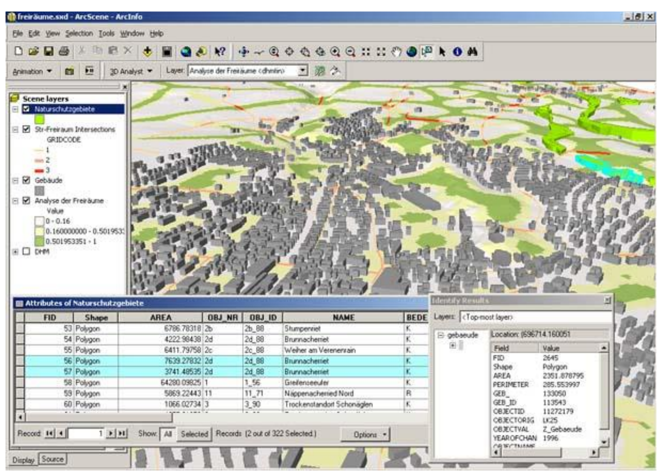

Figure 3. 4: GIS Software on the computer monitor

d. Methods

A successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to each organization.

Types of GIS

In recent time, there are nine types of GIS in practice. Thise are categorised as below:

- Desktop GIS
- Professional GIS
- Enterprise GIS

- Web GIS
- Internet GIS
- Mobile GIS
- Distributed GIS
- 4 D GIS
- Cloud GIS

Desktop GIS:

Desktop GIS is an immensely powerful computer mapping system. It is a tool for managing information of any kind according to where it is located. For example, businesses can track customer locations, optimize delivery routes, or decide where to site future businesses using GIS; scientists use GIS to manage sensitive wildlife habitats or track animal movements in an ecosystem; and health care specialists track the spread of infectious disease with GIS

Desktop GIS represents the real geographical features on a computer similar to the way maps represent the same on paper. Both GIS and paper maps convey information about places. However, desktop GIS has power and flexibility to change, if any, that paper maps lack. The scale of the map influences the size of what appears on it. With GIS, however, you can store and link huge amounts of information about the objects represented on maps. These objects are called features. Each map feature has a location, a representative shape, and a symbol that represents one or more of its characteristics. Because features on maps are organized according to relative location or position, maps are good for showing the relationships among feature locations. These relationships, called spatial relationships, are important because understanding them helps us solve problems.

While preparing the maps we use three basic shapes-- points, lines and areas to represent real-world objects location on the basis of geographical coordinates. Points represent objects that have discrete locations and are too small to be depicted as areas. Lines represent objects that have length but are too narrow to be depicted as areas. Areas represent objects too large to be depicted as points or lines. Shapes alone do not give you enough information, so maps use graphic symbols to help identify features and provide information about them.

Most features can be represented as more than one shape. The scale of a map tells how the size of the map features compares with the size of the geographic objects they represent. Map scales vary from small-scale to large-scale. For example, on a small-scale map a city may be represented as a point . That same city would be represented as an area on a large-scale map.

With desktop GIS, you are not limited to the amount of information you can get about what you see on the map. Desktop GIS stores all the information about map features in a GIS database and links the features on the map to the information about them. This means that you can access all the information about a feature by simply clicking on it.

The information that a desktop GIS stores about map features is referred to as attribute information, or attributes. Desktop GIS formats attributes in rows and columns, and stores them as tables. Each column stores a different attribute and each row relates to a single feature. The link between map features and their attributes is the basic principle behind how a desktop GIS works, and is the source of its power. Once the map features and attributes are linked, you can access the attributes for any map feature or locate any feature from its attributes in a table. GIS can also display features based on any attribute in the table. Because the link between features and attributes is a two-way relationship, changing an attribute in the table automatically results in a change on a map. Desktop GIS links sets of features and their attributes and manages them together in units called themes. A theme contains a set of related features, such as roads, streams, parcels, or wildlife habitat areas, along with the attributes for those features.

All the themes for a geographic area taken together make up a GIS database. The design of a GIS database is strong because it's flexible. You can add new themes to a GIS database or delete old ones; you can separate themes to create more themes, or combine themes if they have common characteristics. What you want to do with a GIS database, and what information you need, will determine the best design for you.

The GIS database can be ‘queried’ .This means a user can ask questions and get answers about the database. For example, in Figure 3.5, the user queries the database about location of the residential area in and around Brookings, SD. The results of the query are highlighted in yellow in both the table and the map.

Information can be presented as maps, charts, and tables, along with graphics you import from other programs or even graphics you draw yourself. The presentations you create can be output to a printer to produce hard copy, or displayed on your computer's screen. You decide what information to present and how much--how much detail, which colors and symbols, and how the final pieces will be arranged. And if you audience or your objective should change, it's easy to make your presentation reflect those changes, without having to start over.

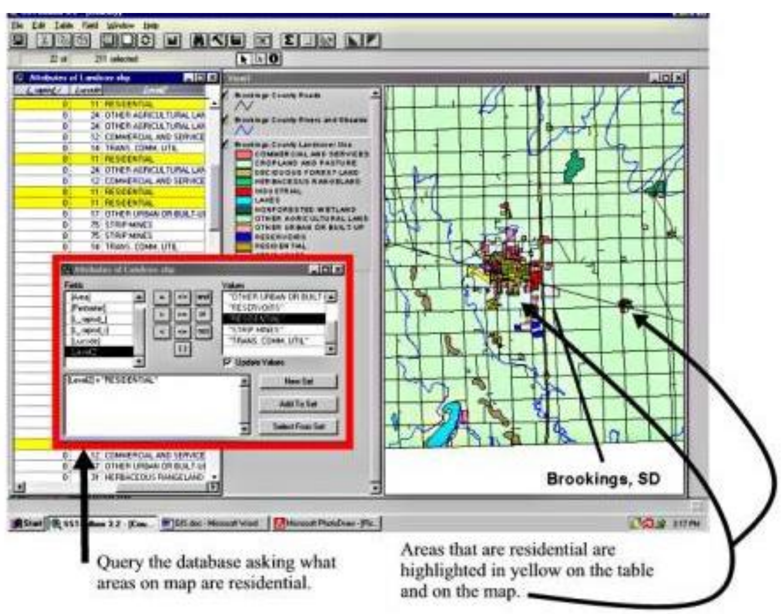

Figure 3.5 GIS Database Query

Professional GIS:

Professional GIS is important in the field of GIS as it helps to establish GIS as a true profession, ensures those who produce geographic information have competency in a core set of knowledge and skills, encourages long-term professional development, and promotes ethical behavior by members of the profession. For individuals, successful certification may improve advancement opportunities; result in higher compensation and greater career mobility, and greater recognition from employers and colleagues.

Enterprise GIS:

Enterprise GIS is a geographic information system that is integrated through an entire organization so that a large number of users can manage, share, and use spatial data and related information to address a variety of needs, including data creation, modification, visualization, analysis, and dissemination.

Web GIS:

Web GIS is a GIS system that uses web technologies. It often uses web technologies to communicate among different components of the system. Web GIS originates from a combination of web technology and the Geographical Information System, which is a recognized technology that is mainly composed of data handling tools for storage, recovery, management and analysis of spatial data. Web GIS is a kind of distributed information system. The simplest architecture of a Web GIS must have at least one client and one server that client is a desktop application or web browser application that allows users to communicate with server, and the server is a web server application.

Internet GIS:

Web GIS is a close term to Internet GIS. These two words are always used as synonymous with each other. There is a slight difference between these two words. The Internet supports many services with the Web being one of these services. So we can call a system as Internet GIS if it uses many of services of Internet not only Web service and if it uses only Web we should name

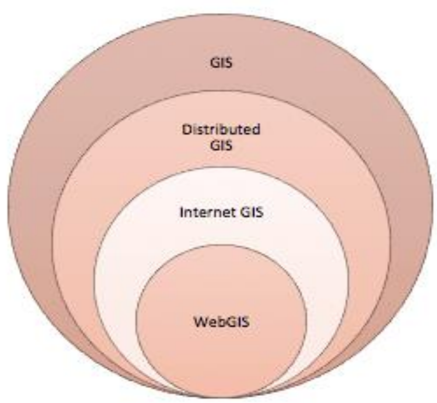

Figure 3.6: Internet GIS and web GIS Comparison

it Web GIS. This definition makes Internet GIS boarder than Web GIS. In real world Web is the most attractive service of Internet and it is why Web GIS is more common than Internet GIS.
The geospatial Web, or GeoWeb, is another term that uses to refer Web GIS , However the definition of Web GIS is not identical to Web GIS . GeoWeb can be defined by merging geospatial information with none geospatial information such as news, photos, stories and so on.

Mobile GIS:
Geographic Information Systems (GIS) being used out of the office and into the field is called Mobile GIS. A mobile GIS is used in the field to capture, store, update, manipulate, analyze, and display geospatial data and information. Mobile GIS integrates one or more of the following technologies:
- Mobile devices (such as a PDA, tablet, or laptop computer, and in some countries mobile phones)
- Geographic Information System (GIS) software.
- The Global Positioning System (GPS).
- Wireless communications for Internet-based GIS access.

For most applications, it is an extension of desktop GIS, although increasingly users are taking mobile GIS data and uploading it directly to powerful visualization tools online such as Google Earth. Mobile GIS can allow for edits and changes to be made in the field, increasing accuracy and saving time. Many mobile GIS systems are relatively inexpensive.

Distributed GIS:
It refers to GI Systems that do not have all of the system components in the same physical location. This could be the processing, the database, the rendering or the user interface. Examples of distributed systems are web-based GIS and Mobile GIS.

4D GIS:
4D GIS has developed into an essential component of GIS applications, incorporating 2D and 3D data with time. 4D GIS integrates, manages, and analyzes spatial and nonspatial information, providing quality visualization, simulation, and communication. While also facilitating better decision making by providing a geographic representation of the full scope of a project.
Cloud GIS:
This refers to hosted services on the internet meant for users of GIS technology or members of public who want to access maps. Services include map service, data storage and access, powerful analysis with applications, to manage assets and information.

GIS Data Types:
There are two types of data stored for each item in the database.
i)Attribute data:
Attribute data says ***what*** a feature is, eg. statistics, text, images, sound, etc.

ii) Spatial data:

Spatial data reflects where the features are existing, eg. all features, objects and related phenomenon. It has the following characteristics:

a. It is co-ordinate based

b. It may be a **Vector** data showing the following discrete features:

i. Points

ii) Lines

iii) Polygons (zones or areas)

c. It may be a **Raster** data which represent a continuous surface.

Details of raster and vector data will be discussed in the next unit.

HISTORY OF GIS:

While considering about the history of GIS, we must think over the conventional methods of map preparation as map is always at the heart of GIS. Mapping has revolutionized how we think about location. Maps are important decision-making tools. They help us get to places. And they are becoming more immersed in our everyday lives.

Conventional methods of map preparation dates back 1854. With the passage of time, there had been the tremendous changes in the field of cartography and mapping. In fact GIS has no meaning and no importance if we do not consider its strong powerful computerized tool and the varieties of software. GIS was developed by Geographers just because to overcome the conventional method of map making and the integration of different GIS layers, its analysis and modeling. The development of GIS has saved money, man power and the time. But the important point is saving paper containing map which we were bound to torn after a frequent stipulated time when the environment and surface features were changing and the maps had no meaning /no importance.

Advancements in GIS was the result of several technologies. Databases, computer mapping, remote sensing, programming, geography, mathematics, computer aided design, and computer science all played a key role in the development of GIS.

Today, we'll uncover some of the key moments in the history of GIS that has shaped it what it has become today:

Paper Mapping Analysis with Cholera Clusters:

The history of GIS all started in 1854 when British physician John Snow began mapping outbreak locations, roads, property boundaries and water lines of Cholera hit city of London. When he added these features to a map, something interesting happened: He saw that Cholera cases were commonly found along the water line.

John Snow's Cholera map was a major event connecting geography and public health safety. Not only was this the beginning of spatial analysis, it also marked the start of a whole field of study: Epidemiology – the study of the spread of disease. To this date, John Snow is known as the father of epidemiology. The work of John Snow demonstrated that GIS is a problem-solving tool. He put geographic layers on a paper map and made a life-saving discovery.

During 20th century, the concepts of printing different theme maps and to separate layers from a map were developed. But this concept did not represent a full GIS as there was no option to analyse mapped data. With the passage of time, many other concepts were developed but that did not full fill the whole concept of GIS. The actual concept of GIS was first introduced in the early 1960s, by Dr. Roger Tomlinson and it was subsequently researched and developed as a new discipline. The GIS history views Roger Tomlinson as a pioneer of the concept, where the first iteration was designed to store, collate, and analyze data about land usage in Canada. Thus Dr. Roger Tomlinson is generally recognized as the "father of GIS." He is the visionary geographer who conceived and developed the first GIS for use by the Canada Land Inventory in the early 1960s.

During 1970s, the second phase of development in GIS history was continued and by the 1980s the concept progressed in a big way and likely to be adopted by different agencies. By the late 1980s, there was a focus on improving the usability of technology and making facilitates more user-specific.

Throughout the 1990s, software company Esri released ArcView, a desktop solution for mapping systems. The influx of the Internet saw widespread adoption of GIS heading into the millennium, and the technology reached governmental authorities. Many companies adopted the technology to provide services to cities, municipalities and private organizations to manage assets in the field, gather business intelligence, and easily send data to the company headquarters to analyze.

In recent past, the focus of GIS shifted to sharing data across multiple platforms, and if its history is anything to go by, the industry will continue to debate how to resolve problems arising from data ownership.

4D mapping is a logical step for GIS, and this will help specifically for urban planning. GIS is not only essential for developing an urban area, but it is also necessary for today's fast-moving, technological landscape.

3.5 CONCLUSION

GIS is the most powerful computerized tool for collection, storage, analysis, manipulation, modeling and retrieval of information. GIS is equally important like remote sensing for successful planning, management and optimization of land uses/resource utilization. In fact remote sensing based data/information and its analysis and modeling through GIS tools and techniques are complementary to each other for all kinds of developmental planning.

3.6 SUMMARY

GIS is the most powerful computerised tool for collection, storage, analysis, manipulation, modeling and retrieval of information. GIS is equally important like remote sensing for successful planning, management and optimization of land uses/resource utilisation. In fact remote sensing based data/information and its analysis and modeling through GIS tools and techniques are complementary to each other for all kinds of developmental planning.

In this unit, the basics of GIS includes GIS objectives, concept, definition need, scope, importance, history, components of GIS and GIS types. Generally, GIS is based on an integrating technology consisting of remote Sensing, cartography and mapping, GPS, Computers, RDMS, information technology, communication technology, survey and field data collection.

Geographic information systems are among the most exciting and powerful geomatics decision-making tools in the world. A GIS uses computer technology to integrate, manipulate and display a wide range of information to create a picture of an area's geography, environment and socio-economic characteristics. Beginning with a computerised topographic map as its base, a GIS *overlays and integrates* graphic and textual information from separate databases. The end result is a customised and reliable tool that can support decision making and problem solving and provide almost instantaneous answers to complex questions. The important characteristics of GIS is having its tool-kit which highlights to manipulate and analyse the data spatially and visualise it in the form of maps, tables, graphs, animations and virtual landscapes.

Geographic data refers to information about the earth's surface and the objects found on it. This information comes in three basic forms: spatial data, tabular data, and image data. Spatial data contains the locations and shapes of map features. Tabular data is collected and compiled for specific areas and is the descriptive data that GIS links to map features. Image data includes such diverse elements as satellite images, aerial photographs, and scanned data--data that's been converted from printed to digital format. In addition to data GIS components include hardware, software, users and methods.

GIS types are categorised as desktop GIS, professional GIS, enterprise GIS, web GIS, internet GIS, mobile GIS, distributed GIS, 4 d GIS and cloud GIS. GIS data types consists of attribute data and spatial data. Examples of attribute data are statistics, text, images and sound of a feature. Similarly spatial data indicate the existance of feature, objects and related phenomenon. The nature of spatial data is either vector or raster.

Historically, the concept of GIS started a long back during 1854 when British physician John Snow began mapping of the probable sites for Cholera outbreak disease locations and found the real locations along the water lines of London city. During the period of 1854 -1960, there were some concepts developed related to this subject but none of them had been satisfactory.

The actual concept of GIS was first introduced in the early 1960s, by Dr. Roger Tomlinson, Geographer who is generally recognized as the "father of GIS." Since that time, there had been a tremendous developments in this field. Today the focus of GIS shifted to sharing data across multiple platforms, multiple numbers of Government and private organizations and even the critical problems are being solved through GIS and GIS software's like ArcView, *ERDAS Imagine etc.*

3.7 GLOSSARY

- **Altitude :** Altitude is specified relative to either mean sea level (MSL) or an ellipsoid. In simplest term altitude is the vertical distance from mean sea level.
- **Analysis :** Analysis is the process of identifying a question or issue to be addressed, modeling the issue, investigating model results, interpreting the results, and possibly making a recommendation.
- **ArcGIS :** A comprehensive desktop GIS software package developed by ESRI.
- **ArcMap :** Editing and map making module of ArcGIS.
- **ARC/INFO :** Private domain complete GIS software package from ESRI, Inc. that has very powerful modeling, analysis and output capabilities.
- **ArcView :** Private domain GIS software from ESRI, Inc. that allows users to organize, maintain, visualize, and disseminate maps and spatial information. This GIS software does not have the analysis and modeling capabilities like ARC/lNFO.
- **Attribute :** i) A characteristic of a feature in a Geographic Information System (GIS). Each identifiable feature has attributes. One common attribute of all geographic features is its position. other attributes depend on the type of feature. Example: a road may have a name or designation number, pavement type, width, number of lanes, etc. Each attribute has a range of possible values called its domain.

ii) Attribute is also called a column in a database table.

- **Attribute table:** A tabular file containing rows and columns. In a GIS, attribute tables are associated with a class of geographic features, such as wells or roads. Each row represents a geographic feature. Each column represents one attribute of a feature, with the same column representing the same attribute in each row.
- **Data type:** The characteristic of columns and variables that defines what types of data values they can store. Examples include character, floating point and integer.
- **DBMS:** Database management system. It is a set of computer programs for organizing the information in database. A DBMS supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation.
- **Geographic data:** The locations and descriptions of geographic features. The composite of spatial data and descriptive data.
- **Geographic database:** A collection of spatial data and related descriptive data organized for efficient storage and retrieval by many users.
- **Geographic feature:** A user-defined geographic phenomenon that can be modeled or represented using geographic data sets in a GIS. Examples of geographic features include streets, sewer lines, manhole covers, accidents, lot lines, and parcels.

3.8 ANSWER TO CHECK YOUR PROGRESS

- Describe GIS objectives, Concept and Definition.
- Explain Need, Scope and Importance of GIS.
- Discuss the History of GIS.
- Write about the Components of GIS and GIS types.

3.9 REFERENCES

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3.10 SUGGESTED READINGS

1. Lillesand, T.M. and Kiefer, R.W., 2000. Remote sensing and image interpretation, John Wiley & Sons, Inc., Singapore.

3.11 TERMINAL QUESTIONS

i) What is GIS and what does it do?
ii) How does Desktop GIS work?
iii) What do you need to know about the data?
iv) Explain the importance of GIS in the field of Efficiency based cost saving, Prompt and the best decision making and improved communication.
i) List the GIS types and differentiate between mobile and Internet GIS .
ii) What are the different GIS components? Explain GIS software
iii) Write the historical overview of GIS.
iv) Both remote sensing and GIS are complementary to each other for efficient planning and decision making processes. Elaborate this statement in context with the role of information technology.