PREFACE

In the curricular structure introduced by this University for students of Post-Graduate degree programme, the opportunity to pursue Post-Graduate course in any subject introduced by this University is equally available to all learners. Instead of being guided by any presumption about ability level, it would perhaps stand to reason if receptivity of a learner is judged in the course of the learning process. That would be entirely in keeping with the objectives of open education which does not believe in artificial differentiation.

Keeping this in view, the study materials of the Post-Graduate level in different subjects are being prepared on the basis of a well laid-out syllabus. The course structure combines the best elements in the approved syllabi of Central and State Universities in respective subjects. It has been so designed as to be upgradable with the addition of new information as well as results of fresh thinking and analysis.

The accepted methodology of distance education has been followed in the preparation of these study materials. Co-operation in every form of experienced scholars is indispensable for a work of this kind. We, therefore, owe an enormous debt of gratitude to everyone whose tireless efforts went into the writing, editing, and devising of a proper lay-out of the materials. Practically speaking, their role amounts to an involvement in 'invisible teaching'. For, whoever makes use of these study materials would virtually derive the benefit of learning under their collective care without each being seen by the other.

The more a learner would seriously pursue these study materials, the easier it will be for him or her to reach out to larger horizons of a subject. Care has also been taken to make the language lucid and presentation attractive so that they may be rated as quality self-learning materials. If anything remains still obscure or difficult to follow, arrangements are there to come to terms with them through the counselling sessions regularly available at the network of study centres set up by the University.

Needless to add, a great deal of these efforts is still experimental—in fact, pioneering in certain areas. Naturally, there is every possibility of some lapse or deficiency here and there. However, these do admit of rectification and further improvement in due course. On the whole, therefore, these study materials are expected to evoke wider appreciation the more they receive serious attention of all concerned.

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POST GRADUATE GEOGRAPHY

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PGGR-07

Group A

Unit 1.1.1 ❑ Geographer's Approach to Environmental Studies; Physical components of Environment

Structure

1.1.1.1 Definition of the term 'Environment'

Environment in broad sense means everything that surrounds us. It also means the conditions under which any individual or thing sustains to live and develop. The surrounding conditions (Gilpin, 1990) are :

i) the sum total of physical conditions which affect and influence the growth and development of individual or community.

ii) the social and cultural conditions which affect the nature of an individual or community, and

iii) the surrounding of an inanimate object of intrinsic value.

1.1.1.2 Classification of Environment

Human environment is classified as a) biotic and b) abiotic. Biotic environment encompasses human beings, flora, fauna, bacteria, viruses, ecology and all the social factors that constitute the quality of life, while abiotic environment includes land, water, atmosphere, climate, sound, odour and tastes. The concept of environment emerged from an assembly of living and inanimate objects.

1.1.13 Definition of Environment given by European Commission

The European Commission defined 'Environment' as "the combination elements whose complex inter-relationships make up the settings, surroundings and the condition of life of the individual and society as they are felt". If we consider all approaches of defining environment it would appear that humanity has been put at the centre stage of all things. If practical orientation has to be given in defining 'Environment' one must.take into account the following ingredients of the word 'Environment' as laid down in the national legislations of most of the countries :

i) each and every aspect of surroundings of human beings which affects human beings as an individual groupings,

ii) air, water and land representing the gamut of natural resources,

iii) ecosystem and biological diversity,

iv) economic, social and cultural circumstances,

v) anthropogenic activities directly or indirectly producing any solid, liquid, gaseous, odour, heat, noise, vibration and radiation.

vi) natural assets, such as natural beauty, outlook and scenic routes,

vii) historical, cultural, religious and heritage assets,

viii) public health characteristics,

ix) environmental planning, protection and management of pollution control, nature conservation and other mitigation measures.

Tire word 'Environment' used in other situations are built environment, geo-environment, business environment, economic environment, political environment etc.

1.1.1.4 Ecology versus Environment

The concept of environment is based upon the themes of ecology. In 1859 St. Hilarie, the French Zoologist proposed the term *Ethology.* Later in 1868 Charles Ritter, the German Scientist, proposed the term *Oikology* derived from the Greek words *oikos* (meaning house) and logos (meaning a study); the literal meaning of which is 'organisms at home'. But it was not until 1869 that Earnest Haeckel, the English Biologist elaborated the meaning of the term Ecology by saying "Ecology is the study of totality of pattern or relations between organisms and their environment.

There is a certain relationship between ecology and environment. Basically Ecology is the study of structure and function of nature, mankind being a part of the nature; and Ecosystem is a self-sustaining community organisms, plants and animals taken together with its inorganic environment. In this unit there exists an interrelationship between biotic and abiotic factors through a system of exchange of energy and matter. The living and non-living in an ecosystem exist in a symbiotic relationship where a state of equilibrium is always maintained. Environmental science on the other hand is the aspect of science, which deals with environment, both biotic and abiotic, their impact on other and their interaction and cohesion which result in various ecosystems both terrestrial and marine.

1.1.1.5 Scope of the study

Scope of the study of environmental issues and awareness about it gradually developed since the termination of the Second World War in the mid-forties of the 20th century when, through practical experiences, man realized that some serious threats already started emerging from his physical and socio-economic surroundings owing to uncontrolled and excessive interference in the biosphere. This concern grew largely as a result of :

i) Calamities and catastrophes occurred under the direct impact of the war, *viz.*, explosion of atom bombs in Japan and other environmental degradation occurred in the aftermath of the war.

ii) Rapid growth of population as well as expansion of urbanization. The Southeast Asian, African and Latin American countries experienced rapid growth of population and faced food shortage.

iii) Interference and mass exploitation of natural resources in the so far untouched virgin lands (the Biomes of Tropical and Temperate forests, Arctic and Alpine environments), and

iv) Increasing use of chemical products in agriculture as fertilizer and in industry as dyers and petroleum products (for vehicles) discharging lethal wastes that become detrimental to the so far maintained quality of the nature (land, water, vegetation and atmosphere).

1.1.1.6 Contents of the environmental issues

Contents of the environmental issues in geography are multidimensional. They can be summarized as follows :

First, the concepts relate to the understanding of the classified form of environment, viz., natural and human environments are very important. This covers man-environment interrelationships with respect to population growth, human occupation, economy and technology.

Second, is the study of natural resources—their exploitation and management.

Third, the study of environmental hazards and disasters affecting the human beings is very important

Fourth, comes the study of the varied nature in physical, economic and human environments covering primary activities, social and demographic disparities and economic inequalities—their causes and consequences.

Fifth, is the study of emerging environmental issues like population explosion, deforestation, global wanning and the need and suggested pattern of biodiversity conservation.

Sixth, comes the important aspect of environmental management for sustainable development This covers planning for local regional and national development with special reference to our country India.

1.1.2 PHYSICAL COMPONENTS OF ENVIRONMENT

Physical system of the environment has four basic components, *viz.* atmosphere, hydrosphere, lithosphere and biosphere. Continuous interactions are going on among these components. These interactions involve the transport or transformation of elements, compounds and also various energy forms.

1.1.2.1 Atmosphere

The atmosphere, as we observe today, is the gaseous envelope around the earth.

Although the fluid system forms gaseous envelope around the earth, its boundaries are not easily defined. They can be arbitrarily defined as the earth's atmosphere interface and the space interface.

The gases like Nitrogen, Oxygen, Carbon dioxide; Argon, Neon, water vapour etc together make up the total volume of atmosphere. Together with suspended particles, viz., dust and soot, constitute the gaseous turbidity particularly in Troposphere. In terms of temperature condition, depth and vertical extension atmosphere has two major successions : **1) *Homosphere,*** and **2) *Heterosphere***. From the surface of the earth upto about 100 km the chemical composition, i.e., the proportion of different gases remains unchanged; this part is called *Homosphere.* Beyond this the proportion various widely and this part is called *Heterosphere*. The lower zone of the Homosphere is referred to as *Troposphere* and the upper is the *Mesosphere.* These are separated by a little mixing in which the atmosphere tends towards a layered structure referred to as the *Stratosphere.* Between the Troposphere and the Stratosphere is the *Tropopause* which marks the approximate upper limit of mixing in the lower atmosphere. The average height of Troposphere is about 11 km, but this varies over the earth. In tropical latitude its average height is 16 km and in polar latitude it is only 10 km there is one further zone of heating, above the *Mesosphere,* and more than 90 km above the earth's surface, where short wave ultra-violet radiation is absorbed by any oxygen molecules present at this height. This is referred to as *hermosphere.* Beyond the Thermosphere at a height of approximately 700 km, lies the exposure where the atmosphere has an extremely low density. About 99% of the total mass of the atmosphere lies within the Troposphere and Stratosphere. Concentration of O_3 forms a layer extending from the upper part of the Troposphere (at about 15 km above the earth's surface) throught the lower half of the Stratosphere (up to about 28 km above the earth's surface). This is known as ***Ozone Layer*** and it protects the entire Biosphere by absorbing the incoming Ultraviolet Ray from the sun.

1.1.2.2 Hydrosphere

It includes the surface water and its surrounding interface. It is vital for life molecule to survive. Water possesses a number of physical and chemical properties that help the molecule to act as best suited medium for life activities. The movement of water from earth surface to atmosphere through hydrological cycle appears to be a close system. Water is the most abundant substance on the earth's surface. The oceans cover approximately 71% of the planet, glaciers and ice caps cover additional areas; and water is also found in lakes and streams, in soils and underground reservoirs, in the atmosphere, and in the bodies of all living organisms.

Humans use water in the home, in industry, in agriculture and for recreation. These applications differ widely in the quantities and quality of the water that they require. ID one way or another, we use all available sources—inland waters, ground water, and even ocean water. The demand for global water resources increased day by day through pure fresh water availability decreased severely.

1.1.2.3 Lithosphere

It is the outer boundary layer of solid earth and the discontinuity within the mantle. The outer boundary forms a complex interface with the atmosphere and hydrosphere and is also the environment in which life has evolved. The inner boundary is adjacent to rock, which is near its melting point and is capable of motion relative to the Hthosphere above. Basically Hthosphere is nothing but a crucial system composed of various layers; core mantle and outer crust. Various elements constitute such crustal layer in mixture of different proportion. In general the earth's crust is composed of three major classes of rocks : igneous rocks, sedimentary rocks and metamorphic rocks. There are two types of crusts—continental crust which is composed of granitic rocks in silicon aluminium and with a mean density of 2.8, the other, oceanic crust with is basaltic in composition, consisting of more basic minerals and has a mean density of 3.0. Overall, the average density of the earth is 5.5 gm/cc.

Interaction between the crustal system of the Hthosphere and the atmosphere and biosphere takes place where continental crust is exposed above sea level. At the land-air interface crustal material becomes exposed to inputs of solar radiant energy, precipitation and atmospheric gases. Under the influence of these inputs, crustal rocks are broken down by weathering processes and are transformed to fine porous layer called soil.

1.1.2.4 Biosphere

The Biosphere encompasses all the zones on the earth in which life is present, i.e., entire bio-resources of the earth. It developed on the earth since 4.5 billion years through evolutionary processes. At the top of the Hthosphere, throughout the hydrosphere and into the lower atmosphere life of diverse type exists. These bio-resources and their surrounding constitute the ***Biosphere,*** where mankind is acting as the most evolved creature.

The steps involved in the origin of life on earth are very complex and requires several centuries. Considerable uncertainty surrounds the details of atmospheric composition, the processes involved and even the sequence of some events leading to

formation of living cells. The conventional view has been that the earliest organism on the plant was a heterotrophic prokaryotic bacterium. Subsequently autotrophic prokaryotes and eukaryotes start appearing as stepwise evolutionary changes.

Life on earth requires water, a source of energy (sun light) and variour nutrients found in the soil, water and air. Suitable comination of these essentials can not be found high in the upper atmosphere or deep underground. They exist only in a narrow layer near the surface of the earth. This biosphere layer extends over most of the surface of the earth. It includes the upper layers of the earth's crust and the thin layer of the soil that supports plants life. The zone of life also extends about 8 km up into the atmosphere (air biome biota) and as much as 8 km down into the depths of the sea. Living organisms are not distributed uniformly on globe; only a few organisms survive on polar ice caps and glaciers, where as a wide range of them live in tropical rainforests.

Within the biosphere there are several major regions containing specific types of ecosystems. These major regions are called *biomes.* Biomes are then recognized by the types of dominant ecosystems—tropical rainforests, temperate forests, prairies, deserts, and arctic tundra. The ecosystem is again composed of population and population is composed of individuals. The following table gives details of the number of species exist in the biosphere :

Class	**Identified species**	**Estimated species**
Mammals	4,170	43,000
Birds	8,715	9,000
Reptiles	5,115	6,000
Amphibians	3,125	3,500
Fishes	21,000	23,000
Investebrates	13,00,000	4,40,000
Vascular plants	2,50,000	2,80,000
Non-vascular plants	1,50,000	2,00,000
Rounded Total	***17,42,000***	***49,26,000***

Source : World Resource Institute, 1986

1.1.3 Model Questions

1) Give definition of the term ‘Environment and discuss the ingredients of it as proposed by the European Commission.

2) Make a discussion on Ecology vs. Environment.

3) Describe the physical components of the environment.

1.1.4 Select Readings

- Golly Frank B : A Primer for Environmental Literacy, University Press, Hyderabad
- Mukhopadhyay, A. D. (2003): Perspectives and Issues in Environmental Studies, Vidyasagar University, Medinipur
- Santra, S. C. (2001) : Environmental Science, New Central Book Agency, Kolkata
- Sharma, P. D. (2000) : Ecology and Environment, Rastogi Publications, Meerut
- Singh Savindra (2000) : Environmental Geography, Prayag Pustak Bhawan, Allahabad

Unit 1.2 ❑ Socio-cultural Components of Environment

Structure

1.2.1 Introduction

Knowledge of the physical environment can illuminate only one-half of any environmental issue. Hence after assuming the conditions and aspects of physical environment it is essential to have a clear about the human environment. As because it is always important to know the extent to and pattern of which the human beings respond to the physical environmental conditions in which they live.

Relationships between human activity and the natural world have changed greatly in the relatively short time that people have been present on the earth. A very large increase in human population, along v'ith widespread urbanization associated with advances in technology and related developments of economic, political and social structures have all combined to make the interaction between humankind and nature very different from the situation just a few thousand years ago.

Pre-historic human inhabitants responded to the physical environmental conditions, to large extent, morbidly and instinctively and to a limited extent cautiously. With the passage of time the development of ability of humans to conceive environment allowed them to formalize their view of the interactions with the physical environment

1.2.2 Human forces behind environmental issues

The interactions between humankind and the physical environment result from our attempts to satisfy real and perceived needs and wants. The specific actions include such

things as modifying natural distributions of vegetation and animal, overusing soils, polluting water and air and living in hazardous areas.

1.2.2.1 Housing and Sanitation

Housing is the prime need of the human beings. In the primary stage of civilization when he lived on hunting and food gathering, he did not have any permanent shelter. Afterwards he learn the art of farming and started living permanently in favourable places. He learnt how to build proper shelters in the form of huts and cottages. Later with development of civil engineering technology he improved housing conditions with proper sanitation systems. The remains of ancient civilizations, tike those of Indus valley *(Mahendjo daro* and *Harppa*), Nile valley (Egypt) bear the evidences of highly improved housing as well as sanitation systems of the urban areas with which they substantially improved their life style in the ancient days thus dominated over the natural environmental conditions. In the present day development of proper housing and sanitation system is the prime need of the mankind living in both rural and urban areas of the society. The housing and sanitation are also conditions for human health and hygiene, these reflect the income and education levels of the people. Higher the education and income level (as in the developed countries) better is the housing conditions of the people. Thus developed countries are ahead of the rest of the world in exercising controls over the physical environmental conditions of the earth.

1.2.2.2 Health and Nutrition

Man’s victory over his physical environment has become possible largely due to the improvement in health during the past century. Health is directly associated with nutrition and again nutrition depends upon the status and condition of food supply. Physical factors of environment, like air, water, climate, light, noise etc. influence the health status in any community. Human resource in any country is largely dependent upon nutrition and health.

In most developing countries, defective environment continues to be the main reason of health problem. Man has partially altered almost everything in his physical environment including hydrosphere, lithosphere, biosphere and atmosphere for his temporary benefits. In doing so, he has created for himself a host of new health problems such as pollutions on soils, water, air and others.

In 1072 WHO (World Health Organisation) has compiled a wide ranging survey on

environmental hazards to human health. On this survey, a new branch of social medicine has developed which is known as *Environmental Sanitation.* The term 'Environmental Sanitation' has been defined by WHO as "the control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical environment, health and survival".

The demographic growth and fast urbanization all over the world have been making profound changes on the socio-economic and socio-cultural environments. Therefore the attainment of a healthy environment becomes increasingly complex.

1.2.2.3 Health Hazards

Throughout the developing world, the greatest environmental health threats tend to be those closer to home. Many of these countries live in situations that imperil their health through steady exposure to biological pathogens in the immediate environment. More than one billion people in the developing countries live without adequate shelter or in unacceptable housing, more than 1.4 billion lack accesse to safe water, and more than 2.9 billion people have no access to adequate sanitation—all of which are essential for good hygiene. Unable to afford clean fuel, the poor rely instead on biomass fuel for cooking and heating. Inside the smoky dwellings of developing countries air pollution is often higher than it is outdoors in the world's most congested cities.

Such problems, historically considered rural, have now become urban as well, as sprawling slum settlements surround the world's major cities. Risks are compounded in these peri-urban settlements where garbage collection is often non-existent and drainage tends to be poor, creating ideal conditions for insects and other disease vectors. Overcrowding increases the risk of disease transmission.

In developing countries, the poorest strata are often excluded from the benefits of emerging prosperity and may also face a disproportionate share of health risks related to economic growth. Urban slums may be located near major roads and factories where waste disposal and polluted air cause serious health hazards.

1.2.2.4 Levels of Income and Education

The levels of income and education finally determine the status of socio-cultural environment. Education makes decisive improvements of the cultural level of the society. This helps man to perceive the natural ecosystem gives him expertise to keep up with

the system in the best possible way. Thus better the education level of man, higher is man's ability to adjust with the environmental condition and utilize environmental elements to improve his living condition. Education also teaches man how to handle the hazard situation, manage the disasters in the human environment. Teducation and income are to a great extent complementary to each other. While education makes up gradation of the society, the status of the society income supports man make his living condition better. The level of income is much higher in the educated society. Hence capacity of handling the environmental adversities and expertise in making best use of the natural environment for the betterment of the living condition increase.

In terms of economic development, today's world is quite sharply divided between economically backward (poor) and economically developed (wealthy) countries. As the disproportionate burden of ill health in the poorest country shows, a clear correlation between health and wealth. By and large wealthier a country, or the higher its average per capita income, the healthier would be its population.

Why is the link between health and wealth so strong? At the most fundamental level many of the world* s poorest of the poor, the 1.3 billion who live on less than Rs. 15/ - a day, are unable to secure even the bare necessities for a healthy life—adequate food, water, clothing, shelter and health care. One of the major causes of ill health globally is malnutrition, which are an issue of poverty and rarely an indicator of actual food shortages. Most recent estimates indicate that globally there are 158 million children under age 5 who are malnourished. By one estimate, malnutrition accounted for roughly 12 percent of all dathsin'1990.

1.2.3 Model Questions

1) Discuss the importance of human forces behind the environmental issues.
2) Discuss the role of conditions of housing, sanitation health and nutrition in reforming the structure of the socio-cultural components of the environment.
3) Discuss the impacts of health, hygiene, levels of Income and Education on the human society.

1.2.4 Select Readings

- Mukhopadhyay, A. D. (2003): Perspectives and Issues in Environmental Stadies, Vidyasagar University, Medinipur.
- Population and Development Goals, Oxford University Press, Kolkata.
- Santra, S: C. (2001) : Environmental Science, New Central Book Agency, Kolkata.
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- United Nations Population Fund (1997) : India : Towards.

Unit 1.3 ❑ Concept of Holistic Environment, Degradation, Hazards and Disaster

Structure

1.3.1 What is a Holistic Environment

A Holistic Environment is a building or location that does not need extra ordinary adaptation for any “Special” Group of people. It is a place that has been modified or predestined for everyone’s use and enjoyment throughout their life times.

An environment for ones lifetime includes way finding, multi-model transportation, building, auditing and environmental impact analysis and understanding, and comprehensive integral design concepts.

1.3.2 Comprehensive Integral Design

Working with the engineers and architects to assist in using the above elements in an environment in order to create a holistic environment that can support the conceptual design of the architect and engineer without compromising the importance and inclusion of the holistic elements of a design.

The inclusion of holistic environmental design concepts leads to a more universal configuration by :

1. Comprehensive thinking by engineers, designers and architects.
2. Fostering development for a continuing culture of understanding that values the holistic vision of human communities by municipal, state and federal entities.
3. Stringent enforcement of public that address holistic design.

New aspects that are missing from most programs include

1. Tactile Way finding
2. Full Sensory Signage
3. Sound, vibration and the impact of sound distribution within environments
4. Textural surfacing for natural environments
5. Studies of how people have navigated natural environments by reading the lay of the land
6. The physiology of motion in a designed environment

1.3.3 Environmental Degradation, Hazard and Disaster

Any kind of quality deterioration of the environment is called **Environmental degradation.** Environmental degradation occurs in most cases due to undue interference in the environmental system by the human being. Thus it is more of anthropogenic than a natural process.

As general people assumes ***Disaster*** is a state of total devastation in the existing environment, which extensively affects human beings as well as all living beings on the

earth. These events, whether caused by natural processes or through human interferences, are virtually the extreme events, which occur very rarely and aggravate natural environmental processes to cause disaster for human society such as sudden tectonic movements causing earthquake and volcanic eruption, continued dry conditions or heavy rains leading to droughts or devastating floods etc. In real sense disasters are brought by some environmental hazards.

It is also understood that *Environmental Hazard* is that extreme event, either natural or man-made which exceeds the tolerance limit within or beyond certain time limits, make adjust difficult, and in total, result in catastrophic loses of property and lives. Therefore two alternative terms, viz., ***Environmental hazards*** and ***Environmental disasters*** are used today to deal with the extreme events whether natural or man-made. *Hazards* are generally taken to be the processes, both natural and anthropogenic, which cause an accident or danger, whereas *Disasters are* sudden extreme events which cause greater and large-scale damages to. the human beings as well as the entire natural environmental system. Hence it can be stated that ***the environmental hazards are the process where as the environmental disasters are the result or responses of the environmental hazards.***

1.3.4 Types and nature of various Natural and Man-made Hazards causing Disasters in Human Environment

The type and nature of various natural ad made hazards, which eventually cause disasters in the human environment, are discussed below :

1.3.4.1 Earthquake

Earthquake is a natural phenomenon; which is unparallel in the suddenness of its occurrence as well as its fury. It is actually a tremor through the earth's crust, which rocks the surface. Huge destruction can be caused in a matter of a few seconds without any prior warning. Earthquakes can neither be prevented nor reliably predicted at the present state of knowledge. They occur repeatedly at regular interval of and with varying intensities in certain areas on the earth, called as seismic belts, which according to present hypothesis, lie on peripheral contacts of large tectonic plate of earth's lithosphere. These plates are constantly subjected to huge tectonic forces tending to move towards or away from the adjoining ones, releasing large amounts of stain energy in the process in the form of earthquake waves. Though not very common as the plate marginal ones,

intra-plate earthquakes also occur due to tectonic adjustment within the plate and sometimes they also become catastrophic.

In India, earthquake activity largely affects the areas of the Himalayan mountain region and in the northeastern India (the North-Eastem Hill States. However, intra-plate earthquakes are also common in peninsular shield area of India, especially the area of Gujarat, Maharashtra and Madhya Pradesh.

Earth quake hazards : The primary hazards caused by earthquakes in a few seconds ground shaking, ground settlement, land and mud slides, soil liquefaction, avalanches etc. These are responsible for collapse and destruction of house, road bridges, railway lines etc.; damage to property and public utility services and finally death and injury to man and animal.

The secondary effects of earthquake results in a few days time, in Tsunamis and seiches for submarine earthquakes, floods due to failure of both artificial and natural dams and levees, across and along the rivers, respectively. It has been observed that during severe earthquakes in the higher reaches of river regime natural darns, are created across the river due to landslides and mass movements, to the downstream of which water level is lowered very rapidly after the earthquake. When the pressure of the impounded water overcomes the strength of such natural damming the dam bursts and the downstream area received flash flood of very high intensity creating havoc. This had happened in the upstream of Brahmaputra River during 1950 in great Assam earthquake. After a violent submarine earthquake the seismic energy, traveling along the interface of sea bottom and water column towards the coast, generates catastrophic Tsunamis in the coastal area. Another ***important secondary adverse effect of disastrous earthquake is the psychological changes and*** traumatic among the survivors requiring counseling and speedy settlement.

Mitigative measures **:** A number of mitigative measures are to be taken to combat the earthquake disaster. They are as follows

i) Collection of all past historical earthquake data; ii) identification of all seismogenic and neo-tectonic faults, their rupture length, periodicity of their episodic movements; iii) preparation of seismogenic and seismic zoning maps; iv) establishment of close network of seismic monitoring stations in vulnerable areas and the data thus generated to be analyzed regularly; v) related studies towards earthquake prediction; vi) study of physical effects of past earthquakes—their spatial and temporal variations, including the study of paleoseismicity; vii) in situ stress measurements; viii). estimation of risk and vulnerability to disaster; ix) adopting proper landuse method and regulation, proper

design parameters, enforcing strict building code based on probabilistic analysis of maximum credible earthquake of the area and x) finally, creating awareness among people and preparedness for timely relief and rehabilitation.

Though pioneering scientific studies of earthquake have been carried out in India after the 1897 Assam earthquake, a lot has remained to,be done based on the state of art of knowledge towards the study for understanding the cause of earthquake, determination of source, predictive research and for mitigative measures even today.

1.3.4.2 Flood

The flood is a condition of partial or complete inundation of normal dry land in a river valley of coastal plain. There are various types of floods, such as, flash or reverie flood, coastal and shoreline flood induced by wave action and tidal effects and backwater flooding induced by variety of conditions that led to damming of rivers. Flash or riverine flood, the most common type of flood, develops from concentrated rainfall or melting of snow into the headwater tributaries, which merge the tributary floods into a single flood-wave along the main channel. Coastal flooding occurs as a result of a) inundation of stream flooding, b) coastal wave action including high tides and c) storm surges. Backwater flood is abrupt waveforms as dammed waters are suddenly released from a dam break or generated as splash wave by a landslide in to the reservoir.

In majority of cases, flooding is caused by a river over spilling its banks/levee due excessive precipitation in a short period in the catchment area combined with inadequate channel capacity associated with aggradation of river bed and inadequate waterways at rail and road crossings. Most important cause of flood hazard is unplanned encroachment of flood plains and lack of control of proper lands. Deforestation and lack of soil conservation and watershed management are causes contributory to flash flood and soil erosion. Structural measures adopted for flood hazard mitigation or for flood control frequently enhance the risk of more severe flood damage.

Out of 329 hectares of land areas of our country, about 44 million hectares is estimated to be liable to flood hazard, thus constituting 13% of the country’s geographical area. Though so far reasonable protection measures have been provided to about 10 million hectares, the intensity of damage due to floods in terms of human lives and area affected has been increasing alarming. The National Flood Commission had estimated in 1978, that the flood-prone area has increased from 25 million hectares at the end of 1960s’ to about 40 million hectares by the mid- 1970s’. Using the same methodology, Centre for science and Environment has found that flood-prone area in

the country by 1984 was 59 million hectares—an extraordinary increase in just six years since 1978.

Mitigation of Flood Hazard **:** So far in India flood control and protection measures include two major aspects, viz. construction of retention structures and storage reservoirs, drainage channel improvement, flood diversion, protective embankments, and b) flood warning and evacuation. These efforts carried out so far have not borne much fruit probably due to the fact that these measures are not planned on the basis of validated data on surface hydrology, climatic conditions, geo-factors of terrain and natural resources of the project area, so that protective structures and their locations can be harmonious with nature.

Though we have no control on the vagaries of nature connected with heavy rains in a very short period. Upliftment of catchment area and subsidence of river basins etc. through understanding of these processes should be attempted and actions be taken. Best way of flood mitigation is to avoid the flood prone area for settlement and for any development activities. Strictly prohibit deforestation in catchment area with simultaneous whole hearted effort to afforestation. It may be mentioned here a good forest canopy removes 40% of precipitation through transportation and canopy interception, and increases the infiltration of water into the soil and decreases soil erosion and mass movement substantially thus reducing silt load of the river channel.

1.3.43 Drought

According to the National Commission on Agriculture (1976) drought is of three types :

i) ***Meteorological drought*** **:** It is a situation when there is a significant (>25%) decrease of rainfall from normal value over an area.

ii) ***Hydrological drought*** **:** Meteorological drought when prolonged, results in hydrological drought with a marked depletion of surface water and consequent drying up of reservoirs, lakes, streams and rivers, cessation of spring flows and also fall in ground water level.

iii) ***Agricultural drought*** **:** It occurs when soil moisture and rainfall are inadequate during the growing season to support healthy crop growth to maturity and causes crop stress and wilting. Almost all the area in the country, which received a normal rainfall of less than 700 mm, can be classified as drought prone. This is about 35% of the country's area. Another 18.5% of the country, which receives a normal rainfall of 750-1,000 mm, can be described as

transitional zone. Thus over a half of the country, without irrigation would be drought prone.

Causes of drought : As is evident from the definition, drought is a natural phenomenon which results from reduction in the usual rainfall in an area; sometime reduction of rainfall in proper season or time. However, there is indirect correction between certain human activities and occurrence of drought viz., deforestation, over exploitation of grazing land* over exploitation of groundwater, neglect of tanks/water reservoirs, inequitable distribution of canal irrigation water. Therefore it is believed that drought is the combined effect of neglect and over exploitation of common environmental resources, essentially the system that provide a cushion against the problems caused by dry periods.

Drought mitigative **measures** : The following measures are recommended for mitigation of drought :

i) It is estimated that about 28.75% of rain and snow melt water received in the country, flows to ocean as surface runoff. Therefore utmost effort will be to retain as much as possible the surface runoff by way of water harvesting especially in the drought prone areas.

ii) To increase the measure of afforestation and development of grassland which help in retaining the soil moisture and water percolation during the rains.

in) Measures leading to regeneration of ground water and controlled exploitation of ground water in problem areas.

iv) Increase the storage capacity of all water retention structures by way of enlargement and desalinization.

v) In some places ground reservoirs must be maintained as ground water sanctuaries and to be used only for drinking water during the period of acute drought.

vi) Effort towards regeneration of all wasteland produced by over exploitation and prevents all types of land degradation in drought prone area.

vii) Mixed cropping to be encouraged in dry land agriculture to reduce risk of crop failure.

Thus it is seen that as the tree cover declines and ecological imbalance grows, this inevitably affects the marginal crop lands, by adversely exposing them to increased floods and droughts.

1.3.4.4 Landslides

A landslide is an event in which surface materials of earth move outward and

downward from their underlying and stable floors in response to the force of gravity. Such movement includes falls, creeps, flows and slides which may be triggered by various factors. Down slope movement of large volumes of surface materials under gravitational influences-poses a serious threat of environmental hazard, especially in mountainous terrain. Rapid movements cause loss of life and damage; slow movements on the other hand have less potential to kill but can be costly for the economic life of the country.

In recent years, landslide risk is increasingworldwide as land hunger forces new developments onto unstable slopes. According to Jones (1992) it is under-recognised threat because the impacts tend to be frequent and small scale, whilst the process itself is often attributed to other hazards, such as earthquakes and rainstorms. During the early 1970s an average of nearly 600 people per year were killed by slope failures worldwide, with som 90% of these deaths occurring around the Pacific Ocean Rim. This zone is particularly susceptible to mass movements because of the combinations of rock type, steep terrain, heavy typhoon rainfall, rapid landuse change and high population density. However, it is likely that most of these deaths would be associated with slope failures caused by seismic events. As with many other environmental hazards, it is urban areas which are most vulnerable because of the large populations at risk (Alexander, 1989). Economic losses due to landslides have been estimated at more than US $ 1 billion per year in several countries. In India, numerous urban centres and transport networks over the Himalayan region stretching from Kashmir in the west to the Arunachal Pradesh in the east are threatened by landslide activity. In addition to direct damage, mass movement hazards cause a variety of indirect losses such as road blockages, flooding due to landslide dams across rivers, reduced agricultural and industrial production.

Sensitive zones for landslide hazards : Jones (1995) claimed that landslides would become an increasingly important hazard, especially in the developing countries and drew attention for several types of terrain where the greatest physical threat exists. These are as follows :

1) Areas subject to seismic shaking : An earthquake can trigger widespread mass movements in thousands of individual slides, as in 1950 Assam (in eastern India) earthquake when over 50 × 109 m^3 of material was dislodged over a total area of 15,000 km^2. Major landsides were also a feature of the 1988 Armenian and the 1990 Iranian earthquakes.

2) Mountain environments with high relative relief : Environmentalists all over the world have estimated that the high-energy mountains such as the Himalaya or the Andes mountain chains produce extensive catastrophic rock fall. These

slope failures comprise huge masses of material (up to 100 × 106 m^3) which at least at the initial stages of movement travel near-vertically at very high velocities and cover long run out distances.

3) Areas of moderate relief suffering severe land degradation : Readily erodable soils on slopes subject to land degradation resulting from deforestation, overgrazing and other poor management practices create the potential for gully expansion and land slipping.

4) Areas covered with thick sheets of loess : Any mantling of an existing surface with finely grained material such as windblown loess is likely to lead to a shear zone with the old surface. Slope failure occurs in the loose cohesion less deposit, often in the form of flow or slides.

5) Areas subject to high rainfall inputs : In tropical areas subject to monsoon or cyclonic rainfall weathering can penetrate tens of metres below the ground surface. Throughout the humid tropics intensively weathered soils produce a relatively deep and porous mantle, which is prone to landslides.

Causes of landslides : Causes of landslide include a variety of events that combine .either to increase the driving force or to reduce the shear resistance on a slope. Factors that increase the driving forces may be either physical or human aid include:

1. An increase in slope angle, which may occur if a stream erodes the bottom of a slope or if the slope is steepended by building work.
2. Removal of any lateral support at the foot of the slope again caused either by natural mass wasting processes or by building activity.
3. Any additional weight placed on the slope, as through the dumping of waste or . house construction. Residential development not only adds weight to the slope through the buildings themselves but also through excess water supplied from landscape irrigation and sewage effluent systems.
4. Removal of vegetation, which can occur naturally from forest fire or through human activities such as logging, overgrazing or construction.
5. Local shocks and vibrations, which can occur naturally *from* seismic activity or from the operation nearby of heavy construction machinery.

Factors that leas to a reduction in the shear resistance on a slope :

a) An increase in pore-water pressure in slope materials, especially along a slip surface. This is the most important single factor and explains the close relationship, which exists between shallowseated landslides, debris flows and rainstorms.

b) An increase in slope angle. Many developed slopes are over-steepended by - cutting into the base, a process, which increases the driving force.

c) A combination of weathering and other natural processes. These include the physical and chemical breakdown of slope materials.

In most urban areas landslides may be attributed to a combination of the above factors. The progressive human invasion of landslide hazard zones is not confined to the wealthy developed world. The need for improved transportation is leading to new road construction in terrain with a high probability of slope movement throughout the developing world. In mis world limited resources may lead to inadequate hazard protection.

Event Modification Adjustments : The ability to assess the probability of landslide risk at specific sites is of considerable assistance in implementing mitigation strategies. General indicators include the structure and lithology of slopes, including the presence of weak rock types, clay-rich soils and slopes generally in excess of 25°. Property damage from landslides usually leads to demands for engineering works to stabilise the slope. However, the human response to slope failure is often complicated by statutory and funding distinctions, which are made between emergency and permanent works. If the problems can be overcome, the stability of the slope may be improved by a variety of engineering techniques :

- Excavation and filling method can be used to produce a more stable average slope. This type of reshaping is usually successful but becomes more difficult and expansive as the slide area increases. Specific techniques include unloading the head of the slide and loading the toe, with the replacement of failed material with lighter loads.
- Drainage, especially sub-surface drainage, can be equally effective where changes in pore-water pressure have been cause by the rise in the water table. Properly designed and constructed drainage systems work well but others soon become clogged by fine particles.
- Vegetation of slopes performs several functions. Plant roots help to bind soil particles together, the vegetation canopy protects the soil surface from rain-splash impact and transpiration processes aid in drying out the slope.
- Restraining structures—such as piles, buttresses and retaining walls—can be helpful for slides covering limited areas. But they are generally too expensive for large, unstable slopes and the location of property boundaries may also restrict the approach.

- Other methods include the chemical stabilisation of slopes and the use of grouting to reduce soil permeability and increase its strength.

Slope stabilisation, along with hazard-resistant construction techniques, appears to be the most effective preventive strategy for controlling new development

1.3.4.5 Severe Storms (Tropical Cyclones)

Tropical cyclones are among the most destructive hazards around the globe. Strong winds, heavy rains, give rise to development of storm surge, flood and landslide. As a result considerable amount of loss of life and property takes place. Such natural hazards set back social and economic advancement of country like India; e.g., devastating storms around the Paradwip coastal tract of Orissa in 1999. The hazards become even worse due to lack of appropriate warning and preparedness system. To reduce loss of lives, suffering and property damage, the nation shall have to strengthen her capability to provide timely warning of occurrence and impact of cyclone and associated phenomena such as floods and storm surges, as well as to organise and execute the related disaster prevention and preparedness measures.

Tropical Cyclones in India: Tropical cyclones over the Bay of Bengal and Arabian Sea are of major concern to coastal people in and around west and east coast of India. Each year considerable number of cyclonic storms hit these coasts. Seven percent of the global tropical cyclones form over the Bay of Bengal and Arabian Sea. Formation of cyclones in these regions is related to seasonal migration of ITCZ. Ratio of cyclones in Bay of Bengal and Arabian Sea is 4 : 1. Tropical cyclones over Bay of Bengal form during pre-monsoon and post-monsoon seasons. During premonsoon phase, they form in The North Bay and travel northwards. Few of them attain the structure of tropical cyclone as the time available for their formation is small. During monsoon phase prevalent high wind shear inhibits their formation. During post-monsoon phase, the available time being sufficient, the depressions turned out to be a cyclonic storm often imparts severe disastrous effect. In post-monsoon phase, the average life of these storms is 4-5 days. Storms of hurricane intensity has average life of 2-4 days (<6 days for global average).

Factors responsible for generation of storm surge and cyclone **:** The following factors are responsible for generation of storm surge and cyclone :

1. In the location of tropical storm, the low-level velocity is twice that in non-developing disturbances. This increases upward motion, cumulus convection and as a result, release of more latent heat. Increased heating due to latent heat release increases horizontal convergence, which again increases relative velocity.

2. Near-equator Carioles parameter is very small. For this reason they **do** not form between 00 and 6° N latitude.

3. Above and around the zone of formation of vertical wind shear should be low. Otherwise latent heat released through convection will be advected away. If during formation upper level divergence is above the lower level convergence, intensification takes place rapidly.

4. Sea-surface temperature should normally be above 27° around the zone of formation.

5. For the formation mature tropical cyclone, the vertical gradient of equivalent potential temperature should be very high. The equivalent potential temperature at sea surface level should higher than that

6. Relative humidity should be high in lower and middle troposphere.

Disaster management on cyclone-affected areas **:** Disaster management on cyclones can be done in two separate and systematic ways : a) by Hazard and Risk Mapping and b) by making Disaster ***Management and Preparedness Programme.***

Through risk mapping potential losses in hazardous areas can be identified. A hazard index is devised to indicate intensity of a hazard. Usually it is numerical grading on the basis of the area's history of past disasters. Real time risk assessment is related to estimation of risk due to impending cyclone and storm surge. On the basis of this assessment, evacuation programmes, arrangement for relief and rehabilitation measures can be undertaken. In such cases, it is needed to forecast the magnitude of wind speed, storm surge height and amount of associated flood accuracy. Better the forecasting capability; the less is the loss of life and property.

Disaster management and preparedness programme covers all the activities of collecting information related to disaster comprising : i) collection and analysis of data on past disasters, ii) risk assessment, iii) prevention and preparedness programme, iv) relief, v) reconstruction, vi) rehabilitation, vii) policy planning and viii) action plan.

Our objective of tropical cyclone and storm surge disaster mitigation programme should be to strengthen the capability of providing:

a) Reliable forecast of tropical cyclone track and intensity and related forecasts of strong winds, quantitative timely assessment of heavy rainfall, quantitative forecast and simulation of storm surge and timely warning to all hazard-prone areas.

b) Promote response to warning and carry out activities at the interface between warning system and users of warning.

c) The required meteorological and hydrological data and assessment of risk and disaster.

d) National disaster preparedness and prevention measures. Natural Disaster Reduction and Management

The reduction of natural hazards and disasters and their management involves : 1) provision of immediate relief measures to disaster affected people, 2) prediction of hazards and disasters and 3) measures of adjustment to natural hazards.

The provision of relief measures to the disaster victims involves several steps to be followed such as i) there should be correct picture of the nature and magnitude of disasters. Very often the news media report their own misconception instead of reporting the real events. This is not done deliberately. The misconceptions about a particular natural event arise because of the personal opinion of the observer or analyzer. It is, therefore desirable for the international communities to respond to the official requests of the concerned government only; ii) priorities must be decided before undertaking the remedial and relief measures. For example, relief measures must be concentrated in the high-density areas of the affected locality. Special resource tools, communication equipment, heavy machines to remove debris, water pumps, cement and technicians are more important than drugs and doctors because the health dangers after disasters are predominantly environmental in character and not medical.

Management of natural hazards involves disaster research and disaster predictions. The predictions of natural hazards may be made on the basis of the study of the past history of the area prone to a particular natural hazard in terms of frequency, recurrence intervals, magnitude and dimension of events, precursor events, nature of causative factors *(e.g.,* possible floods may be forecast on the basis of amount and intensity of rainfall in the catchment area; spotting of the tropical cyclones and local storms near their sources).

Mapping and Monitoring of Natural Hazards and Disasters and global changes in the environmental conditions are very important aspects of disaster management Tliis requires in-depth study of hazard-prone areas at global, regional and local levels. The *INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (ICSU)* and other organizations have launched several research programmes to study the environmental changes caused by human activities and natural disasters in terms of the mechanisms involved in the genesis of such disasters, their monitoring and mitigation.

1.3.5 Man-induced (Anthropogenic) Hazards and Disasters

Environmental degradation may also occur as a result of undue interference of man on the nature. Any environmental degradation induced by man becomes hazard and disaster when it assumes alarming proportion and causes irreparable loss to human society. Man-induced environmental hazards and disasters may be caused through a variety of human activities both of intentional and unintentional character.

The man-induced environmental hazards and disasters may be classified in three broad categories

i) Man-induced Physical Hazards such as earthquakes, landslides and accelerated rate of soil erosion;

ii) Man-induced Chemical Hazards such as release of toxic chemicals and dumping and exposure at later date of toxic chemicals, nuclear explosion, leakage of crude oil from oil tankers into the oceanic water etc. and

iii) Man-induced Biological Hazards such as population explosion, eutrophication etc.

Earthquakes are certainly natural phenomena and are caused by the endogenetic forces coming from within the earth but certain human activities, such as pumping of water and oil, deep underground mining, blasting of rocks by dynamites for constructional purposes, nuclear, explosion, storage of huge volume of water hi big reservoirs etc. also cause earth tremors of serious consequences. The introduction of additional artificial superintendent load through the construction of large dams and impounding of enormous volume of water in big reservoirs behind the dam causes disequilibria of already isostatically adjusted rocks below the reservoirs or further augment the already fragile structures due to faults and fractures underneath.

The process causes earthquakes of varying intensity, which inflict damage to human life and property. Many major seismic events have been correlated with dams and reservoirs all over the world, such as i) earthquake of 1931 hi Greece due to Marathon Darn constructed in 1929; ii) start of earth trarnours since 1936 around Hoover Darn USA due to creation of Mead Lake in 1935; iii) Koyna earthquake of 1967 (Koyna, Maharashtra in India) due to Koyna reseryoir constructed in 1962; other examples of significant earthquakes caused by dams and reservoirs are of Monteynard and Grandvale in France, Mangla in Pakistan, Kariba in Zambia etc. Underground disturbance due to hydrostatic pressure of water in the reservoirs also causes landslides and earth-flow

along the natural and artificial walls of the reservoirs. It may be pointed out that the intensity of earthquakes has been positively correlated with the levels of the water in the reservoirs.

Dumping of toxic chemical substances in the ground may become hazardous to subsequent colonization of the area concerned by human beings. For example, the ditch dug out in 1892 for the construction of Love Canal in USA was later abandoned, and was thereafter continued to be used as dumping ditch for the industrial wastes. The process of 'dumping of chemical substances went on till 1952 when this dumpsite was colonized by 200 houses as the suburb of Niagara Falls city. The 'TIME BOMB' in the form of toxic chemicals hidden in the dumped canal suddenly burst during the winter of 1976-77 due to heavy rainfall and heavy snow fall which resulted into severe health bazard of alarming proportion as the residents of newly built suburb suffered from higher rate of abortions (among women), blood an liver abnormalities, birth defects, and several kinds of physiological disorders.

Spilling of immense quantity of crude oil from oil tankers into sea water causes rapid rate of spreading of oil slicks which creates disastrous hazard for marine organisms and the human population faces the shortage of food supply. For example the great marine disaster was created because of leakage of 100,000 tons of crude oil from the huge oil tanker, which stnicke the Spanish coast near the Port of La Corunna and exploded on May 12,1976. The oil slicks killed most of the sea organisms meant for human food such as mussels, oysters and clams. Another incident of leakage of crude oil occurred on June 24, 1989 when 5,000,000 tons of crude oil leaked from an oil tanker into Atlantic Ocean.

Unintentional disaster of nuclear establishment becomes most lethal hazards because its adverse effects not only affect plants and animals including man at the time of disaster but they are perpetuated for several years to come and many generations of human beings may continue to suffer from radioactive substances. The disaster of nuclear installation of Ghernobyl (USSR) in 1986 is burning example of such man-induced environmental disaster. The Bhopal (M.P.) Gas Tragedy of Union Carbide Factory in 1984 is another example of lethal environmental hazard caused due to improper maintenance of the gas containers. The dropping of atom bombs on the cities of Nagasaki and Hiroshima (Japan) by the USA in 1945 and resultant nuclear disaster affecting millions of Japanese population is the example of environmental hazard caused by man's intentional actions.

1.3.6 Distinct types of Man-made Environmental Degradation

1. **Degradation of Wildlife** : India presently has more than 15,000 species of higher plants and 80,000 species of animals, constituting respectively 5.2% and 4.3% of all the knowi plants and animals of the world. About 134 species of plants (99 species in the Himalayan region alone), 29 species of mammals, 29 species of birds and three species of reptiles are threatened. Deforestation has destroyed the habitats of birds and other vertebrates and also threatened the survival of many secies of birds and mammals in particular. Significantly the extinction of birds and animals is directly related to the increase in human population in earth planet It is a certain fact that in India the extermination of rich wild life is due to the demands of the first multiplying hungry human population.

2. **Depletion of Ozone layer** : Depletion of Ozone layer in the •Stratosphere has become a serious concern in recent years. The phenomenon is the formation of Ozone hole, which has been occurring locally over the Antarctic continent in the Austral spring, between September and November each year since about 1979. Stratospheric Ozone is very important because it acts as a Ultra-violet Filter, cutting out short-wave ultraviolet radiation from the sun which otherwise would be damaging plants and animals as they have evolved on Earth. In addition, as a result of absorbing this short wave, highly energetic radiation ozone causes a wanning of the upper stratosphere, which influences global air motions. Increase in man-made pollution of atmosphere by nitrogen oxides and more seriously by CFG and CH_4 has given rise to fears that the delicate ozone balance might be shifted, with possibly serious consequences. The processes leading to the ozone hole formation particularly in the Antarctic region.

3. **The Greenhouse effect** : The greenhouse effect arises because the atmosphere is largely transparent to incoming solar radiation, while being quite heavily absorbing to outgoing thermal radiation from the planetary surface and the atmosphere. Of course, the greenhouse effect is a perfectly natural process, which exists whether or not mankind is thought to be modifying the climate. It is the enhancement to the greenhouse effect resulting from man's activities that is liable to destabilize the natural balance. Many different gases in the atmosphere contribute to the greenhouse effect. Among the greenhouse gases CO_2 has a major effect, in that a temperature rise of 0.53-0.79 k is predicted for just a 25% increase in concentration.

4. **El Nino :** The El Nino phenomenon, e.g. 'El Nino is a warm oceanic current affecting the Peruvian coast every 10 years or so*. It is not a process with a clear beginning and end, at least not on the basis of our present understanding. It is system of several coupled phenomena; each interacting with and driving the others and what is not clear is just how a particular cycle of events is triggered. This phenomena occurring as an anomaly of warming atmosphere.

5. **Acid rain and industrial pollution :** With rise of global industrialisation, increasing acidity in natural waters and soils has become a problem. The acidity is associated with the transport and subsequent deposition of sulfur dioxide, nitrogen oxides and their acid oxidation products. Thus much concern was raised in the international platform about the future strategies for combating industrial emission of pollutants, regionally and locally.

6. **Problems with toxic waste, chemicals and radioactive substance disposal:** with gradual rise of mining industries, nuclear power plants and production on of hazardous chemicals all over the world an arena of environmental hazards started during past couple of decades. Hazards related to toxic substances are already exposed after a number of disasters like the Bhopal gas tragedy, Chernobyl nuclear power plant accident etc. Chemical and biological weapons used in wars also significantly deteriorate the global environment Intensive agricultural practices over the past three-four decades also added newer chemicals like insecticides and pesticides in the cropping areas. Many of these chemicals are not only hazardous to biological system but also non-biodegradable, so that they accumulate in biological systems slowly and finally cause long-term damage to the systems.

1.3.7 Degradation and Hazards due to Social problems

13.7.1 Poverty

In terms of economic development, today's world is quite sharply divided between economically backward (poor) and economically developed (wealthy) countries. As the disproportionate burden of ill health in the poorest country shows, a clear correlation exists between health and wealth. By and large wealthier a country becomes, or the higher its average per capita income, the healthier its population becomes, by several measures.

Why is the link between health and wealth so strong? At the most fundamental level many of the world's poorest poor, the 1.3 billion who live on less than Rs. 15/- a day, are unable to secure even the bare necessities for a healthy life—adequate food, water,

clothing, shelter and health care. One of the major causes of ill heaUn globally is malnutrition, which is an issue of poverty and rarely an indicator of actual food shortages. Most recent estimates indicate that globally there are 158 million children undfr age 5 who are malnourished. By one estimate, malnutrition accounted for roughly 12 percent of all deaths in 1990.

1.3.7.2 Urban poverty

Traditionally poverty has been concentrated in rural areas. Yet as the bulk of the world's population shifts from rural to urban areas, poverty is becoming an increasingly urban phenomenon. The World Bank estimates that in 1988 approximately one quarter of the developing world's absolute poor was living in urban areas. By this year of 2000, half of the developing world's absolute poor will be in urban areas. Several factors, including structural adjustment programs, economic crisis, and massive rural-to-urban migration, have contributed to an increasing number of urban poor since the 1980.

Urban poverty is especially pronounced in Latin America. In this region, the absolute number of urban poor already surpasses the number of rural poor. Between 1970 and 1990, the number of urban poor increased from 44 million to 115 million, while the number of rural poor increased from 75 million to 80 million. In Asia, large decreased in the proportion of the population living in poverty were reported for the rapidly growing economies, such as Malaysia, the Republic of Korea and Indonesia. However South Asia is expected to continue to house a large share of the world's urban poor.

Poverty has also risen steeply in the countries of Central and Eastern Europe as they struggle with the transition toward a market economy. Cities that relied heavily on industrial production are experiencing record numbers of unemployed as factories shut down and production is curtailed.

In North America and industrial Europe most of the population, and thus most of the poverty, has been concentrated in urban areas since the beginning of the 20th century. The characteristics of urban poverty, however, are changing. As the manufacturing base of many cities has declined and the middle class has fled to the suburbs, urban poverty has become concentrated in the inner cities and among ethnic minorities, especially hi North America.

1.3.73 Poverty and crime

In the economically backward countries, poverty not only brings health hazards but also ensures series of social problems, particularly crimes. Crime may be fantasy for

groups of young stars in the rich urban sectors of the wealthy countries, but in the economically backward countries steadily growing population aggravates unemployment problem, more numbers of jobless persons generally get involved in crimes like burglary, mugging, robbery etc. In the periurban areas of the rich countries as well where mainly labour-class prople live (like the Ghetto areas around New York and Chicago metropolitan cities in U.S.A.) this problem is obvious, this problem is particularly acute in the slum areas where groups of young unemployed persons, in order to earn money, commit regular violence and crimes around their own areas and alsa spread their icy hands in the other sectors of the city.

13.7A Poverty and social risks

Health hazards : Poverty influences health because it largely determines an individual's environmental risks, as well as assess to resources to deal with those risks.

Throughout the developing worlck the greatest environmental health threats tend tobe those closest to home. Many of these countries live in situations that imperil their health through steady exposure tobiological pathogens in the immediate environment. More than one billion people in the developing countries live without adequate shelter or in unacceptable housing, more than 1.4 billion lack access to safe water, and more than 2.9 billion people have no access to adequate sanitation - all of which are essential for good hygiene. Unable to afford clean fuels, the poor rely instead on biomass fuels for cooking and heating. Inside the smoky dwellings of developing countries air pollution is often higher than it is outdoors in the world's most congested cities.

Such problems, historically considered rural, have now become urban as well, as sprawling slum settlements surround the world's major cities. Risks are compounded in these peri-urban settlements where garbage collection is often non-existent and drainage tends to be poor, creating ideal conditions for insects and other disease vectors. Overcrowding increases the risk of disease transmission.

In developing countries the poorest strata are often excluded from the benefits of emerging prosperity and may also face a disproportionate share of health risks related to economic growth. Urban slums may be located near major roads and factories where waste disposal and polluted air cause serious health hazards.

13.7.5 Urbanisation and Unemployment problems :

Unemployment is a significant problem in most cities in developing countries, because the formal economies of Africa, Asia and Latin America are unable to absorb the enormous influx or workers. Given the urbanisation rates, these cities are now experiencing the demand for new jobs which will be intense: Starting in 1990, it is

estimated that an additional 35 million jobs per year will be required to provide employment to all new labour force participants. As a result, substantial number of the developing world's urban poor makes their living through subsistence activities or informal jobs - namely, production and exchange outside of the formal market. These jobs run the gamut from providing services such as garbage collection and domestic help, to provide goods such as food and building materials in small stores, to small-scale clothing manufacturing. Informal jobs make up an estimated 75 percent of urban employment in many countries in sub-Saharan Africa and between 30 and 50 percent in Latin America.

1.3.8 Model Questions

1) What do you mean by Holistic Environment? Suggest for a Comprehensive Integral Design of holistic environment

2) Make brief discussion on the terms: Environmental Degradation, Hazard and Disaster.

3) Discuss upon causes, consequences and mitigative measures of earthquakes.

4) Make a concise discussion on the environmental hazards created by floods and droughts and suggest for their mitigative measures.

5) Make a concise discussion on the environmental hazards created by landslides and suggest for their mitigative measures.

6) Make a concise discussion on the environmental hazards created by severe storms and suggest for their mitigative measures.

7) Describe some typical hazards and disasters that may be of anthropogenic origin and show their extent of impacts upon the human beings.

1.3.9 Select Readings

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Unit 1.4 ❑ Global Resource Crisis and Sustainable Development

Structure

Part-I.

Part-II.

1.4.1 Introduction of Global Resource Crisis and the Need of Sustainable Development

Sustainable Development is **a** system of development with which a Nation or Society can be able to satisfy its requirements - social, economic and others without jeopardizing the interest of future generations. ***Sustainability*** is a concept on which social and natural scientists, and philosophers have expressed their views from time to time. It is long term as against short-term development, which is to be addressed. The concept of long term overlapping generations brings in certain difficulties in understanding development However, for all operational and practical purposes, policy options and empirical content can determine and justify the length of the time horizon.

Sustainable Development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and the institutional change are all in harmony and enhance both current and future potential to

meet human needs and aspirations (WCED-1987, Report).

The focus in this manner of characterising sustainable development is on a process which links exploitation of resources, investments, technology and institutions with human needs and aspirations. Operationalising sustainable development within this framework is the responsibility of policy makers and administrators. In order to translate policies expressed as employment programmes investments, price supports and transfer of technology, into sustainable development indicators, they need to have information on the current state of production, consumption, employment, prices, distribution of income, and so on. In addition, to conceptualise the links of economic variables with sustainable development, it is essential that the information is supplemented with measures of the services supplied and welfare augmented by non-market assets such as environmental goods and resources, as well as the utility provided by the level.and the quality of their stock, should be monitored carefully. Only then can it be ascertained whether the economic performance of a region or a area is becoming more or less sustainable overtime.

Thus Sustainable Development has been defined in terms of meeting the needs of present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). According to this anthropocentric definition, sustainability becomes meaningless when human survival is under threat Development may be unsustainable due to various reasons such as socio-economic transformation, unequal access to resources and localisation of growth, etc. The basic rule of sustainable development is to harvest the renewable resources at an optimum rate which should not exceed its generation rates (Rennings and Wiggering, 1996).

Resource utilisation at a rate higher than its generation rate will be ecologically unsustainable. But, resource utilisation and a rate below its regeneration capacity may cause economic unsustainability on a regional scale.

Therefore, sustainable development could be defined as ***the management and the conservation of natural resources base and the orientation of technological and institutional change, in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations.*** Such development conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable.

1.4.2 Why the need of Sustainable Development has been felt

During the last centuries population of the world has been growing rapidly. Since

1900 the rate of growth of population declined in Europe, North America and Oceania. But in Africa, Asia and Central and Southe America the population growth has increased. The rapid growth of world population prompted the growth of global production and consumption. Thus a need for immediate and rapid development has been felt aiming at controlling world population growth. Countries with higher population growth rates experienced faster conservation of land to agricultural uses putting additional pressure on land and natural habitats.

It is in fact that in comparison to the demands of world population there is shortage of natural resources. The carrying capacity of the earth is already over-sought and as a consequence citizens of the world must find ways to reduce material consumption. In other words, citizens should try to reduce total resource use taking into account sustainable life style. Sustainable development stresses the need for the people to live within the capacity of nature.

The pursuit for development in such a scenario of population growth vis-a-vis high consumption is only oriented towards a short-term economic goal and is not a sustainable one. Economic Boom and its result on the environment can be understood from the following :

1) Protest against a dam to be built on prime farmland led to killing of four villagers in Madura off Eastern Java.

2) More than one million farmers in Thailand were faced with massive displacement to make way for large-scale tree plantation to supply pulp for the global industry.

3) More than 400 villagers were arrested since 1987 for defending ancestral lands against logging of Sarawark, Malaysia.

4) HOECHST threatened a lawsuit against indigenous workers who decry toxic pesticide poisoning in Philippines.

5) Such instances for instance tussle over land rights and access to natural resources, livelihood and health are erupting more and more in the cauldron of rapidly industrialising south-east Asia in its transformation from traditionally agricultural societies to intensive export oriented economics.

6) Structural shifts in resource use and perceptions of nature, and escalating materialism among a growing urban middle class are driving to the surface fundamental clashes between those who benefit from the economic success and those who are victimised.

7) When primary resources were first exploited population who traditionally lived in forests and coastal areas were direct victims.

8) The countries like Thailand and Philippines have logged so much forests that they have not only a valuable heritage of biodiversity but face severe water shortages and regular floods. They deprive the forests to play their ecological functions

9) The FAO and International Rice Research Institute have in the past year, officially acknowledged that the Green Revolution has failed and rice production has dropped by 1-3% per year.

10) Industrialisation itself has spread pollution in the unprecedented scale in the regions like Bangkok, Djakarta and Manila.

1.4.3 Key elements of Sustainable Development

In the context of the discussion upon Sustainable Development it is worth mentioning that the word "development" so frequently been used in the context of the term "Economic Development". The word ***Sustainable Development*** (SD) carries the meaning of the word' "Development" quite different from' 'Economic Development:'' Development (D) encompasses three sources of development: 1) Social (W) 2) Economic (I) and Environmental (N). This is indicated as D = WIN. This is indicative of the fact that development takes place when social, economic and environmental objectives or any grouping is present in dominant form. Wide recognition of the concept of SD came with the publication of Brutland Commission Report on "Our Common Future" in 1980.

Brutland Commission reaffirmed the basic promises of the UN Declaration on the right to development that "right to development is inalienable human right and human personis the central subject of development". Club of Rome highlighted a further dimension to SD "a sustainable society implicitly connects one that is based on a long-term vision. In that it must foresee the consequence of its diverse activities to ensure that they do not breach the cycles of renewal.

a) Key elements of the concept of Sustainable Development

ILA's (1993) NIEO Committee in its Cairo Conference (UN) noted the following key elements of the concept of sustainable Development :

i) The concept of SD dows not imply limits - not absolute limits but limitations imposed by the present state of technology and social organizations and environmental resources and by the ability of the biosphere to absorve the effect of human activities;

ii) SD requires the needs of all and extending to all the opportunity to fulfill their aspirations for a better life i,e., world in which poverty is endemic and will always be prone to ecological and other catastrophe;

iii) SD requires meeting essential needs that requires not only a new era of economic growth for nations in which the majority are poor, but an assurance that those poor get their full shoe of the resources required to attain their growth.

iv) SD requires that equity would be aided by political systems that secure effective citizens participation in decision making and by greater democracy in international decision making; and

v) SD requires that those who are more affluent adopt life style within the planet's ecological means - their use of energy. For example, rapidly growing populations can increase the pressure on resources

A significant achievement for the Rio conference is the setting up of institutional machinery "Sustainable Development Commission (SDC)" and the adoption of Agenda 21 by different countries into national policies.

b) Principal features of Sustainable Development

SD implies integrated human development It means meeting the basic needs of all and extending opportunity to all to fulfill their aspirations for better life. SD seeks to provide poor with an assurance for full share of resources required to attain the growth. SD symbolizes effective citizen's participation to decision-making and greater democratic process for formulation of international norms and conventions. Thus SD means allround development without causing environmental disaster.

SD is not a static concept or static state of harmony but rather a process of change in which the use of resources, the diversions of investments, the orientation of technological developments an institutional changes are made consistent with future as well as present needs. SD is a relational notion, related to pattern of investment, state of technological development and trend in international change. In fact SD rests on political will/system in international decision-making.

SD is viewed as the mutually beneficial interaction between the legitimate interests of business and the economy, government and the policy, civil society and culture. From this perspective, five dimensions of sustainable development are clearly visible - these are i) Human being, ii) Culture, iii) Polity and iv) Economy and v) Nature.

SD emanates from basic principles of a) equity, b) solidarity and c) duty to cooperate for global development. The principle of Equity aims to achieve a balance between

converging and diverging interests of developed and developing countries.

1.4.4 Sustainable Development – Major transformation in society

To act in a sustainable fashion involves a major transformation in society, focusing on the following actions:

(a) Population stabilizations;

(b) Efficient and effective use natural resources;

(c) Determining environmental limits;

(d) Refining market economies;

(e) Waste reduction and pollution prevention;

(f) New technologies and technology transfer;

(g) Perception attitude and behavioural changes;

(h) Social and cultural development;

(i) Education for all;

(j) Women empowerment;

(k) Integrated environmental system management

Development to be sustainable must meet three fundamental objectives :

1) An economic objective : Production of goods and service through efficiency.

2) An environmental objective : The conservation and prudent management of natural resources (preserving biodiversity and maintaining biological integrity).

3) A social objective : The maintenance and enhance of quality of life (equity being the main characterization).

These objectivesshould take into account the inter-relationship between people, resources, environment and development.

1.4.5 Global Dimensions of Sustainable Development

Numerous international attempts to promote conservation and sustainable development have already been mentioned. These include the establishment of 'UN Environment Programme', the recommendations of organizations, such as the *World Commission on*

Environment and Development, and many international agreements such as the conventions on biological diversity and climate changed signed at UNCD. These and other initiatives have all made a positive contribution, but they have done little to address one of the major underlying difficulties in achieving global sustainability: poverty and the unequal distribution of resources.

Inequalities exist at all levels, but on the global scale an obvious imbalance is evident between North and South. Some minor, if insignificant, attempts have been made to address both debt problems and environmental problems in developing countries by covering part of the external debt of a country into a domestic obligation to support a specific programme.

1.4.6 The Sustainable future

It is important to realize that sustainable development does nit mean no human impact on the environment. Such a situation is impossible to achieve so long as there are people on the planet The ideal scenario to strive for is one in which all environmental impacts can be undertaken consciously, in the full knowledge of the costs and consequences, even though this situation is a long way off, not least because we still have much to learn about the operation of nature. There is a considerable debate over the limits of sustainability but there is a general consensus that we must learn to live together within the means of nature. Ecological sustainability is the simple part of SD concept But socio-economic sustainability is more difficult and potentially contentious concept. The question who gets what (and how) raises the spectre of potential conflict both within and between nations. So far as the sustainability question is concerned the need for shared justice and associated conflict is the scariest and politically taxing part. In other words SD means achieving in an integrated comprehensive pattern the economic health, environmental protection and social equity objectives. SD is in reality concerned about equal consideration between :

i) economic development and environmental quality

ii) technological innovation and community stability

iii) investment in people and investment in infrastructure

Above all it is important to realize that a sustainable future lies in our hands. The need to alter values, beliefs and behaviour should by now be clear.

As a part of Agenda 21 of Rio Summit 1992 the global plan for sustainable development was emphasized as development that embraces economic growth, social

development and environmentl protection. During the Johannesburg Summit (August, 2002) on SD according to the UN Secretary Kafl Annan's report it was highlighted "Progress towards to goals established at Rio has been slower than anticipated and in some respects conditions are worse than they were ten years ago". In Johannesburg Conference UN Secretary General Kafi Annan calling political will "the key issue* said "it was necessary to find practical steps and partnerships, combined with a renewed spirit of global cooperation and solidarity, to create major changes in the way policies and programmes for SD are designed and implemented*'. The Johannesburg Summit report also found that many steps can be taken to make globalisation work for and SD and to jump start implementation efforts. The report also provides a ten-point programme that countries business leaders, non-governmental organizations and leaders of other stakeholders could consider during the preparatory negotiations of the summit. The report put forward the following main factors for which implementation of Agenda 21 have been hampered :

(i) Lack of integrated approach towards policies and programmes related to economic, social and environmental concerns.

(ii) Global utilization of resources beyond the carrying limits of the ecosystem,

(iii) In coherent policies in areas of finance, trade, investment and technology.

(iv) Difficulties in obtaining new technologies by developing countries and fall in developmental assistance.

A large trend of disparities detrimental to the concept of equity, solidarity and global cooperation has been emphasized in the report. These include:

(i) 15% of the world's population who live in high-income countries account for 56% of all the world's consumption, while poorest 40% live in the developing countries account for only 11% consumption. Average household expenses in Africa are 20% less than it was 25 years ago.

(ii) 1.1 billion people still lack access to safer drinking water and about 2.4 billion lake adequate sanitation. Infant death in developing countries amount to 8% of the children population.

(iii) 113 million primary-age school children in developing countries (60% of them girls) are not in school.

(iv) 815 million people in the world are undernourished out of which 777 million in developing regions. The number is declining in Asia but increasing in Africa.

(v) More than 80% of all disease in developing countries are caused by contaminated water, and inadequate sanitation.

(vi) The world will need 17% more fresh water to grow food for growing populations in developing countries and total water use will increase by 40%

(vii) By 2025 two-thirds of the world would live in areas facing moderate to severe water stress.

(viii) 500% of world's major fisheries are fully utilized and 25% are over fished.

(ix) The estimated rate of present day deforestation is 14.6 million hectare a year. Net deforestation rates are highest in South America and in Africa.

(x) Use of energy in developed countries is ten times as much person as people in developing countries.

(xi) Globalisation is yet to be made to work for SD.

(xii) Improvement of livelihood and eradication of poverty in rural and urban areas are essential for SD.

(xiii) Unsustainable pattern of productionand consumption needs to be changed.

(xiv) Improvement health through safe and affordable access to fresh water, a reduction in lead in gasoline and improved air quality.

(xv) Development ofmore renewable and energy efficient technologies and providing access to energy.

(xvi) Fresh water supply improvement, management and its equitable distribution.

(xvii) Providing financial resources and environmentally sound technologies.

(xviii) Strengthening international governance for SD.

Part - n : Ecotourism

1.4.7 Concept of Tourism & Eco-tourism

History of the development of Tourism as an industry : The two words 'Travel' and Tour' maynot be synnymous but they mean almost the same and the most common hobby of man. Traveling is perhaps the oldest hobby and certainly the common habit of human beings maintained ever since the beginning of civilisation. In the ancient times groups of people traveled from place to place in search of better life conditions. Thereafter came the period when many travelers started moving round the world through the continents and over the oceans to discover lands for trading as well as to find better places to live. In the 18th and 19th centuries many geo-scientists and scholars conceded to extensive traveling to enrich their geographical knowledge. German scientist Alexander

Humboldt traveled round the world and wrote as many as forty books. In his famous book *Cosmos* he explained geographically everything he explored in different places. Afterwards his follower Carl Ritter also traveled extensively and on the basis of his wide range of findings composed the famous book ***Erdkunde***.

The studies concerning travel and tour have attracted contemporary geo-scientists, sociologists and economists because of their close association with socio-economic aspects. Today the scientists have identified some basic difference between the usages of the words 'travel' and 'tour'. While travel has some association with activities related with earning, tour is organized purely for enjoyment and pleasure of visiting places of interest Tourism is recognised as the outcome of leisure but all travels cannot be taken as tour.

The concept of tourism in true sense developed in 1937 when a committee of statistical experts of the League of Nations as this committee defined tourists' as people who travel for a period of one day or more in a country other than that in which they reside, and the persons visit a place outside his residential area for a period of less than 24 hours would be identified as *excursionists'.

First authentic book on tourism was published in Switzerland (now the universally famous country for tourism) in 1942 by Prof. Hunzlkar and Prof, Krapf. In 1963, at the UN Conference on Travel and Tourism, held in Rome the basic difference between tourists and excursionists was recommended as follows:

a) Tourists - those making overnight stay at a place on travel for visit

b) Excursionists - Those making only a day visit to a place

The *World Tourism Organisation (WTO)* in 1990 identified the following five motivations for travel and tourism :

a) Educational and Cultural,

b) Social and Historical,

c) Religious and Ethnic,

d) Health and Sports,

e) Relaxation and pleasure.

1.4.8 Tourism versus Eco-Tourism : A conceptual framework

Up till 1950s tourism as a moneymaking industry for many countries (*Viz*. Switzerland, Scotland etc. in Europe and many South-East Asiatic countries) maintained a reasonably clean and attractive image as a harmless business that could bring financial benefits to

their places of origin. However, from 1960s numerous case snidies uncovered the fact that tourism could also upset the ecosystem balance of the environment of a given area. Although apparently tourism is a harmless industry it cannot be considered as completely pollution-free. Uncontrolled tourism can create two-fold environmental pollution : *a) physical,* as well as *b) sodo-cultural.* Physical environmental pollution due to tourism is obvious, as influx of a large number of tourists (i.e. temporary visitors with little care for maintenance of the place to visit) means dumping of additional garbage in the environment in the form of litters on the land surface, destruction of surface vegetation and emissions in the atmosphere. Environmental pollution at the sodo-cultural leel is alarming. If tourism is viewed as a phenomenon of interaction between host and guest cultures, it makes little effect on the culture of guests but the culture of guests leave considerable impression on the host's mind. The structure of society and economy in a particular tourist location, particularly in the developing countries, have been found to be changing rapidly under the growing pressure of high spending and free-living affluent tourists from the developed parts of the world.

Escalation of concern of the quality deterioration of the total environment prompted the WTO (World Tourism Organisation) to make a joint declaration with UNEP (United Nation's Environment Programme) in-1982 as: *"The protection, enhancement and improvement of the various components of man's environment are among the fundamental conditions for the harmonious development of tourism. Similarly, rational management of tourism may contribute to a large extent to protecting and developing the physical environment and cultural heritage as well as improving the quality of life"*

The concept of eco-tourism is the outcome of this global concern over tourism. ***In true sense all forms of tourism appreciating and preserving the environmental quality without disturbing the maintained resource base are considered to be eco-tourism.*** Thus eco-tourism is the development of tourism in a place of interest by maintainingits ecological set up; hence the influx of tourists at any given time must not exceed its total carrying capacity. Eco-tourism offers a form of tourism development, which accepts the principles of sustainability as well as offers economic opportunities.

At present tourism is the largest growing industry in the world accounting for 11% of the world's GDP but India's share is only 0.04% in total international arrivals. In order to earn formidable amount of foreign exchange from tourism to upgrade the country's economy India should concentrate on catering eco-tourists.

The concept of eco-tourism generates a new tourist group in the global tourism

market. These eco-tourists would be the travelers who would be more interested in people, place, customs and culture rather than instant comforts (air-conditioned hotels and bars). Through eco-tourism tourists learn to leave sites of their visits undisturbed and it will be possible to keep tourist places eco-friendly.

1.4.9 Model Questions

1) Describe the need for Sustainable Development in the context of the present resource crisis of the world.

2) Discuss the key elements of Sustainable Development.

3) Make a discussion on the key elements inthe context of themajor transformation in the present society.

4) Write an essay on the global dimension of Sustainable development

5) Discuss the background in which the concept and need of Ecotourism has developed.

6) Assess the key elements and directives to promote ecotourism.

1.4.10 Select Readings

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Unit 2.1 ❑ Soil, Air, Water and Noise Pollution

Structure

The present generation and the coming generations have to solve three grave problems, namely, population, poverty and pollution if they have to survive. Pollution being the most dangerous problem likes cancer in which death is sure but slow. Environment pollution is assuming dangerous proportions all through the globe and India is not free from this poisonous disease. This is the gift of modern living, industrialization and urbanization. Unless timely action is taken we have a forbid and bleak future for the world.

2.1.1 Soil Pollution

As the demand for food has grown very high, there is an increase in field size and mechanization. The increase in Meld size makes it economically viable for the fanner but results in loss of habitat and shelter for wildlife, as hedgerows and copses disappear. When crops are harvested, the naked soil is left open to wind after the heavy machinery has compacted it. Another consequence of more intensive agriculture is the move to monoculture. This is unnatural; it depletes the soil nutrients, allows diseases and pests to spread and, in short, brings into play the use of chemical substances foreign to the environment.

Hence **Soil pollution** is caused by the presence of man-made chemicals or other alteration in the natural soil environment. This type of contamination typically arises from the rupture of underground storage tanks, application of pesticides, percolation of contaminated surface water to subsurface strata, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil. The most common chemicals involved are petroleum hydrocarbons, solvents, pesticides, lead and other heavy metals. The occurrence of this phenomenon is correlated with the degree of industrializations and intensities of chemical usage.

The concern over soil contamination stems primarily from health risks, both of direct contact and from secondary contamination of water supplies. Mapping of contaminated soil sites and the resulting cleanup are time consuming and expensive tasks, requiring

extensive amounts of geology, hydrology, chemistry and computer modeling skills.

2.1.1.1 Ecosystem effects

Not unexpectedly, soil contaminants can have significant deleterious consequences for ecosystems. There are radical soil chemistry changes which can arise from the presence of many hazardous chemicals even at low concentration of the contaminant species. These changes can manifest in the alteration of metabolism of endemic microorganisms and arthropods resident in a given soil environment. The result can be virtual eradication of some of the primary food chain, which in turn have major consequnces for predator or consumer species. Even if the chemical effect on lower life forms is small, the lower pyramid levels of the food chain may ingest alien chemicals, which normally become more concentrated for each consuming rung of the food chain. Many of these effects are now well known, such as the concentration of persistent DDT materials for avian consumers, leading toweakening of egg shells, increased chick mortality and potentially species extinction.

Effects occur to agricultural lands which have certain types of soil contamination. Contaminants typically alter plant metabolism, most commonly to reduce cro yields, This has a secondary effect upon soil conservation, since the languishing crops cannot shield the Earth's soil mantle from erosion phenomena. Some of these chemical contaminants have long half-lives and in other cases derivative chemicals are formed from decay of primary soil contaminants.

2.1.1.2 Causes and Sources of Soil Pollution

- ***Pesticides***

A pesticide is a substance or mixture of substances used to kill a pest A pesticide may be a chemical substance, biological agent (such as a virus or bacteria), antimicrobial, disinfectant or device used against any pest Pests include insects, plant pathogens, weeds, molluscs, birds, mammals, fish, nematodes (roundworms) and microbes that compete with humans for food, destroy property, spread or are a vector for disease or cause a nuisance. Although there are benefits to the use of pesticides, there are also drawbacks, such as potential toxicity to humans and other animals. Pesticides are used to control organisms which are considered harmful. For example, they are used to kill mosquitoes that can transmit potentially deadly diseases like west nile virus, yellow fever, and malaria They can also kill bees, wasps or ants that can cause allergic reactions. Insecticides can protect animals from illnesses that can be caused by parasites such as fleas. Pesticides can prevent sickness in humans that could be caused by mouldy food or diseased produce.

- ***Herbicides***

Herbicides are used to kill weeds, especially on pavements and railways. They are

similar to auxins and most are biodegradable by soil bacteria. However one ?roup derived from trinitrophenol (2:4 D and 2:4:5 T) have the impurity dioxin, which is very toxic and causes fatality even in low concentrations. It also causes spontaneous abortions, haemorrhaging and cancer. Agent Orange (50% 2:4:5 T) was used as a defoliant in Vietnam. Eleven million gallons were used and children born since men to America! soldiers who served in mis conflict, have shown increased physical and mental disabilities compared to the rest of the population. It affects the head of the sperm and the chromosomes inside it.

Another herbicide, much loved by murder story writers, is Paraquat. It is highly toxic but it rapidly degrades in soil due to the action of bacteria and does not kill soil fauna.

- ***Insecticides***

Insecticides are used to rid farms of pests which damage crops. The insects damage not only standing crops but also'stored ones and in the tropics it is reckoned that one third of the total production is lost during food storage. As with fungicides, the first insecticides used in the nineteenth century were inorganic e.g. Paris Green and other compounds of arsenic. Nicotine has also been used since the late eighteenth century. There are now two main groups of synthetic insecticides–

OrganoMorines : Organochlorines include DDT, Aldrin, Dieldrin and BHC. They are cheap to produce, potent and persistent DpT was used on a massive scale from the 1930s, with a peak of 72,000 tonnes used 1970, Then usage fell as the harmful environmental effects were realized, ft was found worldwide in fish and birds and was even discovered in the snow in the Antarctic. It is only slightly soluble in water but is very soluble in the bloodstream. It affects the nervous and endocrine systems and causes the eggshells of birds to lack calcium causing mem to be easily breakable. It is thought to be responsible for the decline of the numbers of birds of prey like ospreys and peregrine falcons in the 1950s - they are now recovering.

As well as increased concentration via the food chain, it is known to enter via permeable membranes, so fish get it through thir gills. As it has low water solubility, it tends to stay at the water surface, so organisms that live there are most affected. DDT found in fish that formed part of the human food chain caused concern, but the levels found in the liver, kidney and brain tissues was less than Ippm and in fat was 10 ppm which was below the level likely to cause harm. However, DDT was banned in Britain and America! to stop the further build up of it in the food chain. The USA exploited this ban and sold DDT to developing countries, who could not afford the expensive replacement chemicals and who did not have such stringent regulations governing the use of pesticides. Some insects have developed a resistance to insecticides.

Organopbosphates : Organophosphates, e.g. parathion, methyl parathion and about

40 other insecticides are available nationally. Parathion ishighly toxic, methyl-parathion is less so and Malathion is generally considered safe as it has low toxicity and is rapidly broken down in the mammalian liver. This group works by preventing normal nerve transmission as cholinesterase is prevented from breaking down the transmitter substance acetylcholine, resulting in uncontrolled muscle movements.

Entry of a variety of pesticides into our water supplies causes concern to environmental groups, as in many cases the long term effects of these specific chemicals is now known.

Restrictions came into force in July 1985 and were so frequently broken that in 1987, formal proceedings were taken against the British government. Britain is still the only European state to use Aldrin and organochlorines, although it was supposed to stop in 1993. East Anglia has the Worst for pesticide contamination of drinking water. Of the 350 pesticides used in Britain, only 50 can be analyzed, which is worrying for the global community.

- ***Mining***

Modern mining projects leave behind distrupted communities, damages landscapes, and polluted water. Mining also affects ground and surface waters, the aquatic life, vegetation, soils, animals, and the human health. Acid mine drainage can cause damage to streams which in return can kill aquatic life. The vast variety of toxic chemicals released by mining activities can harm animals and aquatic life as well as their habitat The average mine disturbs over a thousand acres of land.

- ***Burial***

Burial is the technique used by Jews, Muslims, Christians and other religions with Abrahamic influence, to dispose off the corpse of dead humans and animals. This process leads to regular soil erosiondue to loosening of soil. Also, the decomposing fluids act as poisonous herbicides, pesticides and may even lead to epidemics in surrounding areas. It leads to soil pollution, soil erosion and even water pollution.

- ***Construction***

Construction often puts sediments in rivers and bodies of water. By doing this, natural water filters are damaged. Natural water filters help break down many pollutants before they reach other water bodies. Some harmful chemicals that may run off with water and sediments from construction sites are oils, debris, and paint This can cause damage to soil, aquatic life, and promote hazordous chemicals toget into drinking water. California Integrated Waste Mnagement Board provides more “green building basics” that educates readers about healthy construction.

- ***Increased waste disposal***

In Scotland in 1993,14 million tons of waste was produced. 100,000 tons was special waste and 260,000 tons was controlled waste from other parts of Britain and

abroad 45% of the special waste was in liquid form and 18% was asbestos - radioactive waste was not included. Of the controlled waste, 48% came from the demolition of buildings, 22% from industry, 17% from households and 13% business - only 3% were recycled. 90% of controlled waste was buried in landfill sites and produced2 million tons of methane gas. 1.5% was burned in incinerators and 1.5% were exported to be disposed of or recycled. There are 748 disposal sites inScotland.

Landfills produce leachate, which has to be recycled to keep favourable conditions for microbial activity, methane gas and some carbon dioxide.

There are very few vacant or derelict land sites in the north east of Scotland, as there are few traditional heavy industries or coal/mineral extraction sites. However some areas are contaminated by aromatic hydrocarbons (500 cubic meters).

The Urban Waste Water Treatment Directive allows sewage sludge to be sprayed onto land and the volume is expected to double to 185,000 tons of dry solids in 2005. <!-information should be updated-> This has good agricultural properties due to the high nitrogen and phosphate content In 1990/1991,13% wet weight was sprayed onto 0.13% of the land, however this is expected to rise 15 fold by 2005. There is a need to control this so that pathogenic microorganisms do not get into water courses and to ensure that there is no accumulation of heavy metals in the top soil.

2.1.13 Cleanup options

Cleanup or remediation is analyzed, by environmental scientists who utilize field measurement of soil chemicals and also apply computer models for analyzing transport and fate of soil chemicals. Thousands of soil contamination cases are currently in active cleanup across the U.S. as of 2006. There are several principal strategies for remediation :

- Excavate soil and take it to a disposal site away from ready pathways for human or sensitive ecosystem contact. This technique also applies to dreadging of bay muds containing toxins.
- Aeration of soils at the contaminated site (with attendant risk of creating air pollution)
- Thermal remediation by introduction of heat to raise subsurface temperatures sufficiently high to volatiz chemical contaminants out of the soil for vapour extraction. Technologies include ISTD, electrical resistance heating (ERH), and ET-DSP^{tm}.
- Biorernedianon, involving microbial digestion of certain organic chemicals. Techniques used in bioremediation include landfarming, biostimulation and bioaugmentating soil biota with commercially available microflora.
- Extraction of groundwater or soil vapour with an active electromechanical system, with subsequent stripping of the contaminants from the extract.
- Containment of the soil contaminants (such as by capping or paving over in place).

2.1.1.4 How to Reduce Land Pollution

There are many ways to help reduce land pollution. Some ideas are listed below.

- Use reusable materials
- Do not litter
- Recycle
- Purchase products with little packaging to throw away (buy in bulk if possible)
- Use safer alternative pesticides
- Buy organic grown fruits
- Buy biogradeable products

2.1.2 Water Pollution

Water pollution is the contamination of water bodies such as lakes, rivers, oceans, and groundwater. All water pollution affects organisms and plants that live in these water bodies and in almost all cases the effect is damaging either to individual species and populations but also to the natural biological communities. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful constituents.

Water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. In addition to the acute problems of water pollution in developing countries, industrialized countries continue to struggle with pollution as well. In the most recent national report on water quality in the United States, 45 percent of assessed stream miles, 47 percent of assessed lake acres, and 32 percent of assessed bay and estuarine square miles were classified as polluted.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, like serving as drinking water, and/ or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, and earthquakes also cause major changes in water quality and the ecological status of water. Water pollution has many causes and characteristics.

2.1.2.1 Water pollution categories

Surface water and groundwatr have often been studied and managed as separate resources, although they are interrelated. Sources of surface water pollution are generally grouped into two categories based on their origin.

- ***Point source pollution***

Point source pollution refers to contaminants that enter a waterway through a discrete conveyance, such as a pipe or ditch. Examples of sources in this category include discharges from a sewage treatment plant, a factory, or a city storm drain. The U.S. Clean Water Act (CWA) defines point source for regulatory enforcement purposes.

- ***Non-point source pollution***

Non-point source (NFS) pollution refers to diffuse contamination that does not originate from a single discrete source. NFS pollution is often accumulative effect of small amounts of contaminants gathered from a large area. Nutrient run off in storm-water from "sheet flow" over an agricultural field or a forest are sometimes cited as examples of NFS pollutioa

Contaminated storm-water washed off of parking lots, roads and highways, called urban runoff, is sometimes included under the category of NFS pollution. However, this runoff is typically channeled into storm drain systems and discharged through pipes to local surface waters, and is a point source. The CWA definition of point source was amended in 1987 to include municipal storm sewer systems, as well as industrial storm-water, such as from construction sites.

- ***Groundwater pollution***

Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, sometimes referred to as groundwater contamination, is not as easily classified as surface water pollution. By its very nature, groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies, and the distinction of point vs. non-point source may be irrelevant. A spill of a chemical contaminant on soil, located away from a surface water body, may not necessarily create point source or non-point source pollution, but nonetheless may contaminate the aquifer below. Analysis of groundwater contamination may focus on soil characteristics and hydrology, as well as the nature of the contaminant itself.

The substances which degrade water quality are known as water pollutants. The major sources of pollutants are: ***1) Natural sources,*** and ***2) Anthropogenic sources.*** *Natural sources* of water pollutants include soil erosion, landslides, coastal and cliff erosion, volcanic eruption and decomposition of plant and animal bodies. *Anthropogenic sources* are the real sources of water pollution today. These include industrial, urban and agricultural sources.

Urban sources contributes water pollutants such as sewage, huge quantity of municipal and domestic garbage, and industrial effluents from the industrial units located in the urban centres, fallouts of paniculate matter at automobile exhausts etc.

Various types of chemicals used in the chemical fertilizers, pesticides and herbicides

are the pollutants, which are derived *from* agricultural sources. These chemical substances are brought to the rivers and lakes through surface runoff caused by rainfall and are also moved downward by infiltrating rainwater to reach ground water.

Industrial sources pollute streams, rivers, lakes and coastal waters through industrial effluents, solid and dissolved chemical pollutants and numerous metals. Besides, fallout of radioactive substances is very dangerous source of both air and water pollution.

2.1.2.2 Identification of Sources of Pollution

The important sources of water pollution, as have been identified, are ***(i) sewage and other waste, (ii) industrial effluents, (iii) agricultural discharges,*** and ***(iv) industrial wastes*** from chemical industries, fossil fuel plants (thermal power plants) and nuclear power plants. Each of these sources of pollution carries a variety of pollutants that enter our water bodies. Following are the sources of water pollution and kind of the pollutants spread by them :

(i) Sewage and other waste

Sewage is the watr borne waste derived from domestic waste and animal or food processing plants. It includes human excreta, paper, cloth, soap, detergents etc. These are a major proportion of pollutants entering in our water. There is uncontrolled dumping of wastes of rural areas, towns and cities into ponds, lakes, streams or rivers. Due to continuous accumulation of sewage and other wastes in these water bodies, they loose the ability to recycle them and self-regulatory capability is lost Decomposition of these wastes by aerobic microbs decreases due to higher level of pollution. The self-purifying ability of the water is lost and water becomes unfit for drinking and other domestic uses.

Phosphates are the major ingredients of most detergents. They favour the luxuriant growth of algae which form water blooms. This extensive algal growth also consumes most of the available oxygen from water. This decrease in O_2 level becomes detrimental to growth of other organisms, which produces a foul smell upon decay. Some decomposing plants are known to produce toxins as strychnine, which kills animals including cattle.

One of the most common primary sources of water pollution is the discharge of untreated or partly treated sewage in water bodies, sometimes due to improper sewage handling procsses of municipal bodies. This is not uncommon in major cities. Such adischarge of sewage and other wastes in water results into depltion of oxygen levels of water, and stimulation of algal growth.

Biological oxygen demand (BOD)

BOD is the amount of oxygen required for biological oxidation by microbes in any unit volume of water. The test is done at 20°C for at least five days. BOD values generally approximate the amount of oxydisable organic matter, and are therefore, used a measure of

degree of water pollution and waste level. Thus mostly BOD value is proportional to the amount of organic waste present in water. Hence due to addtion of sewage and waste, oxygen level declines, which is reflected in terms of BOD value of water.

BOD values are thus useful in evaluation of self-purification capacity of a water body and for possible control measures of pollution. The quantity of oxygen in water (Dissolvd Oxygen—DO) along with BOD is indicated by the kind of organisms present in water. Thus fish becomes rare at DO value of 4 to 5 ppm of water. Further decrease in DO value may lead to increase in anaerobic bacteria.

Eutrophication

Due to addition of domestic waste (sewage), phosphates, nitrates etc. form wastes or their decomposition products in water bodies, toey become rich in nutrients, phosphates and nitrate ions. Thus with the passage of these nutrients through such organic wastes the water bodies become highly productive or eutrophic and the phenomenon is known as eutrophication. It must be remembered that ponds lakes etc. during their early stages of formation are relatively barren and nutrient-deficient thus supporting no or very poor aquatic life. This state of these bodies is known as oligotrophic. With the addition of nutrients, there is stimulated luxuriant growth of algae in water. There is also generally a shift in algal flora, blue-green algae begin to predominate. These start forming algal blooms, floating scum or blankets of algae. The algal blooms compete with other aquatic plants for light for photosynthesis. Thus oxygen level is depleted. Moreover, these blooms also release some toxic chemicals, which kill fish, birds and other animals, thus water begins to stink.

***(ii) Industrial effluents* :**

A wide variety of both organic and inorganic pollutants are present in effluents from breweries, tanneries, dying textiles, paper and pulp mills, steel industries, mining operations etc.. The pollutants includes oils, gases, plastics, plasticisers, metallic wastes, suspended solids, phenols, toxins, acids, salts, dyes, cyanides, DDT etc, many of which are not readily susceptible to degradation and thus cause serious pollution problems.

(iii) Agricultural discharges :

These include chiefly the chemicals used as fertilizers and the pesticides used in disease control. Their discharges reach into the water bodies. As compared to developed countries India has relatively a low use of these chemicals, thus discharges into water are still low. But the rate at which their use is being increased now it is apparent that this would enhance pollution in the coming years.

a) Artificial Fertilisers : Modem agriculture rely heavily on a wide range of synthetic chemicals which include different types of fertilizers and biocides (pesticides, herbicids

etc). These chemicals along with waste are wasted off lands through irrigation, rainfall, drainage etc. reaching into the rivers, lakes streams etc. where they disturb the natural ecosystem.

Artificial fertilizers crowd out useful minerals naturally present in the topsoil. The microbes (bacteria, fungi, worms etc) in top soil enrich the humus and help to produce nutrients to be taken up by the plant and later by animals. But fertiliser-enriched soil cannot support microbial life and hence there is less humus and less nutrients and the soil can easily become poor and eroded by wind and rain.

b) Pesticides and biocides : Pesticides are the chemicals used with water for killing the plant and animal pests. It is a general term that includes bactericides, fungicides, nematicides, insecticides and herbicides. .The long-range effects of such biocides are in fact a threat to our ecological security.

(iv) Industrial wastes

The two chief water pollutants of this category are heat and radioactive substances. These are the wastes chiefly from power plants—thermal and nuclear, which use large quantities of water. Some other industries also give of wastewater after use. Nuclear power plants are the source of radionuclide.

The quantity of wastewater is highest in the thermal power plants in the country. This waste water is returned after use at very high temperatures to the streams, rivers and lakes. This affects the aquatic life in these water bodies.

This is also known as ***thermal pollution*** since heat acts as a pollutant. Similarly nuclear power plants, besides causingfallout problems, also release waste heat. This also contributes to thermal pollution. Some plants and animals are killed outright by the very hot water. Though wastewater from nuclear power plant not as hot, but still has adverse effects on aquatic life.

2.1.2.3 Ground Water Pollution

As the industrialisation progressed most of the underground sources of drinking water, especially in the outskirts of larger cities and villages of the developing countries have become polluted to a certain extent. For instance Trans-Yamuna areas of Delhi face drinking water pollution problem at regular intervals. There had been epidemics of cholera, dysentery and other diseases over the last five years. This has been mainly due to inadequate water supply system in these areas. Ground water is now threatened with pollution from seepage pits, refuse dumps, septic tanks and different other pollutants. Important sources of ground watr pollution are sewage and other water otherwise. Raw sewage is dumped in shallow soak pits. This gives birth go cholera, hepatitis, dysentery etc, especially in areas with high water table. The industries of woolens, bicycles in aras of Punjab (Ludhiana) and Haryana (Ambala, Sonepat) contribute high amounts of Ni,

Fe, Cu, Cr and Cyanides to ground water.

2.1.2.4 Marine Pollution

The condition of marine pollution continues to aggravate in the present day. The main source of marine pollution (pollution in the coastal water) is the rivers discharging waters in the sea. All that what do rivers carry ultimately ends up in the seas. On their way to the sea, rivers receive huge amounts of sewage, garbage, agricultural discharge, and biocides, including heavy metals. These all are added to the sea. Besides this discharge of oils and petroleum products and dumping of radionuclides waste into sea also cause marine pollution. Huge quantity of planstic is being added to sea and oceans. Over 50 million pounds plastic packing material is being dumped in the sea of commercial fleets, whereas over 300 million pounds entering through inland waterways in USA. Many marine birds ingest plastic that causes gastrointestinal disorders. The chemical principle in PCBS causes more damage as thinning of eggshell and tissue damage of egg. Radionuclide waste in sea includes Sr-90, Csl37, Pu-239 and Pu-240.

In marine water the most serious pollutant is oil, particularly when afloat on sea. Spill in oil and petroleum product due to accidents or due to deliberate discharge of oil-polluted waste brings about pollution. About 285 million gallons of oil are spilled in the ocean each year, mostly from transport tankers. This is enough to coat a beach 20 ft wide with half an inch oil layer for 8,633 miles. Oil pollution cause damage to marine flora and fauna including algae, fish, birds, and invertebrates. About 50,000 to 25,000 birds are killed every year by oil. Hydrocarbons and benzpyrene accumulate in food chain and consumption of fish by man may cause cancer.

2.1.2.5 Mercury Pollution

Mercury enters water naturally as well as through industrial effluents. It is a potent hazardous substance. Both inorganic and organic forms are highly poisonous. Methyl mercury gives off vapours. Mercury was responsible for the Mina Mata epidemic that caused several deaths in Japan and Sweden. The tragedy had occurred due to consumption of heavily mercury-contaminated fish by the villagers. The source of mercury to the bay was a single chloride producing plant, using Hgel2 as a catalyst. In Sweden many rivers and lakes are already polluted due to widespread use of mercury compounds as fungicides and algaecides in paper and pulp industries and in agriculture. Chloral alkali plants sem to be the chief source of mercury contaminating effluents. Paper and pulp industries of Japan and Canada also cause mercury pollution. Effluents of industris making switches, batteries, thermometer, fluorescent light tubes and high intensity street lamps also contain mercury.

The symptom of Mina Mata includes malaise, numbness, visual disturbance, dysphasia, ataxia, mental deterioration, convulsions and finally death. Mercury readily

penetrated in the central nervous system of children born in Mina Mata causing teratogenic effects. Methyl mercury penetrates through placenta. Swedish fish eaters have high mercury content in blood.

2.1.2.6 Lead Pollution

The chief source of lead to watris the effluents oflead and lead processing industries. The children may chew lead toys. Painters also have a risk oflead consumption. In some plastic pipes lead is used as stabiliser. The water may become contaminated in these pipes. Lead is also used in insecticides, food, beverages, ointments and medicinal concoctions for flavouring and sweetening.

Lead pollution causes damage to liver and kidney, reducing in hemoglobin formation, mental retardation and abnormalities in fertility and pregnancy. Chronic lead poisoning may cause three general disease syndromes: i) gastrointestinal disorders, ii) neuromuscular effects (leadlapsy)-weakness, fatigue, muscular atrophy, and iii) central nervous system effects or CNS Syndrom that may result to coma and death.

2.1.3.7 Fluoride Pollution

Fluoride, as in the case of air, may regularly present in water and soil. In nature it is found as fluoride. The crop plants grown in high-fluoride soils in agricultural, non-industrial areas had fluoride content as high as high as 300 ppm. In Haryana and Punjab consumption of fluoride-rich water from wells caused epidemic fluorisis. In Andhra Pradesh also high fluoride content caused dental fluorisis. In our country this problem has more severe in Rajasthan. This has already crippled about 3.5 lakh persons in state. Many people in Rajasthan have humped back due to high fluoride content in water sources in arid and semi-arid zopes. Prolonged intake of fluoride containing water stiffens the bone joints, particularly of spinal cord.

2.1.2.8 Biological Pollution

There are three main sources of Biological Pollution : i) urban liquid and solid waste (largest amount of pollution), ii) dead bodies of animals and humans, and iii) wallowing of cattle.

The urbanwaste is mostly in the form of shear faucal matter that also goes into the river as surface run off. Since the river is used for mass bathing at Rishikesh, Hardwar and Allahabad, there is problem of water-borne diseases. The problem is particularly serious with downstream of Kanpur.

2.1.2.9 Prevention and control of Water Pollution

Biodegradable pollutants alone are not responsible for water pollution though these indicate level of pollution (through BOD values). Besides these a substantial pollution

load is contributed by non dgradable and slow degrading pollutants, such as heavy metals, mineral oils, biocides, plastic materials etc. that are dumped into water. For biodegradable pollutants, pollution may be controlled at sources by their treatment for rescue and recycling. The non-degradable toxic substances can be removed from water by suitable method.

In addition to these methods, some standards, conditions and requirements are to be legally enforced by the government through Acts. The various ways and techniques suggested for control of water pollution are as follows :

a) Stabilisation of the ecosystem

This is the most scientific way to control water pollution. The basic principles involved are the reduction in waste input (thus control at source), harvesting and removal of biomass, trapping of nutrients, fish management and aeration. Various methods may be used (biological as well as physical) to restore species diversity and ecological balance in the water body to prevent pollution.

b) Re-utilisation and recycling of waste

Various kinds of waste which, include industrial effluents (as paper pulp or other industrial chemicals), sewage of municipal and other systems and thermal pollutants (waste water etc) may be recycled to beneficial use. For instance urban waste may be recycled to generate cheaper fuel gas and electricity. The NEERI, Nagpur could develop technology .for management of radioactive wastes and chemical wastes of atomic power plants, reclamation of wastewater and to supply cheap piped gas and generate electricity by recycle of urban waste. In Okhla, New Delhi one large treatment plant for sewage recycles is already in operation. NEERI is also involved in development of suitable technology for wastewater reclamation through aquaculture, utilisation of domestic and industrial wastewaterin agriculture and detoxification of phenol and cyanides in waste by biological means. One distillery of Gujarat is able to treat 450,000 litres of waste daily and generating energy equal to the produced by ten tons of coal.

c) Removal of pollutants

Various pollutants (radioactive, chemical, and biological) present in the water body can be removed by appropriate methods-such as adsorption, electro dialysis, ion exchange, reverse-osmosis etc. Reverse-osmosis is based on the removal of salts and other substances by forcing the water through a semi permeable membrane under a pressure exceeding the osmotic pressure. Due to this, flow occurs in reverse direction. For this, we use a powers membrane that attracts the solvent and repulses the solute. Reverse osmosis is commonly used to desalinate the brackish water and can also be used to desalinate the brackish Water and can also be used for purifying water from sewage.

2.1.3 Air Pollution

Our atmosphere is a gaseous envelope which surrounds the earth and air is a mechanical mixute of a number of gases, mainly nitrogen (78.09), oxygen (20.95%), argon (0.93%) and carbon dioxide (0.03). The atmosphere has always been a sink or a place for deposition and storage for gaseous or paniculate wastes. When the amount of waste entering the atmosphere in an area exceeds the ability of the atmosphere to disperse or degrade the pollutants, problems occur. In general sense air pollution may be defined as the disequilibria condition of the air caused due to introduction of foreign elements from natural as well as anthropogenic sources to the air so that the air looses its freshness and become injurious to communities of biosphere in general and human community in particular. The main target of this module is to explain:

- to find the major categories and sourcs of air pollutants.
- to find the conditions of how air pollution problems vary from place to place.
- to find the conditions of human activities polluting the air exceeding the natural abilities of atmosphere to remove wastes.
- to find the environmental impacts of the acid rain and discover the controlling condition for its reduction
- to find the methods which are useful in the collection, capture or retention of pollutants before they ener the atmosphere.

2.1.3.1 Sources and Types of Air Pollutants

Many of the pollutants in our atmosphere have natural as well as human rlated origins. Major sources of air pollution are Natural Sources (volcanic eruption, deflation of sands and dusts, wild firs etc.) and Man-made Sources (industries, urban centres, automobiles, aircrafts, agriculture, power plants etc, A General outline of the pollutants of natural and anthropogenic (man-made) sourcs is given below :

(I) ***Pollutants from natural sources :***

Pollutants from natural sources can be classified as follows:

a) from volcanoes : dust, ashes, smoke, carbon dioxide, and other gases.

b) from extra-terrstrial bodies : cosmic dust, dust produced due to collision of asteroids, meteors, comets etc. with the earth.

c) from green plants : vapour through evaporation, pollen of plant flowers, carbon dioxide from bacteria.

d) From fungi : fungal spores; viruses.

e) From land surface : salt spray from seas and oceans, dusts and soil particles from ground surface.

(II) Pollutants from anthropogenic sources :

Pollutants from man-made sourcs are the following :

a) gases from kitchen and domestic hating, industries, incineration of domestic and municipal garbage, automobiles, mostly from coals and diesel engines, air crafts etc.

b) solid or particulat matter from industries, mines and urban centres

c) radio-active substancs from nuclear plants, nuclear fuel releases, nuclear explosions.

d) heat from industries and domestic kitchens.

2.13.2 Categories on the basis of the nature of pollutants

Air pollutants can also be divided in terms of categories on the basis of the nature of pollutants. They are : ***1) Particulate matter pollutants, and 2) Gaseous pollutants.***

1. Particulate air pollutants

Particulate air pollutants are identified as *a) Aerosols,* those fine particls which are around one micron to 10 microns in size; these are added to the atmosphere by industry, power generation, automobiles, space heating, agricultural activities; ***b) Smokes,*** Soot and Fumes are smaller than aerosols in size and are added to the atmosphere through the incineration of municipal and domestic wastes, power plants and almost all types of manufacturing procsses; and, ***c) Dusts,*** include those solid particles which are larger than aerosols in size. These are added to the atmosphere from all types of combustions and agriculture. Particulate pollutants are also divided into *i) viable of living type* (such as bacteria, pollen grain, fungal and other spores, all of which belong to the category of natural air pollutants), and *ii) non-living type* (all of the pollutants whether gases or particulat from man-made sources as referrd to above).

2. Gaseous air pollutants

These are identified as *a) Carbon dioxid* (CO_2), *Carbon monoxide* (CO) from combustion of fossil fuls; transportation, industrial processes and garbage disposal; *b) Hydrocarbons,* from incomplete combustion of fuels; *c) Fluorocarbons* from aerosol cans, and refrigration systems; *d) Sulfur compounds* such as sulfur dioxide (SO_2) and sulfur trioxide (SO_3), Hydrogen Suiphid (H_2S) and H_2SO_4 (sulfuric acid) from the burning of sulfur containing fossil fuls; *e) Nitrogen oxides* and other nitrogenous compounds such, as Nitrous oxide (N_2O), Nitric oxide (NO), nitrogen oxide (NO_2) and Nitrogen trioxide (NO_3) from high-flying air crafts, combustion of fuels and chemical fertilizers; *f*) *Aldehydes* from thermal decomposition of fats, oils or glycerol and *g) Chlorine* from bleaching cotton cloths and flour and many other chemical procsses.

It may be pointed out that burning of fossil fuels (coal, petroleum and natural gas) in the factories, in the automobiles, diesel rail engines, air crafts and at homes releases most of the gaseous pollutants such as carbon monoxide (CO), carbon dioxide (CO_2), various oxides of nitrogen (NO, NO_2, NO_3) and particulate matter such as ash, dusts, moke, soot, water vapour into the atmosphere and thus these pollutants constitute major portion of air pollutants.

2.1.3.3 Major Gases and Matters Contributing to Air Pollution

Air polluting gases are usually classified in terms of their levels of influence, thy are : ***Primary*** land ***secondary***.

Primary pollutants arc those emitted directly into the air. They include *participates, sulfuric oxid, carbon monoxide, nitrogen oxides* and *hydrocarbons.* **Secondary pollutants** are pollutants produced through reactions btween primary pollutants and normal atmospheric compounds. For exampl, ozone forms over urban areas through reactions of primary pollutants sunlight and natural atmospheric gases. Thus *ozone* is a secondary pollutant that is producd on bright sunny days in areas where there is much primary pollution. Again the primary pollutants that account for nearly all air pollution problems are *carbon monoside, particulates, hydrocarbons, nitrogn oxids,* and *sulfur oxides.* Each year well over a billion metric tons of these materials enter the atmosphere from ***human-relatedprocsses.*** Typical air pollutants have been discussed below :

- ***Sulfur Dioxide (SO_2)***

Sulfur dioxide (SO_2) is a colourless and odorless gas normally present at the earth's surface at low concentration. One of the significant featurs of SO_2 is that one it is emitted into the atmosphere it may be converted through complex reactions to fine particulate sulfate (SO_4). The major anthropogenic source of sulfur dioxid is the burning of fossil fuels, mostly coal in power plants. Another major source comprises of a variety of industrial processes, ranging from petroleum refining to the production of paper, cement and aluminum.

Adverse effects associated with sulfur dioxide depend on the dose or concentration present and include corrosion of paint and metals and injury or death to animals and plants. Crops such as *alfalfa,* cotton and barley are espcially susceptible. Sulfur dioxide is capable of causing sever damage to human and other animal lungs, particularly in the surface form. It is also an important precursor to acid rain.

- ***Nitrogen Oxides (NO_X)***

Nitrogen Oxides (NO_X) are emitted in several forms (NO, NO_2, NO_3 and NO_X refers to the number of oxygen atoms present in the gas molecule). The most important of these is nitrogen dioxide (NO_2), which is a visible yellow brown to reddish brown gas.

A major concern with nitrogen dioxide is that it may be converted by complex reactions in the atmosphere to fine paniculate nitrate (NO_3). Additionally nitrogen dioxide is one of the main pollutants that contribute to the development of smog, as is nitrogen dioxide, NO. Nearly all nitrogen dioxide is emitted from anthropogenic sources: the two major contributors are automobiles and power plants that bum fossil fuels.

The environmental effects of nitrogen dioxides on humans are variabl but include the irritation of eyes, nose, throat, and lungs and increased suscptibility to viral infections, including influenza. Nitrogen oxides suppress plant growth and damage leaf tissue. When the oxides are converted to their nitrate form in the atmospher, they impair visibility. However, when nitrat is deposited on the soil, it can promote plant growth.

- ***Carbon Monoxide (CO)***

Carbon monoxide (CO) is a colourless odorless gas that at very low concntrations is extremely toxic to humans and other animals. The high toxicity results from a striking physiological effect, namely, that carbon monoxide and hemoglobin in blood have strong natural attraction for one another. Hemoglobin in our blood will take up carbon monoxide nearly 250 times more rapidly than oxygen. Therefore, if there is any carbon monoxide in the vicinity, a person will take it in very rapidly with potentially dire effects. Many people have been unintentionally asphyxiated by carbon monoxide produced from incomplete combustion of fuels in campers, tents and houses. The effect depends on the dose or concntration of exposur and range from dizziness and hadaches to death. Carbon monoxid is particularly hazardous to people with known heart disease, anemia, or respiratory disease. In addition it may cause birth defects, including mental retardation and impairment of growth of the fetus. Finally, the effects of carbon monoxide tend to be worse at higher altituds, where oxygen Ivels are naturally lower.

Approximately 90% of the carbon monoxide in the atmosphere comes from natural sourcs, and the other 10% comes mainly from fires, automobiles and otheer sourcs of incomplt burning of organic compounds. Concntrations of carbon monoxide can build up and cause serious health effects in a localized area.

- ***Photochemical Oxidants***

Photochemical oxidants result from atmospheric interactions of nitrogen dioxide and sunlight. The most common photochemical oxidant is ozone (03), a colourless gas with a slightly sweet odor. In addition to ozone, a number of photochemical oxidants known as PANs occur with photochemical smog.

Ozone is a form of oxygen in which three atoms of oxygen occur togther rathr than the normal two. Ozone is relatively unstable and reeleases its third oxygen atom readily, so that it oxidizes or burns things more readily and at lower concntrations than does normal oxygen. Ozone is sometimes used to sterilize; for example, bubbling ozone gas

through water is a method used to purify water. The ozone is toxic to and kills bacteria and other organisms in the water. When it is realised into the air or produced in the air, ozone may injure living things.

Chemically ozone is very active, and it has a very short average lifetime in the air. Because of the effect of sunlight on normal oxygen, ozone forms a natural layer high in the atmosphere (Stratosphere). This ozone layer protects us from harmful ultraviolet radiation from the sun. Ozone is considered a pollutant when present above the National Air Quality Standard threshold concentration of 0.12 ppm in the lower atmosphere, but is beneficial in the stratosphere.

The major sources of the chemicals that produce oxidants, and particularly ozone, ate automobiles, fossil fuel burning, and industrial processes that produce nitrogen dioxide. *The* adverse environmental effects of ozone and other oxidants, as with other pollutants, depend in part on the dose or concentration of exposure and include damage to plants and animals as well as to materials such as rubber, paint and textiles.

The effects of ozone on plants can be subtle. At very low concentrations, ozone can reduce growth rates while not producing any visible injury. At higher concentrations, ozone kills leaf tissues, eventually killing entire leaves and if the pollutant levels remain high, killing whole plants. Ozone's effect on animals, including man involves various kinds of damage, especially to the eyes and the respiratory system.

- ***Hydrocarbons***

Hydrocarbons are compounds composed of hydrogen and carbon. There are thousands of such compounds, including natural gas or methane (CH_4), butane (CH_4H_{10}) and propane (CH_3H_8). Analysis of urban air has identified manydifferent hydrocarbons, some of which are much more reactive with sunlight: producing photochemical smog) than others. The potential adverse effects of hydrocarbons are numerous: many at a specific dose or concentration are toxic to plants and animals or may be converted to harmful compounds through complex chemical changes that occur in the atmosphere. Over 80% of the hydrocarbons (which are primary pollutants) that enter the atmosphere are emitted from natural sources. The most important anthropogenic source is the automobile. Hydrocarbons may also escape to the atmosphere when a car's tank is being filled with gasoline or gasoline or gasoline is spilled and it evaporates. Vapour recovery systems on the hoses that feed the gasoline to the tank are now required in many urban areas and heelping to reduce the problem of hydrocarbons escaping while tanks are being filled.

- ***Hydrogen Sulfide***

Hydrogen sulfied (H_2S) is a highly toxic and corrosive gas, easily identified by its rottenegg odor. Hydrogen sulfide is produced from natural sources, such as geysers, swamps, and bogs, as well as from human sources, such as petroleum refining and metal

smelting. The potential effects of hydrogen sulfide include functional damage to plants and health problems ranging from toxicity to death for humans and other animals.

- ***Hydrogen Fluoride***

Hydrogen fluoride (HF) is a gaseous pollutant that is released primarily by aluminum production, coal gasification, and the burning of coal in power plants. Hydrogen fluoride is extremely toxic, and even a small concntration (as low as 1 ppb) may cause-problems for plants and animals.

- ***Other Hazardous Gases***

It is almost a regular feature that the newspapers carry stories of truck or train accident that releases toxic chemicals in a gaseous form into the atmosphere. In these incidents it is often necessary to evacuate people from the area until the leak is repaired. Chlorine gases are often the culprits, but a variety of other materials used in chemical and agricultural processes may be involved.

Another source of air pollution is sewage treatment plants. Urban sewer systems deliver a termendous variety of organic chemicals, including paint thinner, industrial solvents, chloroform and methyl chloride for treatment plants. These materials are not removed in the treatment plants; in fact the treatment processes facilitate the evaporation of the chemicals into the atmosphere, where people may inhale them. Many of the chemicals are toxic or are suspected of causing cancer. It is an alarmingly real fact that treatment plants designed to control water pollution are now becoming sources of air pollution. This situation adds to our understanding that although some pollutants can be moved from one location to another and can even change form (from liquid to gas), we really can not get rid of them as easily as once we thought.

Some chemicals are so toxic that extreme care must be taken to ensure that they do not enter the environment. The danger of such chemicals was tragically demonstrated on December 3, 1984, when a toxic chemical (stored in liquid form) at a pesticide plant leaked, vaporized and formed a toxic cloud that settled over a 641 cm2 area of Bhopal in Madhya Pradesh. The gas leak lasted less than one hour, yet over 2,000 people were killed and more than 15,000 were injured by the gas, which causes severe irritation (burns on contact) to eyes, nose, throat and lungs. Breathing the gas, in concentrations of only a few parts per million, causes violent coughing, swelling of the lungs bleeding and death. Exposure to lower concentrations can cause a variety of problems, including loss of sight.

- ***Paniculate Matter***

Paniculate matter encompasses the small particles of solid or liquid substances that ate releases in to the atmosphere by many activities. Modern farming adds considerable amounts of particulate matter to the atmosphere, as do desertification and volcanic eruptions. Nearly all industrial processes, as well as the burning of fossil fuels, release

pariculate into the atmosphere. Much particulate matter is easily visible as smok, soot or dust; other particulate matter is not easily visible. Included with the particulates are materials such as airborne asbestos particles and small particles of heavy metals, such as arsenic, copper, lead and zinc, which are usually emitted from industrial facilities such as smelters.

Of particular importance with reference to particulates are the very fine particle pollutants less than 2.5 Jim in diameter (2.5 millionths of ammeter). Among the most significant of the fine particulate pollutants are sulfurs and nitrates. These are mostly secondary pollutants produced in the atmosphere through chemical reactions between normal atmospheric constituents and sulfur dioxide and gen oxides. These reactions are particularly important in the formation of sulfuric and nitric acids in the atmosphere. When measured, particulate matter is often referred to as total suspended particulates (TSP).

Particulates affect human health, ecosystems, and the biosphere profoundly. Particulates that enter the lungs may lodge there and have chronic effects on respiration. Certain materials, such as asbestos, are particularly dangerous in this way. Dust raised byroad building and deposited on the surface of green plants may interfere with their absorptions of carbon dioxide and oxygen and their release of water. Heavy dust may affect th breathing animals. Particulates associated with large construction projects may kill organisms and damage large areas, changing species composition, altering food chains and generally affecting ecosystems. In addition, modem industrial processes have greatly increased the total suspended particulates in the earth's atmosphere. Particulates block sunlight and may cause changes in climate. Such changes have lasting effects on the biosphere.

2.1.3.4 Air Pollution in Urban Areas

Wherever there are many sources of air pollutants over a wide area—if we talk about automobile emissions in the great city of Kolkata, mere is a potential for the development of smog. Formation of pollution depends on the topography and on weather conditions, because these factors determine the rate at which pollutants are transported away from their sources and converted to harmless compounds in the air.

Influences of weather condition and topography : Weather conditions can determine whether air pollution is a nuisance or a major health problem. The primary adverse effects of air pollution are damage to green plants and aggravation of chronic illness in people; most of these effects are due to relatively low-level concentrations of toxins over a long period of time.

In the lower atmosphere, restricted circulation associated with inversion layers may lead to pollution events. An ***atmospheric inversion*** occurs when wanner air is found above cooler air, and it poses a particular problem when there is a stagnated air mass. Evaluating meteorological conditions can be extremely helpful in predicting which areas

have potential smog problems. Cities situated in a valley or topographic bowl surrounded by mountains are more susceptible to smog problems than are cities in open plains. Surrounding mountains and the occurrence of temperature inversions prevent the pollutants from being transported by winds and weather systems.

2.1.3.5 Factor considered potential for Urban Air Pollution

The potential for air pollution in urban areas is determined by the following factors:

i) the rate of emission of pollutants per unit area,

ii) the distance of downwind tha a mass of air may move through an urban area,

iii) the average speed of the wind, and finally

iv) the height to which the potential pollutants may be thoroughly mixed in the lower atmosphere.

The concentration of pollutants inthe air is directly proportional to the first two factors as entioned above. That is, as either the emission rate or downwind travel distance increases so will the concentration of pollutants inthe air. The Los Angeles basin in the western U.S.A. provides a good example. If there is a wind from the ocean the coastal side of cities such as Santa Monica or Malibu will experience much less air pollution man will the inland side of those cities. Conversely, if there is a Sana Ana wind coming off the desert and down from the mountains the air will be more polluted at the coast.

Smog (mixture of smoke and fog): There are two major types of smog: Photochemical smog, which is sometimes called L.A.-type smog, or brown air, and sulfurous smog, which is sometimes referred to as London-type smog, gray air, or' industrial smog. Solar radiation is particularly important in the formation of photochemical smog. The reactions occuring in the development of photochemical smog are complex and involve both nitrogen oxides (NO) and organic compounds (hydrocarbons). The development of photochemical smog is directly related to automobile use. Early in the morning when commuter traffic begins to build up, the concentrations of nitrogen oxide (NO) and hydrocarbons begin to increase, At the same time, the amount of nitrogen dioxide NO2 may decrease, because sunlight breaks it down to NO plus atomic oxygen (NO + 0). The atomic oxygen (0) is then free tocombine with molecular oxygen (02) to form ozone (03), so the con concentration of ozone also increases after sunrise, Shortly thereafter, oxidized hydrocarbons react with NO to increase the concentrations of NO2 by mid morning. This reaction causes the NO concentration to decrease and allows ozone to build up, producing the mi-day peakin ozone and minimum in NO. As the smog matures visibility may be greatly reduced owing to light scattering by aerosols.

Sulfurous smog is produced primarily by burning of coal andoil at large power plants. Sulfur oxides and particulartes combine under certain meteorological conditions

to produce concentrated sulfurous smog.

2.1.3.6 Controlling Measures of Air Pollution in Urban Areas

The optimistic view concerning future air pollution in urban areas is that air quality will improve because we know so much about the sources of air pollution and have developed effective ways to reduce pollution. The pessimistic view, however, is that even though we know a lot about the sources and how to reduce pollution, population pressure and econouiics will dictate what is likely to happen hi many parts of the world, and the result will be poorer air quality (more airpollution) in many locations. The actual situation in the beginning of this 20th century and onwards is likely to be a mixture of the optimistic and pessimistic points of view. Large urban areas in developing countries like India will probably experience a reduction in air quality even as they attempt to improve the situation, because the population and economic factors will likely outweigh pollution abatement

Larger urban areas in developed and more affluent countries, however, may well experience improved air quality in thecoming years. A new multifaceted air quality plan involves the entire urban region and includes the following aspects.

- Strategies to discourage automobile use and reduce the number of cars;
- Stricter emission controls for automobiles;
- A requirement for a certain number of zero-pollutant automobiles (electric cars);
- A requirement for gasoline to be reformulated to burn cleaner;
- Improvements in public transportation and incentives for people to use it;
- Mandatory carpooling; and
- Increased controls on industrial activities and household activities that are known to contribute toair pollution.
- Use of clean fuel in cars.
- More use of mass transport.

At the household level, for example, common materials such as paints and solvents will be reformulated so that their fumes will cause less air pollution, and eventually there may be a ban on certain equipment', such as gasoline-powered lawn mowers.

2.1.3.7 Condition of air pollution in the Developing Countries

Cities in the developing countries with burgeoning populations are particularly susceptible to air pollution now and in the future. They do not have adequate financial base to fight air pollution because they are more concerned with basic survival and finding ways to house and feed their growing populations. A good example is the metropolitan city of kolkata with a present population over 16 millions is the largest

urban complex in India next to Mumbai. Cars, buses, trucks, industry and power plants in the Greater Kolkata Metropolitan City emit hundreds of thousands of metric tons of pollutants into the atmosphere each year. It is becoming a rare day, particularly in the drier months of the year, when the stars in the night sky can be seen- clearly, and physicians report that there has been a steady increase in respiratory diseases. Headaches, irritated eyes and sore throats are common when the pollution settles in.

2.13.8 Suggested measures to Control Air Pollution

For both stationary and mobile sources of air pollutants, the most reasonable strategies for control have been to reduce, collect, capture or retain pollutants before they enter the atmosphere. From an environmental viewpoint, reduction of emissions via energy efficiency and conservation measures (burning less fuel) is the preferred strategy. Pollution problems vary in different regions of the world; reducing air pollution requires that strategies that is to be specific sources and type of pollutants.

1) Control on emission of Participates : Particulates emitted from fugitive, point or area stationary sources are much easier to control than are the very small particulates of primary or secondary origin released from mobile sources, such as automobiles. A variety of settlling chambers or collectors are used to control emissions of coarse particulates from power plants and industrial sites by providing a mechanism that causes particles in gases to settle out in location where they may be collected for disposal in landfills. Particulates *from* fugitive sources (such as a waste pile) must be controlled on site so that the wind does not blow them into the atmosphere.

2) Control on Automobile Pollution : Control of pollutants such as carbon monoxide, nitrogen oxides, and hydrocarbons in urban areas is best achieved through pollution-controlled measures for automobiles. Control of these materials will also regulate the ozone in the lower atmosphere, where it forms by reactions with nitrogen oxides and hydrocarbons in the presence of sunlight. The control of nitrogen oxides from automobile exhausts is accomplished by recalculating exhaust gas, diluting the air-to-fuel mixture being burned in the engine. The dilution reduces the temperature of combustion and decreases the oxygen concentration in the burning mixture thus producing fewer nitrogen oxides. The most common device used to remove carbon monoxide and hydrocarbon emissions from automobiles is the exhaust system’s catalytic coverter. Another approach to reducing urban air pollution produced by vehicles revolves around a number of options, most of which aim to reduce the number of cars on the roads.

3) Control on Acid Rain : Acid rain is a particularly troublesome problem because the pollutants that cause it may be emitted long distances—sometimes across national boundaries, from where the actual acid rain falls. The cause of acid precipitation is known. It is known that the only long-term solution involves decreasing emissions of

sulfur dioxide and nitrogen oxides. From an environmental point of view the best strategy is increasing energy efficiency and conservation measures that result in burning less coal in power plants and utilizing nonpolluting alternative energy sources.

4) Control on emission of Sulfur dioxide : Sulfur dioxide emissions can be reduced by abatement measures performed before, during or after combustion. The technology to clean up coal so that it will burn cleanly is already available, although the cost of removing th sulfur makes the fuel more expensive. Cleaning from higher-sulfur coal to lower-sulfur coal seems an obvious solution to reducing the emissions of sulfur dioxide into the atmosphere.

2.1.3.9 Laws of Air Pollution Control

Clean Air Act Amendments of 1990 are comprehensive regulations that address acid rain, toxic emissions, ozone depletion, and automobile exhaust. In confronting acid deposition (acid rain), the amendments establish limits on the maximum permissible emission of sulfur dioxide from utility companies burning coal. The legislation gave the mandate that the emissions be reduced by about 50% to 10 million tons a year by 2000. Toxic emissions into the atmosphere are targeted to be reduced by as much as 90%. Toxins targted are those thought to have the mosf potential for damaging human health, including cancer. Abatement depends heavily on pollution control equipment that will be required for large manufacturers and small businesses alike. Certainly this requirement would undoubtedly result in an increase in the cost of many goods and services, there should be a compensating improvement in the health of people.

Regarding ozone depletion in the atmosphere, the Clean Air Amendments have the goal of ending the production of all *chloflurocarbons* (CFCs) and other chlorine chemicals in steps from the year 2000 to the year 2030.

Airpollution in urban areas is most commonly related to automobile exhaust, Strategis outlined in the legislation include more stringent emission controls on automobiles and requiring cleaner-burning fuels. The aim is to reduce the occurrence the urban smog. Expected impacts of the legislation include increases in the cost of automobile fuels and the price of new automobiles.

2.1.4 Noise Pollution

Noise **pollution (**or **Environmental** noise) isdispleasing human-, animal- or machine-created sound that disrupts the activity or balance of human or animal life. A common form of noise pollution is from **transportation,** principally motor vehicles. The word *noise* cornes from the Latin word *nausea* meaning seasickness.

The source of most noise worldwide is transportation systems, motor vehicle noise, but also including aircraft noise and rail noise. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential area.

Other sources are ear alarms, emergency service sirens, office equipment, factory machinery, construction work, groundskeeping equipment, barking dogs, appliances, power tools, lighting hum, audio entertainment systems, loudspeakers and noisy people.

2.1.4.1 Measurement of Noise Pollution

A decibel is the standard for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard, on the scale. According to Smith, 20 db is whisper, 40 db the noise in a quiet office, 60 db is normal conversation, 80 db is the level at which sound becoms physically painful.

The Noise quantum of some of the cities in our country indicate their pitch in dcibel in the noisiest areas of corresponding cities, e.g. Delhi - 80 db, Kolkata-87, Bombay-85, Chenai-89 db etc.

Three sources of Noise Pollution :- Noise pollution like other pollutants is also a byproduct of industrialization, urbanizations and modern civilization.

Boadly speaking, the noise pollution has two courcs, i.e. industrial and non-industrial. The industrial source includes the noise from various industries and big machines working at a vry high speed and high noise intensity. Non-industrial source of noise includes the noise includes the noise created by transport/vhicular traffic and the neighborhood noise. Noise pollution can also be divided in to two categories, namely, natural and manmad. Most leading noise sources will fall into the following categories: roads traffic, aircraft, railroads, construction, industry, noise in buildings, and consumer products.

2.1.4.2 Sources of Noise Pollution

Following are the major sources of noise pollution:

1. Road Traffic Noise

In the city, the main sources of traffic noiseare te motors and exhaustsystem of autos, smaller trucks, buses, and motorcycle. This type of noise can b augmented by narrow streets and tall buildings, which produce a canyon in which traffic noise reverberates

2. Air Craft Nouse

Now-a-days, the problem of low flying military aircraft has added a new dimension to community annoyance, as the nation seeks to improve its nap-of the earth aircraft operations over national parks, wilderness areas, and other areas previously unaffected by aircraft noise has claimed national attention over recent years.

3. Noise from railroads

The noise from locomotive engines, horns and whistles, and switching and shunting operation in rail yards can impact neighboring communities amd railroad workers. For example, rail car retarders can produce a high frequency, high level screech that can reach peak levels of 120 dB at a distance of 100 feet, whicfc translate to levels as high as 138, or 140 dB at the railroad worker's ear.

4. Construction Noise

The noise from the construction of highways, city streets, and building is a major contributor to the urban scene. Construction noise sources include pneumatic hammers, air compressors, bulldozers, loaders, dump trucks (and their back-up signals), and pavement breakers.

5. *Noise in Industry*

Although industrial noise is one of the less prvalent community noise problems, neighbors of noisy manufacturing plants can b disturbed by sources such as fans, motors, and compressors mounted on the outside of buildings Interior noise can also be transmitted to the community through open windows and doors, and even through building walls. These interior noise sources have significant impacts on industrial workrs, among whom noise induced beaming loss is unfortunately common.

6. Noise in building

Apartment dwellers are often annoyed by noise in their homes, especially when the building is not well designed and constructed. In this case, internal building noise from plumbing, boilers, generators, air conditioners, and fans, can be audible and annoying. Improperly insulated walls and ceilings can reveal the sound of amplified music, voices, footfalls and noisy activities from neighborning units. External noise from emergency vehicles, traffic, refuse collection, and other city noises can be a problem for urban residents, especially when windows are open or insufficiently glazed.

7. *Noise from Consumer products*

Certain household equipment, such as vacuum cleaners and some kitchen appliances have been and continue to be noismakers, although their contribution to the daily noise dose is usually not very large.

4 Harmful Effects

On Human Being, Animal and Property : Noise has always been with the human civilization but it was never so obvious, so intense, so varied & so pervasive as it is seen in the last of this century. Noise pollution makes men more irritable. The effect of noise pollution is multifaceted & intr related. The effects of noise pollution on human being, animal and property are as follows :

2.1.43 Human health effects of Noise Pollution

Noise affects health and behaviour. The unwanted sound is called noise. This unwanted sound can damage physiological and psychological health. Noise pollution can cause annoyance and aggression, hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. Furthermore, stress and hypertension are the leading causes to health problems, whereas tinnitus can lead to forgetfulness, severe depression and at times & panic attacks.

Chronic exposure to noise may cause noise-induced hearing loss. Older males exposed to significant occupational noise demonstrate significantly reduced hearing sensitivity than their non-exposed peers, though differences in hearing sensitivity decrease with time and the two groups are indistinguishable by age 79. A comparison of Maaban tribesmen, who were insignificantly exposed to transportation or industrial noise, to a typical U.S. population showed that chronic exposure to moderately high levels of environmental noise contributes to hearing loss.

High noise levels can contribute to cardiovascular effects and exposure to moderately high levels during a single eight hour period causes a statistical rise in blood pressure of five to ten points and an increase in stress and vasoconstriction leading to the increased blood pressure noted above as well as to increased indidenceof coronary artery disease.

Noise pollution is also a cause of annoyance. A 2005 study by Spanish researchers found that in urban areas households are willing to pay approximately four Euros per decibel per year for noise reduction.

2.1.4.4 Environmental effects

Noise can have a detrimental effect on animals by causing stress, increasing risk of mortality by changing the delicate balance in predator/prey detection and avoidance, and by interfering with their use of sounds in communication especially in relation to reproduction and in navigation. Acoustic overexposure can lead to temporary or permanent loss of hearing.

An impact of noise on animal life is the reduction of usable habitat that noisy areas may cause, which in the case of endangered species may be part of the path to extinction. One of the best known cases of damage caused by noise pollution is the death of certain species of beached whales, brought on-by the loud sound of military sonar.

Noise also makes species communicate louder, which is called Lombard vocal response. Scientists and researchers have conducted experiments that show whales' song length is longer when submarine-detectors are on. If creatures don't "speak" loud enough, their voice will be masked by anthropogenic sounds. These unheard voices might be wanings, finding of prey, or preparations of net-bubbling. When one species begins louder,

it will mask other species' voice, causing the whole ecosystem to eventually speak louder.

European Robins living in urban environments are more likely to sing at night in places with high levels of noise pollution during the day, suggesting that they sing at night because it is quieter, and their message can propagate through the environment more clearly. Interestingly, the same study showed that daytime noise was a stronger predictor of nocturnal singing than night-time Light pollution, to which the phenomenon is often attributed.

Zebra finches become less faithful to their partners when exposed to traffic noise. This could alter a population's evolutionary trajectory by selecting traits, sapping resourcs normally devoted to other activities and thus lead to profound genetic and evolutionary consequences.

2.1.4.5 Mitigation and control of noise

Technology to mitigate or remove noise can be applied as follows :

There are a variety of strategies for mitigating roadway noise including: use of noise barriers, limitation of vehicle speeds, alteration of roadway surface texture, limitation of heavy vehicles, use of traffic controls that smooth vehicle flow to reduce braking and acceleration, and tyre design. An important factor in applying these strategies is a computer model for roadway noise, that is capable of addressing local topography, meteorology, traffic operations and hypothetical mitigation. Costs of building-in mitigation can be modest, provided these solutions are sought in the planning stage of a roadway project.

Aircraft noise can be reduced, to some extent by design of quieter jet engines, which was pursued vigorously in the 1970s and 1980s. This strategy has brought limited but noticeable reduction of urban sound levels. Reconsideration of operations, such as altering flight paths and time of day runway use, have demonstrated benefits for residential populations near airports. FAA sponsored residential retrofit (insulation) programs initiated in the 1970s has also enjoyed success in reducing interior residential noise hi thousands of residences across the United States.

Exposure of workers to Industrial noise has been addressed since the 1930s. Changes include redesign of industrial equipment, shock mounting assemblies and physical barriers in the workplace.

2.1.4.6 Legal Control

a) Constitution of India

Right to life : - Article 21 of the Constitution guarantees life and personal liberty to all persons. It is well settled by repeated pronouncements of the Supreme Court that right to life enshrined in Article 21 is not of mere survival or existence. It guarantees a

right of persons to life with human dignity. Any one who wishes to live in peace, comfort and quiet within his house has a right to prevent the noise as pollutant reaching him.

Right to Information :- Every one has the right to information know about the norms and conditions on which Government permit the industry which effect the environment.

Right to Religion and Noise :- Right to religion does not include right to perform religious activities on loud speaker and electronic goods which produce high velocity of noise.

Directive Principal of State Policy :- The state has the object to make the environment pollution tree.

Fundamental Duties :- every citizen of the country has the fundamental duty to keep clean environment

b) Cr. P.C. Section 133

Here Section 133 is of great importance. Under Crpc. Section 133 the magisterial court have been empowered to issue order to remove or abate nuisance caused by noise pollution Sec 133 empower an executive magistrate to interfere andremove a public nuisance in the first instance with a conditional order and then with a permanent one. The provision can be utilized in case of nuisance of environment nature. He can adopt immediate measure to prevent danger or injury of a serious land to the public. For prevention of danger to human life, health or safety the magistrate can direct to abstain from certain acts.

c) LP.C. Public Nuisance 26S-29S

Chapter IV of Indian Penal code deals with offences relating to public health, safety, ...decency, morals under Sections 268, 269, 270, 279, 280, 287, 288, 290, 291, 294. Noise pollution can be penalized with the help of above section. Private remedies suits in the area may related to public nuisance under A299. This article includes punishment in case of Public nuisance law of torts covers. A person is guilty of public nuisance who does any act or is guilty of an illegal omission which causes any common injury, danger, or annoyance to the public or to the people in general who dwell or occupy property in the vicinity or which must necessarily cause injury, obstruction danger or annoyance to persons who may have occasion to use any public right A common nuisance is not excused on the ground that it causes some convenience or advantage. Who ver commits a public nuisance in any case not otherwise punishable by this code, shall be punished with fine, which may extend to Rs. 200/-.

d) Law of Torts Noise pollution is considered as civil wrong

Under law of torts, a civil suit can be filed claiming damages for the nuisance. For filing a suit under law of torts a plaintiff is required to comply with some of th requirement of tort of nuisance

e) Factories Act Reduction of Noise and Oil of Machinery

The Factories Act does not contain any specific provision for noise control However, under the Third Schedule Sections 89 and 90 of the Act, noise induced hearing losses mentioned as notifiable disease. Similarly, under the Modal Rules, limits for noise exposure for work zone area have been prescribed.

f) Motor Vehicle Act. Provision Relation to use of horn and change of Engine

In-Motor vehicle Act, rules regarding use of horns and any modification in engine are made.

g) Noise Pollution Control Rule 2000 under Environment Protection Act 1996

Further for better regulation for noise pollution there are The Noise Pollution (Regulation and Control) Rules, 2000 - in order to curb the growing problem of noise pollution the government of India has enacted the noise pollution rules 2000 that includes the following main provisions :

- The state government may categories the areas in the industrial or commercial or residential.
- The ambient air quality standards in respect of noise for different areas have been specified.
- State government shall take measure for abatement of noise including noise emanating from vehicular movement and ensure that the existing noise levels do not exceed the ambient air quality standards specified under these rules.
- Areas not less than 100m around hospitals, educations institutions and court may declare as silence area for the purpose of these rules.
- A loud speaker or a public address system shall not be used except after obtaining written permission from the authority and the same shall not be used at night. Between 10 pm to 6 am.
- A person found violating the provisions as to the maximum noise permissible in any particular area shall be liable to be punished for it as* per the provision of these rules and any other law in force.

2.1.4.7 Conclusions

We have made the law relating to noise pollution but there is need to create general awareness towards the hazardous effects of noise pollution. Particularly, in our country the people generally lack consciousness of the ill effects which noise pollution creates and how the society stand to beneficiary preventing generation and emission of noise pollution. The target area should be educational institutions and more particularly school. The young children of impressionable age should be motivated to desist from

playing with firecrackers, use of high sound producing equipments and instruments on festivals, religious and social functions, family get-togethers and clebrations etc. which cause noise pollution. Suitable chapters can be added into textbooks, which teach civic sense to the children and teach them how to be good and responsible citizen which would include learning by heart of various fundamental duties and that would obliviously include learning not to create nose pollution and to prevent if generated by others. Holding of specil talks and lectures can be organized in the schdbls to highlight the menace of noise pollution and the role of the children in preventing it For these purpose the state must pay its role by the support and cooperation of non-government organizations (NGOs) can also be enlisted.

2.1.5 Model Questions

1) Describe the sources and ecosystem effects of soil pollution.
2) Discuss the role of pesticides, herbicides and insecticides on soil pollution.
3) Discuss how mining, burial, construction and unplanned waste disposal contribute to soil pollution.
4) Suggest the measures of a clean-up operation and reduction of soil pollution.
5) Describe the categories of water pollution with particular reference to ground water.
6) Identify the different sources and their gravity in water pollution.
7) Discuss the characteristics of mercury, lead and fluoride pollution and their impacts on human health.
8) Suggest the measures to control water pollution.
9) Describe the different sources and types of air pollution.
10) Make a discussion on the major gases and matters contributing to air pollution.
11) Discuss the characteristics of air pollution in urban areas and suggest measures of control.
12) What is noise pollution? How is it measured? Identify the major sources of noise pollution.
13) Discuss the effects of noise pollution on human health and suggest mitigative measures and control of noise pollution.

2.1.6 Select Readings

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Unit 2.2 ❑ Conservation of Forests, Wetlands and Biodiversity

Structure

2,2.1 Forest Conservation

The *word* ***forest*** was borrowedby Noddle Englshfrom Old Frenchand Medieval Latin *foresis,* literally meaning "outside". Uses of the word "forest" in English to denote any uninhabited area of non-enclosur are now considered archaic. The word was introduced by th Norman rulers of England as a legal trm (appearing in Latin texts like the Magna Carta) denoting anuncultivatd ara Igally set aside for hunting by feudal nobility. Thes hunting forests were not necessarily wooded land. However, as hunting forests did often include considerable areas of woodland, the word "forest" eventually came to mean wooded land more generally. By the start of the fourteenth century the word appeared in English texts, indicating all three senses : the most common one, the legal term and the archaic usage.

The scientific study of forest species and their interaction with the environment is referred to as forest ecology, while the management of forests is often referred to as forestry. Forest management has changed considerably over the last few cnturies, with rapid changes from the 1980s onwards culminating in a practice now referred to as sustainable forest management, Forest ecologists concentrate on forest patterns and processes, usually with the aim of elucidating cause and effect relationships. Foresters who practice sustainable forest management focus on the integration of ecological, social and economic values, often in consultation with local communities and other stakeholders.

Anthropogenic factors that can affect forests include logging, human-caused forest fires, acid rain, and introduced species, among other things. There are also many natural

factors that can cause changes in forsts over time including forest tires, insects, diseases, weather, competition between species, etc. In 1997, the World Resources Institute recorded that only 20% of the world's original forests remained in large intact tracts of undisturbed forest. More than 75% of these intact forests lie in three countries - the Boreal forests of Russia and Canada and the rainforest of Brazil. In 2006 this information on intact forests was updated using latest available satellite imagery.

Natural forests contain mainly natural patterns of biodiversity in established serial patterns, and they contain mainly species nativ to the region and habitat. The natural formations and processes have not been affected by humans with a frequency or intnsity to change the natural structure and components of the habitat.

Anthropogenic forests have been created by humans or sufficiently affected by humans to change or remove natural serial patterns. They often contain significant elements of species which were originally from other regions or habitats.

2,2,2 Wetland Conservation

2.2.2.1 Definition of Wetlands

In true sense, Wetlands are swamps and marshes formed in low-lying areas but can not be called permanent water bodies. There is much ambiguity about the definition of wetlands. In England, wetlands comprises of large tracts and therefore are synonymous with the name of the region itself like the Fens, Broads, Carrs, Mosses and Levels. Terms such as moors and bogs were often used to describe a particular landscape comprising peat lands and swamps.

2.2.2.2 Importance of Wetlands

Wetlands are one of the most productive ecosystems, comparable to tropical evergreen forests in the biosphere and play a significant role in the ecological sustainability of a region. They are an essential part of human civilisation meeting many crucial needs for life on earth such as drinking water, protein production, water purification, energy, fodder, biodiversity, flood storage, transport, recreation, research-education, sinks and climate stabilizers. The values of wetlands though overlapping, like the cultural, economic and ecological factors, are inseparable. The geomorphological, climatic, hydrological and biotic diversity across continents has contributed to wetland diversity. Across the globe, they are getting extinct due to manifold reasons, including anthropogenic and natural processes. Burgeoning population, intensified human activity, unplanned development, absence of management structure, lack of proper legislation, and lack of awareness about the vital role played by these ecosystems (functions, values, etc.) are the important causes that have contributed to their decline and extinction, With these,

wetlands are permanently destroyed and lose any potential for rehabilitation. This has led to ecological disasters in some areas, at large-scale devastations due to floods etc.

2.2.2.3 Conservation and Management of Wetlands

From the above discussions itcan be realized that with increase in knowledge on wetlands and simultaneous realization that they are rather invaluable to mankin. Thus sonservation and management of wetlands are absolute essential. A range of policies has been adopted depending upon the state of knowledge and the scientific and human capabilities.

The UNCED conference on environment and development as well as global conservation organizations, including RAMSAR convention, have identified the aquatic biodiversity tobe the most threatened of all biodiversities. There is, therefore, an urgent and felt need to conserve the aquatic biodiversity including the ecosystem processes. Wetlands cover an area of about 5.5 million ha, of which 1.5 million ha enjoy complete protection and 1.6 million ha partial protection. India being a developing country supporting the second largest population in the world, having mainly agrarian economy, has a significant impact on all natural resources including that of wetlands. It is in this context, an inventory of th important wetlands is essential. The directory of Asian Wetlands (1989) lists 93 Wetlands of International importance in India. Information on the type and extent of wetlands is lacking in India. Hence, this information is a baseline requirement for forming protected area ntwork and conservation.

However, so far in India there has been no systematic attempt to evolve conservation prserves analogous to terrestrial protected areas. While many developing countries such as China and south-ast Asian countries have progrssed substantially in formulating an action plan for conserving aquatic biodiversity, similar task of identifying such reserves for India is lacking. While acountry like UK could dsignate 161 Ramsar sites, obviously India beinga mga diverse country will have have many morethan the 20 stes presently identified by the national wetland programme. Such a task is daunting given the size, diversity of India. In this paper, we outline a possible approach for identifying important wtland sites taking into account the trmendous advancs made in spatial technology tools. In particular, we demonstrate how tools of remote sensing and geographic information system combined with an extremely well coordinated and organised field programme could contribute to formation of viable national level wetland conservation and monitoring programme.

2.2.3 Biodiversity and Its Conservation

Biotechnology involves the use of all life forms for human welfare. Therefore, extinction of wildspecies and destruction of ecosystms has been a major concern of policy makers and biotechnologists alike. One of the major efforts has been to conduct a survey

and conserve country's biodiversity, so as to save, wild plants andanimals from extinction.

National parks and sanctuaries have been established in many countries to meet this objective. Undere the auspices of the United Nations also, funds are being established and other efforts being made for conservation of germless at the global level. Biodiversity studies thus include the following :

(i) a systematic examination of the full array of organisms on this globe and

(ii) a study of the methods by which diversity can be maintained and used for the benefit of mankind.

A discussion on biodiversity in a book on biotechnology is relevant, because biodiversity is being utilized to provide genes from wild species for biotechnology exercises. In recent years, a discussion on biodiversity has become important also because countries in the North of the hemisphere (developed countries) have been utilizing biodiversity available in the South (developing countries) without paying any compensation.

Several Biodiversity Conventions* were held in 1992 for discussions on measures required to be taken by developing developed countries to preserve the biodiversity at the global level. In this connection the latest Biodiversity Convention was held in May, 1992 at Nairobi to formulate a treaty that was desired to be signed at the UN Conference on Environment and Development (UNCED) later held in Brazil in June 1992.

In this treaty, an agreement was sought by the developed countries to allow, as a matter of right, access of every on the germless or biodiversity available anywhere in the world. Since tropical countries are far richer than temperate countries, such a treaty would benefit only the developed nations.

In view of this, the South (particularly India) had rejected such a treaty desired to be signed in this convention. Such a rejection was also based on the argument that while the convention was meant to globalize the natural resources, it did not want to globalize the benefit derived from biotechnology inventions.

Instead, the developed countries wanted to privatize biotechnology through patents and other intellectual property right (IPR; consult next two chapters for details).

Similarly, to the disadvantage of developing poor countries, the concept of Plant Breeder's Rights (PBRs) was recognized in the North ignoring the Farmers' Rights for compensation desired to be given to poor farmers in the developing countries. Although, most countries agree to the need of preserving biodiversity, there is disagreement on the issue of who will pay for it.

Ecological Reasons for the need of Biodiversity conservation

Individual species and ecosystems have evolved over millions of years into a complex interdependence. This can be viewed as being akin to a vast jigsaw puzzle of inter-locking pieces. If you remove enough of the key pieces on which the framework

is based then the whole picture may be in danger of collapsing. We have no idea how many key 'pieces' we can afford to lose before this might happen, nor even in many cases, which are the key pieces. The ecological arguments for conserving biodiversity are therefore based on the premise that we need to preserve biodiversity in order to maintain our own life support systems.

Two linked issues which are currently of greeat ecological concern include world-wide deforestation and global climate change.

Forests not only harbour untold numbers of different species, but also play a critical role in regulating climate. The destruction of forest, particularly by burning, results in great increases in the amount of carbon in the atmosphere. This happens for two reasons. Firstly, there is a great reduction in the amount .of carbon dioxide taken in by plants for photosynthesis and secondly, burning rleases huge quantities of carbon dioxide into the atmosphere. (The 1997 fires in Indonesia's rain forests are said to have added as much carbon to the atmosphere as all the coal, oil and gasoline burned that year in western Europe.) This is significant because carbon dioxide is one of the main greenhouse gases implicated in the current global warming trend.

2.2.4 Model Questions

1) Examine the need and suggest the measures for forest conservation.

2) Discuss upon the need and management of wetland conservation for maintaining natural and biological ecosystems.

3) Make a discussion on the need and suggested process for Biodiversity conservation

2.2.5 Select Readings

- Mukhopadhyay, A. D. (2003) : Perspectives and Issues in Environmental Stadies, Vidyasagar University, Medinipur.
- Santra, S. C. (2001) : Environmental Science, Nfew Central Book Agency, Kolkata.
- Sharma, P. D. (2000) : Ecology and Environment, Rastogi, Publications, Meerut.
- Singh Savindra (2000) : Environmental Geography, Prayag Pustak Bhawan, Allahabad.
- Frank B. Golly : A Primer for Environmental Literacy. Universities Press, Hyderabad.

Unit 2.3 ❑ Important Protocols at the International Level

Structure

2.3.1 Kyoto Protocol

2.3.1.1 Definition and Introduction

The Kyoto Protocol is a protocol to the United Nations Framework Concention on Climate Change (UNFCCC or FCCC), an international environmental treaty with the goal of achieving stabilization of greenhouse gas concentrations in the atmospher at a level that would prevent dangerous anthropogenic interference with the climate system. The Kyoto Protocol establishes legally binding commitment for the reduction of four greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride), and two groups of gases (hydrofluorocarbons and perfluorocarbons) produced by “annex I” (industrialized) nations, as well as general commitments for all member countries. As of

January 2009, 1 83 parties have ratified the protocol, which was initially adoptd for use on 11 December 1997 in Kyoto, Japan and which entered into force on 16 Febiuary 2005. Under the Kyoto Protocol, industrialized countries agreed to reduce their collective gren house gas (GHG) emissions by 5.2% from the level in 1990. National limitations range from the reduction of 8% for the European Union and others to 7% for the United Scales, 6% for Japan, and 0% for Russia. The treaty permitted the emission incrases of 3% for Australia and 10% for Iceland.

Kyoto includes defind “flexible mechanisms” such a; Emissions Trading, the Clean Development Mechanism and Joint Implementation to allow annex I economies to meet their GHG emission limitations by purchasing GHG emission reductions credits from elsewhere, through financial exchanges, projects that reduce emissions in non-annex I economies, from other annex I countries, or from annex I countries with excess allowances. In practice this means that non-annex I economies have no GHG emission restrictions, but have financial incentives to develop GHG emission reduction projects to receive “carbon. credits” that can then be sold to annex I buyers, encouraging sustainable development. In addition, the flexible mechanisms allow annex I nations with efficient, low GHG-emitting industries, and high prevailing environmental standards to purchase carbon credits on the world market instead of reducing greenhouse gas emissions domestically. Annex I entities typically will want to acquire carbon credits as cheaply as possible, which non-annex I entities want to maximize the value of carbon credits generated from their domestic Greenhouse Gas Projects.

Among the annex I signatories, all nations have established Designated National Authorities to manage their greenhouse gas portfolios; countries including Japan, Canada, Italy, the Netherlands, Germany, France, Spain and others are actively promoting government carbon funds, supporting multilateral carbon funds intent on purchasing carbon credits from non-annex I countries, and are working closely with their major utility, energy, oil and gas and chemicals conglomerates to acquire greenhouse gas certificates as cheaply as possible. Virtually all of the non-annex I countries have also established Designated National Authorities to manage the Kyoto process, specifically the “CDM process” that determines which GHG Projects they wish to propose for accreditation by ifce CDM Executive Board.

23.1.2 Objectives

Kyoto is intended to cut global emissions of greenhouse gases. The objective is the stabilization and reconstruction of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Th objective of the *Kyoto climate change conference* was to establish a legally binding international agreement, whereby all the participating nations commit themselves

to tackling the issue of global wanning and greenhouse gas emissions. The target agreed upon was an average reduction of 5,2% from 1990 levels by the year 2012.

The Intergovernmental Panel on Climate Change (IPCC) has predicted an average global rise in temperature of 14°C (2.5°F) to 5.8°C (10.4°F) between 1990 and 2100.

Proponents also note that Kyoto is a first step as requirements to meet the UNFCCC will be modified until the objective is met, as required by UNFCCC Article 4.2 (d).

The treaty was negotiated in Kyoto, Japan in December 1997, opened for signature on 16 March 1998, and closed on 15 March 1999. The agreement came into force on 16 February 2005 following ratification by Russia on 18 November 2004. As of 14 January 2009, a total of 183 countries and one regional economic organization (the EC) have ratified the agreement (representing over 63.7% of emissions from annex I countries).

According to article 25 of the protocol, it enters into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in annex I which accounted in total for at least 55% of the total carbon dioxide emissions for 1990 of the Parties included in annex I, have deposited their instruments of ratification, acceptance, approval or accession. Of the two conditions, the “55 parties” clause was reached on 23 May 2002 when Iceland ratified The ratification by Russia on 18 Novmber 2004 satisfied the 55% clause and brought the treaty into force, effective 16 February 2005. Australian Prime Ministr Kevin Rudd ratified the Kyoto protocol on 3 December 2007. This came into effect after 90 days (the end of March 2008), as is stated in the guidelines set by the United Nations.

The five principal concepts of the Kyoto Protocol are :

- commitments to reduce greenhouse gases that are legally binding for annex I countries, as well as general commitments for all member countries;
- Implementation to meet the Protocol objectives, to prepare policies and measures which reduce greenhouse gases; increasing absorption of these gases and use all mechanisms available, such as joint implementation, clean development mechanism and emissions trading; being rewarded with credits which allow more greenhouse gas emissions at home;
- minimizing impacts on developing countries by establishing an adaptation fund for climate change;
- accounting, reporting and review to ensure the integrity of the Protocol;
- compliance by establishing a compliance committee to enforce compliance with the commitments under the Protocol.

23.13 Details of the agreement

According to a press release from the United Nations Environment Programme :

After 10 days of tough negotiations, ministers and other high-level officials from 160 countries reached agreement this morning on a legally binding Protocol under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2%. The agreement aims to lower overall emissions from a group of six greenhouse gases by 2008-12, calculated as an average over these five years. Cuts in the three most important gases - carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) - will be measured against a base year of 1990. Cuts in three long-lived industrial gases - hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and Sulphur hexafluoride (SFs) can be measured against either a 1990 or 1995 baseline.

National limitations range from 8% reductions for the European Union and others, to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland.

The agreement is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC, adopted at the Earth Summit in Rio de Janeiro in 1992). All parties to the UNFCCC can sign or ratify the Kyoto Protocol, while non-parties to the UNFCCC cannot. The Kyoto Protocol was adopted at the third session of the Conference of Parties to the UNFCCC (COP3) in 1997 in Kyoto, Japan. Most provisions of the Kyoto Protocol apply to developed countries, listed in annex I to the UNFCCC. Emission figures exclude international aviation and shipping.

23.1.4 Common but differentiated responsibility

The United Nations Framework Convention on Climate Change agreed to a set of a common but differentiated responsibilities. The parties agreed that:

1. the largest share of historical and current global emissions of greenhouse gases originated in developed countries;
2. per capita emissions in developing countries are still relatively low;
3. the share of global emissions originating in developing countries will grow to meet social and development needs.

China, India, and other developing countries were not included in any numerical limitation of the Kyoto Protocol, because they were not main contributors to the greenhouse gas emissions in the pre-treaty industrialization period China has since become the largest, greenhouse gas emitter. However, even without responsibility under the Kyoto target, developing countries were to shar the common responsibility of the countries to reduce emissions.

The protocol defines a mechanism of compliance as a monitoring compliance with the commitments and penalties for non-compliance.

2.3.1.5 Financial commitments

The Protocol also reaffirms the principle that developed countries have to pay billions of dollars, and supply technology to other countries for climate-related studies and projects. The principle was originally agreed in the UNFCCC.

2.3.1.6 Emissions trading

Kyoto provides for a 'cap and trade' system which imposes national caps on the emissions of annex I countries. On average, this cap rquires countries to reduce their emissions 5.2% below their 1990 baseline over the 2008 to 2012 period. Although these caps are national-level commitments, in practice, most countries will evolve their emissions targets to individual industrial entities, such as a power plant or paper factory. One example of a 'cap and trade' system is the EU ETS. Other schemes may follow suit in time.

The ultimat buyers of credits are often individual companies that expect emissions to exceed their quota, their assigned allocation units, AAUs or 'allowances' for short. Typically, they win purchase credits direectly from another party with excess allowances, from a broker, from a JI/CDM developer, or on an exchange.

National governments, some of whom may not have devolved responsibility for meeting Kyoto obligations to industry, and that have a net deficit of allowances, will buy credits for their own account, mainly from JI/CDM developers. These deals are occasionally done directly through a national fund or agency, as in the case of the Dutch government's ERUPT programme, or via collective funds such as the World Bank's Prototype Carbon Fund (PCF). The PCF, for example, represents a consortium of six governments and 17 major utility and energy companies on whose behalf it purchases credits.

Since allowances and carbon credits are tradable instruments with a transparent price, financial investors can buy them on the spot market for speculation purposes, or link them to futures contracts. A high volume of trading in this secondary market helps price discovery and liquidity, and in this way helps to keep down costs and set a clear price signal in COj which helps businesses to plan investments. This market has grown substantially, with banks, brokers, funds, arbitrageurs and private traders now participating in a market valued at about $60 billion in 2007. Emissions Trading PLC, for example, was floated on the London Stock Exchange's AIM market in 2005 with the specific remit of investing in emissions instruments.

Although Kyoto created a framework and a set of rules for a global carbon market, there are in practice several distinct schemes or markets in operation today, with varying degrees of linkages among them.

Kyoto enables a group of several annex I countries to create a market-within-a-market together. The EU elected to be treated as such a group, and created the EU Emissions Trading Scheme (ETS). The EU ETS uses EAUs (EU Allowance Units), each

equivalent to a Kyoto AAU. The scheme went into operation on 1 January 2005, although a forward market has existed since 2003.

The UK established its own learning-by-doing voluntary scheme, die UK ETS, which ran from 2002 through 2006. This market existed alongside the EU's scheme, and participants in the UK scheme have the option of applying to opt out of the first phase of the EU ETS, which lasts through 2007.

The sources of Kyoto credits are the Clean development Mechanism (COM) and Joint Implementation (JO) projects. The COM allows the creation of new carbon credits by developing emission reduction projects in non-annex I countries, while JI allows project-specific credits to be converted from existing credits within annex I countries. CDM projects produce Certified Emission Reductions (CERs), and JI projects produce Emission Reduction Units (ERUs), each equivalent to one AAU. Kyoto CERs are also accepted for meeting EUETS obligations, and ERUs will become similarly valid from 2008 for meeting ETS obligations (although individual countries may choose to limit the number and source of CER/JIs they will allow for compliance purposes starting from 2008). CERs/ ERUs are overshelmingly bought from project developers by funds or individual entities rather than being exchange-traded like allowances.

Since the creation of Kyoto is subject to a lengthy process of registration and certification by the UNFCCC, and the projects themselves require several years to develop, this market is at this point largely a forward market where purchases are made at a discount to their equivalent currency, the EUA, and are almost always subject to certifications and delivery (although up-front payments are sometimes made). According to IETA, the market value of CDM/JI credits transacted in 2004 was EUR 245 m; it is estimated that more than EUR 620 m worth of credits were transacted in 2005.

Several non-Kyoto carbon markets are in existence or being planned, and these are likely to grow in importance and numbers in the coming years. These include the New South Wales Greenhouse Gas Abatement Scheme, the Regional Greenhouse Gas Initiative and Western Climate Initiative in the United States and Canada, the Chicago Climate Exchange and the State of California's recent initiative to reduce emissions.

These initiatives taken together may create a series of partly linked markets, rather than a single carbon market The common theme is the adoption of market-based mechanisms centered on carbon credits mat represent a reduction of CO_2 emissions. The fact that some of these initiatives have similar approaches to certifying their credits make it possible that carbon credits in one market may in the long run be tradable in other schemes. The scheme would broaden the current carbon market far more than the current focus on the CDM/ JI and EU ETS domains. An obvious precondition, however, in a realignment of penalties and fines to similar levels, since these create an effective ceiling for each market.

2.3.1.7 Revisions

The protocol left several issues open to be decided later by the sixth Conference of Parties *(COP)*. COP6 attempted to resolve these issues at its meeting in the Hague in late 2000, but was unable to reach an agreement due to disputes between the European Union on the one hand (which favoured atougher agreement) and the Unitd States, Canada, Japan and Australia on the other (which wanted the agreement to be less demanding and mor flexible).

In 2001, a continuation of the previous meeting (COP6) was held in Bonn where the required decisions were adopted. After some concessions, the supporters of the protocol (led by the European Union) managed to get Japan and Russia in as well by allowing more use of carbon dioxide sinks.

COP7 was held from 29 October 2001 through 9 November 2001 in Marrakech to establish the final details of the protocol.

The first Meeting of the Parties to the Kyoto Protocol (MOP1) was held in Montreal from 28 Nobember to 9 December 2005, along with the 11th conference of the Parties to the UNFCCC (COP11). See United Nations Climate Change Conference.

The 3rd December 2007, Australia ratified the protocol during the first day of the COPlSinBali.

Of the signatories, 36 developed C.G. countries (plus the EU as a party in the European Union) agreed to a 10% emissions increase for Iceland; but, since the EU's member states each have individual obligations, much larger increases (up to 27%) are allowed for some of the less developed EU countries.

23.1.8 Enforcement

If the enforcement branch determines that an annex I country is not in compliance with its emissions limitation, then that country is required to make up the difference plus an additional 30%. In addition, that country will be suspended from making transfers under an emissions trading program.

2.3.2 Montreal Protocol

23.2.1 Definition and Introduction

The *Montreal Protocol* on *Substances that Deplete the Ozone Layer* (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16,1987 and enterd into force on January 1,1989 followed by a first meeting in Helsinki, May 1989. Since then, it has undergone seven revisions, in

1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), and 1999 (Beijing). It is believed that if the international agreement is adhered to, the ozone layer is expected to recover by 2050. Due to its widespread adoption and implementation it has been hailed as an example of exceptional international co-operation with Kofi Annan quoted as saying that perhaps the single most successful international agreement to date has been the Montreal Protocol.

2.3.2.2 Terms and purposes of this treaty

The treaty is structured around several groups of halogenated hydrocarbons that have been shown to play a role in ozone depletion. All of these ozone depleting substances contain either chlorine or bromine (substances containing only fluorine do not harm the ozone layer). For a table of ozone-depleting substances see: For each group, the treaty provides a timetable on which the production of those substances must be phased out and eventually eliminated.

- ***Chlorofluorocarbons (CFCs) Phase-out Management Plan***

The stated purpose of the treaty is mat the signatory states recognizing that worldwide emissions of certain substances can significantly deplete and otherwise modify the Ozone layer in a manner that is likely to result in adverse effects on human health and the environment This trteaty is determined to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge. It has acknowledged that special provision is required to meet the needs of developing countries and shall accept a series of stepped limits on CFC use and production, including: from 1991 to 1992 its levels of consumption and production of the controlled substances in Group I of Annex A do not exceed 150 percent of its calculated levels of production and consumption of those substances in 1986; from 1994 its calculated level of consumption and production of the controlled substances in Group I of Annex A does not exceed, annually, twenty-five percent of its calculated level of consumption and production in 1986, from 1996 its calculated level of consumption and production of the controlled substances in Group I of Annex A does not exceed zero.

There is a slower phase-out (to zero by 2010) of other substances (halon 1211,1301, 2402; CFCs 13, 111, 112, etc) and some chemicals get individual attention (Carbon tetrachloride; 1,1,1- trichloroethane). The phasing-out of the less active HCFCs started only in 1996 and will go on until a complete phasing-out is achieved in 2030.

- ***Hydrochlorofluorocarbons (HCFCs) Phase-out Managment Plan (HPMP)***

Under the Montreal Protocol on Substances that Deplete the Ozone Layer, expecially Executive Committee (ExCom) 53/37 and ExCom 54/39, Parties to this Protocol agreed to set year 2013 as the time to freeze the consumption and production of HCFCs. They

also agreed to start reducing its consumption and production in 2015. ‘Hie time of freezing and reducing HCFCs is then known as 2013/2015.

The HCFCs are transitional CFCs replacements, used as refrigerants, solvents, blowing agents for plastic foam manufacture, and fire extinguishers. In trem of Ozone Depleting Potential (OOP), in comparison to CFCs that have ODP 0.6 - 1.0, these HCFCs ODP have less OPD, i.e. 0.01 - 0.5. Whereas in term of Global Wanning Potential (GWP), in comparison to CFCs that have GWP 4,680-10,720, HCFCs have less GWP, i.e. 76 -2,270.

There are a few exceptions for essential uses, where no acceptable substitutes have been found (for example, in the metered dose inhalers commonly used to treat asthma and other respiratory problems) or “Halon fire suppression systems used in submarines and aircraft (but not in general industry).

The provisions of the Protocol include the requirement that the Parties to the Protocol base their future decisions on the current scientific, environmental, technical, and economic information mat is assessed through panels drawn *from* the worldwide expert communities. To provide that input to the dcision making process, advances in understanding on these topics were assessed in 1989,1991,1994,1998 and 2002 in a series of reports entitled Scientific assessment of ozone depletion.

Several reports have fcfeen published by various governmental and non-governmental organizations to present alternatives to the ozone depleting substances* since the substances have been used in various technical sectors, like in refrigerating, agriculture, energy production, and laboratory measurements.

2.3.2.3 Ratification

At present, 195 of 196 United Nations member states have ratified the original Montreal Protocol (see external link below). That one that has not as of April 2009 is Timor-Leste. Fewer countries have ratified each consecutive amendment Only 154 countries have signed the Beijing Amendment.

In the United States, the Clean Air Act Amendments of 1990 (P.L. 101-549) contain provisions for implementing the Montreal Protocol, as well as explicit, separate authority for the EPA to regulate ozone depleting chemicals.

2.3.2.4 Impact

Since the Montreal Protocol came into effect, the atmospheric concentrations of the most important chlorofluorocarbons and related chlorinated hydrocarbons have either leveled off or decreased. Halon concentrations have continued to increase, as the halons presently stored in fire extinguishers are released, but their rate of increase has slowed and their abundances are expected to begin to decline by about 2020. Also, the concentration of the HCFCs increased drastically at least partly because for many uses CFCs (e.g. used

as solvents or refrigerating agents) were substituted with HCFCs. While there have been reports.of attempts by individuals to circumvent the ban, e.g. by smuggling CFCs from undeveloped to developed nations, the4overall level of compliance has been high. In consequence, the Montreal Protocol has often been called the most successful international environmental agreement to date. In a 2001 report, NASA found the ozone thinning over Antarctica had remained the same thickness for the previous three years. However, in 2003 the Ozone hole grew to its second largest size. The most recent (2006) scientific evaluation of the effects of the Montreal Protocol states. The Montreal Protocol is working. There is clear evidence of a decrease in the atmospheric burden of ozone-depleting substances and some early signs of stratospheric ozone recovery.

Unfortunately, the hydrochlorofluorocarbons, or HCFCs, and hydrofluorocarbons, of HFCs, are now thought to contribute to anthropogenic global warming. On a molecule-for-molecule basis, these compounds are up to 10,000 times more potent greenhouse gases than carbon dioxide. The Montreal Protocol currently calls for a complete phase-out of HCFCs by 2030, but does not place any restriction on HFCs. Since the CFCs themselves are equally powerful as greenhouse gases, the mere substitution of HFCs for CFCs does not significantly increase the rate of anthropogenic global warming, but over time a steady increase in their use could increase the danger that human activity will change the climate.

2.3.3 Model Questions

1) Discuss the main theme and objectives of Kyoto Protocol.
2) Account for the details of agreement reached under the Kyoto Protocol.
3) What is the main theme of Montreal Protocol? Examine the terms and purposes of Montreal Protocol.

2.3.4 Select Readings

- Mukhopadhyay, A. D. (2003): Perspectives and Issues in Environmental Stadies, Vidyasagar University, Medinipur.
- Santra, S. C. (2001): Environmental Science, New Central Book Agency, Kolkata.
- Sharma, P. D. (2000): Ecology and Environment, Rastogi, Publications, Meerat
- Singh Savindra (2000): Environmental Geography, Prayag Pustak Bhawan, Allahabad.
- Frank B. Golly : A Primer for Environmental Literacy. Universities Press, Hyderabad

Unit 2.4 ❑ Environmental Impacts of Big Dams and Urban-Industrial Expansion

Structure

2.4.1 Environmental Impacts of Big Dams

2.4.1.1 Introduction

The main purposes for which big dams are constructed upon major rivers are: 1) to control flood and ensure perennial supply of water for irrigation in agriculture an 2) to generate hydroelectricity for industrial and domestic purposes. People have constructed dams to harness water resources for at least 5,000 years.

The most active phase of large dam construction, defined by the *International Commission on Large Dams* as structures above 15 m in height, was in the 1950s, 1960s and early 1970s, when 373 dams were completed each year. At the end of 1960, there were 7,408 such dams registered. By 1986, the total had reached 36,562. Of those constructed, 64 per cent were in Asia, with no less than half of the would total in China.

Excluding China, most of the new structures have been built in the temperate zone, but tropical and subtropical countries such as Brazil, Mexico, India, Thailand, Indonesia, Zimbabwe, Nigeria, Cote d'lvoire and Venezuela have also become prominent in dam construction. Seventy-nine per cent of these dams are less than 30m in height, and only 4 per cent exceed 60m.

2.4.1.2 Benefits of big dams

There is no doubt mat many big dam schemes have been successful in achieving their primary objectives. Egypt's Aswan High Dam, completed in 1970, illustrates some of the benefits of big dam construction. Hydroelectricity generated by the dam, a renewable energy source which does not produce any harmful atmospheric pollution, is cheap to operate after the initially high capital costs of dam construction and saves on the purchase of fossil fuels from abroad. Hie Aswan High Dam generates about 20 per cent of Egypt's electricity.

The natural discharge of the Nile is subject to wide seasonal variations, with about 80 per cent of the annual total received during the flood season from August to October, and marked high and low flows depending upon climatic conditions in the main catchment area in the Ethiopian highlands. The dam allows management of the flow of the Nile's discharge, evening out the annual flow below the dam and protecting against floods and droughts. Management of the Nile's flow has also had benefits for navigation and tourism, rsulting from the stability of water levels in the river's course and navigation channels. Irrigation water for cropland is also provided by the dam's reservoir storage, which has allowed 400000 hectares of cropland to convert from seasonal to perennial irrigation and the expansion of agriculture onto 490000 ha of new land, a particularly important aspect for a largely hyper-arid country with just 3 per cent of its national area suitable for cultivation.

Large dams are often seen as symbols of economic advancement and national prestige for many developing nations but the huge initial capital outlay needed for construction often means that agendas are set to varying extents by foreign interests. A key element in the financing of Ghana's *Akosombo* Dam, completed in 1965, was the sale of cheap electricity to die Volta Aluminium Company, a consortium with two US-owned companies that produces aluminium from imported alumina, despite the fact that Ghana has considerable reserves of alumina of her' own. The construction of the *Cahora Bassa* Dam in Mozambique in the 1970s, when the country was still a Portuguese colony, was also largely catering to outside interests. Most of the electricity is sold to South African industry, and part of the original reason for flooding the 250 km-long Lake *Cahora Bassa* was to establish a physical barrier against *Frelimo* guerillas seeking independence. The plan for the dam also envisaged the settlement of up to 1 million white farmers in the region, who, it was thought, would fight to protect their new lands.

Within the country, too, concerns have often been raised about the main benefits of a new dam being directed towards urban areas. Wall (1988) points out that although the Bayano Hydroelectric Complex in Panama provides 30 per cent of the country's electricity; no less than 83 per cent of national production is consumed in Panama City and Colon, so that the dam is reinforcing the concentration of wealth in the urban areas.

Hence, it is clear that the undoubted benefits of big dams are not always gained solely by the country where the dam is located, and that within the country concerned, the demands of urban populations can outweigh those of rural areas. Many of the drawbacks of such structures, however, are borne by the rural people of the country concerned. Despite the success of many big dams in achieving their main economic-aims, their construction and associated reservoirs create significant changes in the pre-existing environment, and many of these changes have proved to be detrimental. It is the negative side of environmental impacts that have pushed the issue of big dams to a prominent position in the eyes of environmentalists and many other interest groups.

2.4.13 Environmental Impacts of Big Dams

The environmental impacts of big dams and their associated reservoirs are numerous, and environmental scientists have outlined the main areas that they influence (Table 1).

Table 1 : Areas of influence of dam and reservoir projects

Serial	***Aspects***
1.	The catchments contributing to the reservoir or project area and the area below the dam to the estuary, coastal zone and offshore
2.	All ancillary aspects of the project such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas and construction camps, as well as unplanned developments stimulated by the project (e.g. logging or shifting cultivation along access roads')
3.	Off-site areas required for resettlement or compensatory tracts
4.	The air-shed, such as where air pollution may enter or leave the area of influence
5.	Migratory routes of humans, wildlife or fish, particularly where they relate to public heath, economics, or environmental conservation

Scarce : Goodland (1990)

The temporal aspect of environmental impacts within a certain area is also important The river basin itself can be thought of as a system which will respond to a major change, such as the construction of a dam, in many different ways and on a variety of timescales. While the creation of a reservoir creates an immediate environmental change,

the permanent inundation of an area not previously covered in water, the resulting changes in other aspects of the river basin, such as floral and faunal communities, and soil erosion, will take a longer time to readjust to the new conditions.

The range of environmental impacts consequent upon dam construction, and their effects on human communities, can be considered under the following three headings which reflect the broad spatial regions associated with any dam project : ***a) the dam and its reservoir; b) the upstream area;*** **and** ***c) the downstream area.***

i) The Dam and its Reservoir

The creation of a reservoir results in the loss of resources in the land area inundated. Flooding behind the *Balbina* Dam north of Manaus, Brazil has destroyed much of a centre of plant endemism. In some cases the loss of wilderness areas threatened by new dam projects has raised considerable debate, both nationally and internationally. A case in point was the Nam *Choan* Dam Project on the Kwae Yai River in western Thailand, first proposed in 1982. The proposed reservoir lay largely within the *Thung Yai Wildlife Sanctuary;* one of the largest remaining relatively undisturbed forest areas in Thailand, containing all six of the nation's endangered mammal species. Debate over the destructive impact of the project resulted in it being shelved indefinitely in 1988.

Some resources, such as trees for timber or fuel wood, can be taken from the reservoir site prior to inundation, although this is not always economically feasible in remote regions. There are dangers inherent in not removing them, however. Anaerobic decomposition of submerged forests produces hydrogen sulphide which is toxic to fish and corrodes metal that comes into contact with the water. Corrosion of turbines in Surinam's Brakopondo reservoir has been a serious problem. In a similar vein, decomposition of organic matter by bcteria in the *La Grande 2* reservoir in Quebec, Canada has released large quantitis of mercury by methylation. Mercury has bioaccumulated in reservoir fish tissue to levels often exceeding the Canadian standard for edible fish of 0.5 mg/kg.

Cultural property may also be lost by the creation of a reservoir twenty-four archaeological sites dating from 70-1000 AD were inundated by the Tucurui Dam reservoir in Brazil, for example - although in some cases such property is deemed important enough to be preserved. Lake Nasser submerged some ancient Egyptian monuments but major ones - including the temples of Abu Simbel, Kalabsha and Philae were moved to higher ground prior to flooding.

Big dams often necessitate resettlement programmes if there are inhabitants of the area to be inundated, and the numbers of people involved can be very large. Some of the biggest projects in this respect have been in China. The *Sanmen Gorge Project* on the Huang Ho River involved moving 300,000 people and the proposed Three Gorges Dam on the Yangtze River may involve the displacement of up to 1.2 million people. Some

indication of the trade-off between land lost, people displaced and power generated is indicated in Table 2 for a selection of big dam projects.

Table 2; Hydel power generated per hectare inundated, and mimbr of people displaced for selected big dam projects in the world

Projects and country	***Approx rated capacity (MW)***	***Normal area of Reservoir (ha)***	***Kilowatts per hectare***	***People relocated***
Pehuenchi (Chile)	500	400	1250	
Guavio (Columbia)	1,600	1,500	1067	
Itaipu (Brazil & Paragua	12,600	1,35,000	93	8,000 families
Syaonogorsk (Russia)	6,400	80,000	80	
Churchill Falls (Canada)	5,225	66,500	79	
Tarbela (Pakistan)	1,750	24,300	72	86,000
Grand Cuelee (USA)	2,025	32,400	63	
Tucurui (Brazil)	6,480	2,16000	30	30,000
Keban (Turkey)	1,360	67,500	20	30,000
Three Gorges (China)	13,000	1,10,000	12	1,300,000
Batang Ai (Sarawak, Borneo)	92	8,500	11	3,000
Cahora Bassa (Mozambique)	2,075	2,66,000	8	25,000
Aswan High Dam (Egypt)	2,100	40,000	5	1,00,000
BHA (Panama)	150	35,000	4	4,000
Kariba (Zimbabwe & Zambia)	1,500	5,10,000	3	50,000
Akosombo (Ghana)	833	8,48,000	09	80,000
Brokopondo (Surinam)	30	1,50.000	02	50,000

Source: Barrow (1981), Goldsmith A Hildyard (1984), Wall (1988), Dixon et.ai (1089) A Goodland (1990)

For people who are displaced, the move can be a traumatic one. The resettlement of 57000 members of the Tonga tribe from the area of the *Kariba Dam* on the Zambezi illustrates some of the adverse effects for the people concerned. Some scientists describe the culture shock suffered in moving to very different communities and environments. Drawn-out conflicts over land tenure resulted between the new settlers and previous residents, and since the resettlement area was drier than the Tongan homelands, problems with planting and the timing of harvests were faced. Deprived of fish and riverbank rodents which traditionally supplemented their cultivated diet, the Tongas faced severe food shortages. When the government sent food aid to relieve the suffering, the food distribution centres became transmission sites for trypanosomiasis.

Development following the construction of big dams can also act as a pull for migrants, bringing associated problems of pressure on local resources. The influx of migrants to the Aswan area has led to an increase in population from 2,80,000 in 1960 in 1960 to more, than 1 million by the late 1980s, mainly due to the increase in job opportunities.

Over the longer term, other effects of reservoir inundation become evident. The alteration of the environment can have significant impacts on local health conditions. In some cases these can be beneficial. Onchocerciasis or river blindness, for example, a disease which is common hi Africa, is caused by a small worm transmitted by a species of blackfly. The blackflies breed in fast-running, well-oxygenated waters and dam construction can reduce the number of breeding sites by flooding rapids upstream. This has been the case in Ghana's *Akosombo* and Nigeria's *Kainji* dams although the flies may find alternative breeding sites hi new tributary streams.

Malaria, conversely, is likely to increase as a result of water impoundment, since the mosquitoes which transmit the disease breed in standing waters. Local malaria incidence has increased around Tucurui, Brazil, although management by fluctuating water levels and stranding larvae can help as in the USA's Tennessee Valley Authority water management complex.

Schistosomiasis, also known as *bilhania*, a very debilitating though rarely fatal disease which is widespread throughout the Third World, is transmitted in a different way: by parasitic larvae that infect a certain aquatic snail species as the intermediate host Incidence of schistosomiasis was considerably increased by the construction of the *Akosombo* Dam, with infection rates among 5-19 year old children rising from 15 per cent to 90 per cent within 4 years of its completion. Similar figures have been repelled from other large dams, such as *Kariba* hi Zambia.

Other biological consequences of large reservoirs include the rapid spread of water-weeds that cause hazards to navigation and a number of secondary impacts, notably water losses through evapo-transpiration. Water-fern appeared hi Lake Kariba 6 months after the dam was closed and after 2 years had covered 10 per cent of the 420 km^2 lake area. **More** dramatic still was the spread of water hyacinth on Surinam's Brokopondo reservoir, which covered 50 per cent of the lake's surface within 2 years. Similar serious difficulties have been encountered at *Aswan* and *Pa Mong* in Viet Nam.

New reservoirs also have effects on geomorphological and, in some cases, tectonic processes. The trapping of sediment is a particularly important aspect of reservoir impoundment The siltation of reservoirs has a number of knock-on effects downstream of the dam (see below), but it can also seriously affect the useful life of the dam itself. Some examples of sedimentation rates in Chinese reservoirs are shown in Table 3. An extreme example of rapid sedimentation behind a dam is provided by China's *Sanmenxia* reservoir. River impoundment began in I960, but within just 7.5 years of operation the reservoir had lost 35 per cent of its total storage capacity of 9,700 million m^3 due to sedimentation.

Table 3: Rate of sedimentation in some Chinese reservoirs

Name of Reservoir	*Name of River*	*Total amount of sediment deposited (million m^3)*	*Period of record (years)*	*Storage lost (%)*
Sanmeroda	Huang Ho	3391	7.5	35
Quingtongxia	Huang Ho	527	5	84
Yanguoxia	Huang Ho	150	4	68
Liujiaxia	Huang Ho	522	8	11
Darjiangkou	Hangsuui	625	15	4
Guanting	Yongdinghe	553	24	24
Hongshan	Laohe	440	15	17
Gangnan	Hutuobe	185	17	12
Xingqiao	Hongliuhe	156	14	71

Source : Biswas (1990)

A wide range of techniques is available for reservoir de-siltation, the cost of which needs to be budgeted for. Scientists have document the case of the *Sefid-Rud* reservoir in northwestern Iran which lost over 30 per cent of its storage capacity in the first 17 years after construction. Desiltation successfully restored about seven per cent of total capacity in seven years, but the reservoir had tobe emptied during the non-irrigation season to enable sediment flushing. Emptying the reservoir released a highly erosive flow downstream of the dam and hydroelectricity generation was prevented during the operation.

Local heightening of water tables following reservoir impoundment can have deleterious affects .on new irrigation schemes through water logging and salinisation. Water logging is an occasional problem around the *Kuban* reservoir on the River Kuban, near Krasnodar in southern Russia, when the reservoir is filled above its maximum normal level to aid navigation and benefit rice cultivation. The result has been the ruin of over 100,000 ha of crops, and water damage to 130 communities, including 27,000 homes, 150 km of roads and even the Krasnodar airport. Local changes in groundwater conditions have also affected slope stability, causing landslides around some reservoirs. Water displaced by a landslip at the *Vaiont* Dam in Italy in 1963 overtopped the dam, killing more than 2,000 people in the resulting disaster.

The sheer size of some reservoirs can also create new gee-morphological processes. Artificial lakes behind dams on the Volga River are so large that storms can produce ocean-like wavs which easily erode the fine wind-blown soils lining the shores. When this process undercuts trees, or creates shoals, navigational hazards result.

The stress changes on crustal rocks induced by huge volumes of water impounded behind major dams have been suspected of inducing earthquakes in some regions. Nurek Dam on the Vakhish River in central Tajikistan is the best-documented example of a

large dam, in this case a 315-m-high earth dam, causing seismic activity. Filling of the dam, located in a thrust-faulted setting, began in 1967 and substantial increass in water level were mirrored by significant increases in earthquakes per quarter (3 months) during the first 8 years of the dam's lifetime.

The reservoirs behind the Hoover Dam in the USA and Canada's Manic 3 have also induced local seismic activity, although earthquake incidents suspected to have been caused by other big dams, such as those at the *Kenya* Dam near Bombay in India, Egypt's Aswan High Dam, and at the *Kurobe* Dam on Honshu Island, Japan are unlikely to be due to reservoir-induced stresses.

The creation of new water bodies with large surface areas is thought by many to affect local climate. Tharth and Tarn (1990) suggest that Lake Volta has shifted the peak rainfall season in central Ghana from October to July/August, for example, but few monitoring programmes have proved such effects conclusively, to date. Changes in th local temperature regime have, however been observed at the 45,000 ha *Rybinsk* reservoir north of Moscow in Russia, where the frost-free period has been extended by 5-15 days per year on average in an area of influence that extends for 10 km around the reservoir's shoreline. Evaporation from reservoir surfaces may affect local humidity and the incidence of fog has been observed to rise in some areas.

ii) The upstream area

A variety of upstream impacts can be induced or, exacerbated by big dam projects. Some of these, hi turn, may impact the dam project itself. Notable in this respect is the improved access to previously remote areas. Deforestation in the watershed above the *Ambukloo* Dam in the Philippines has led to sedimentation of the reservoir, reducing its useful life from 60 years to 32 years (UNEP, 1989b). Conversely, afforestation of catchments above dams has been carried out in many areas specifically to limit sediment accumulaton in reservoirs. In the UK, for example, many water authorities have bought land in upper catchments to plant new forests.

Hi) The downstream area

Downstream of a reservoir, hydrological regime of a river is modified. Discharge, velocity, water quality and thermal characteristics are all affected leading to changes in geomorphology, flora and fauna, both on the river itself and in estuarine and marine environments.

The trapping of sediment behind dams leads to reduced loads in the river downstream. The resulting flow downstream of the dam is highly erosive, with degradation of the bed and banks observed 480 km below the dam at *Xiantao.*

Similar effects on the River Nile have been noted, downstream of the Aswan High Dam, and the lack of silt arriving at the Nile delta has had effects on coastal erosion,

salinisation through marine intrusion and a decline in the eastern Mediterranean sardine catch. Expected further changes due to these factors are also shown, To some extent the loss of fisheries off the Nile delta has been offset by a new fishing industry in Lake Nasseiv which has provided employment to 7,000 fishermen. Downstream changes in salinity due to construction of the *Cahora Bassa* Dam in Mozambique are also threatening mangrove forests at the mouth of the Zambezi. Mangroves provide the breeding grounds for prawn and shrimp, amajor source of foreign currency, but strategic water release from the dam could be used to offset the possible deleterious effects on shrimp and prawn catches. The absolute reduction in volumes of flow following dam construction also affects the ecology of downstream seas, as the example of the Black Sea illustrates well.

Dam can also affect marine and lake fish populations through the barrier they create which effectively cuts off access to spawning grounds. This effect has been evident on salmon and aloses in the River Garonne and its tributaries in southwestern France since the middle Ages. In the twentieth century, decline in the landed catches of Caspian Sea sturgeon, a source of caviar, from 40,000 tons early this century to just 11,000 tons in the 1970s, is attributable primarily to large hydroelectric dams on the Volga and the consequent loss of spawning grounds. However, catches had largely recovered to pre-dam levels in the 1980s with the establishment of new sturgeon farms on the Caspian shores.

2.4.1.4 Political Impacts of Big Dams

Increasing public awareness of the environmental and social implications of big dams has generated some heated debates in recent years, in some cases leading to the shelving of construction plans. The Nam *Choan* Dam.

Project in Thailand has been mentioned in this, respect. Another example is the Tasmanian Franklin River Project which was stopped on environmental grounds in 1983. India’s Narmada and Tehri Dams and the Chinese Three Gorges Project have also come under severe criticism over their anticipated impacts. In such cases, the obvious benefits of dam construction must be carefully weighed against the costs measured in environmental and social terms, and the potential impacts predicted and ameliorated by sensible planning. There is little doubt that many of the adverse impacts of dams can be reduced greatly by good planning and anticipation, and aid agencies that finance such projects now require an Environmental Impact Assessment before approval of funding is given. Progress has also been made in the widening scope given to consultation prior to dam construction. Nevertheless a sensible operating schedule is also a key factor - many of the problems caused by dams are the result of operators aiming to maximise water use, through releases for hydroelectricity generation and irrigation, for example, to such an extent that other concerns are given too little consideration.

The building of dams on rivers flowing through more than one country brings

international political considerations onto the agenda of big dam issues. Such considerations are particularly pertinent in dry land regions where rivers represent a high percentage of water availability to many countries. The main issues at stake here are those of water availability and quality.

In several international river basins, peaceful cooperation over the use of waters has been achieved through international agreement. One such agreement, between the USA and Mexico over use of the Rio Grande, was signed in 1944 and is operated by the International Boundary and Water Commission. This body ensures equal allocation of the annual averapv flow between the two countries.

In other international basins, such as the Tigris-Euphrates in the Middle East, the lack of agreement represents a significant potential for conflict While there is currently a water surplus hi this region, the scale of planned developments raises some concern. Turkey's Southeastern Anatolian Project, a regional development scheme on the headwaters of the two rivers, centres on twenty-two dams. In early 1990, when tilling of the Afamnt Dam reservoir commenced, stemming the flow of the Euphrates, immediate alarm was expressed by Syria and Iraq, despite the fact mat governments in both countries had been alerted and discharge before the cut-off had been enhanced in compensation. Syria and Iraq nearly went to war when Syria was filling its Euphrates Dam. Full development of the Southestern Anatolian Project could reduce the flow of the Euphrates by as much as 60 per cent, which could severely jeopardise Syrian and Iraqi agriculture downstream. The three Tigris-Euphrates riparian have tried to reach agreements over the water use from these two rivers, and the need for such an agreement is becoming ever more pressing.

2,4.2 Environmental Impacts of Urban-Industrial Expansion

2.4.2.1 Introduction

Large numbers of people have lived in close proximity to each other in cities for thousands of years. The first urban cultures began todevelop about 5,000 years ago in Egypt, Mesopotamia and India, but the size of cities and their geographical distribution expanded dramatically after the Industrial Revolution in the present millennium. The growth rates of cities in recent decades have been unprecedented. In 1970, four world cities had a population of more than 10 million people; by the year 2010 there will be mor than 30 such cities. While there were thirty-five cities of greater than 3 million people in 1970, by 2020 that total will cross 100 by which time 60 per cent of the world's population will be living in urban areas. Many cities in the developed world, such as New York and London, will have grown little in the last 30-50 years of the prsent century, but cities in the industrialising world show remarkable growth over the same period. Estimates indicate that the populations of Mexico City, Sao Paulo, Karachi and Seoul will have grown by

more than 800 per cent in the second half of the twentieth century.

The phenomenal growth of some cities, and the high concentrations of people they represent (the urban density of Mexico City in 1980 was 14 082 people/km^2), has created some acute environmental problems both outside and within the city limits.

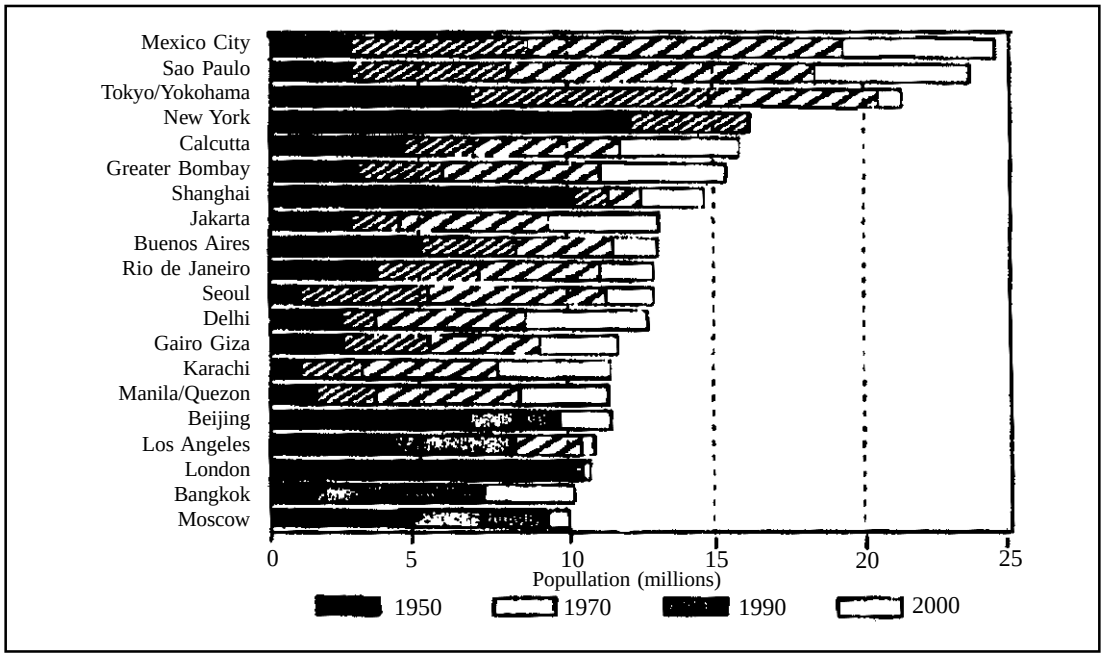


Fig. 1: Population growth pattern of 20 mega-cities in 1950,1970,1990 and 2000

(From *UN Report)*

2.4.2.2 Possible environmental problems with the Urban-industrial expansion

Cities represent a completely artificial environment; they absorb vast quantities of resources from surrounding areas and create high concentrations of wastes to be disposed of. The degree to which cities impinge on their hinterlands is indicated by a few examples. About 10 per cent of prime agricultural land has been lost to urbanisation in Egypt. The twentieth century growth of Sao Paulo was fuelled by the expansion of coffee plantations in south-east Brazil which reduced the forest cover of Sao Paulo State from 81 per cent in 1860 to 6 per cent in the late 1980s. The demand for water in Tehran spurred the construction of a series of dams and canals in the early decades of this century, to bring watr 50 km from the River Karaj to the west, reducing the watr available for rural agriculture. By the 1970s, supplies were again running low, so water was diverted more than 75 km from the River Lar to the north-east. In Rio de Janeiro's Guanabarra Bay, pollution from two oil refineries, two ports, 6000 industries, twelve shipyards, sixteen oil terminals, sewage and garbage dumps has reduced commercial

fishing by 90 per cent, mangrove cover by 90 per cent, led to outbreaks of water-borne diseases such as infectious hepatitis and typhoid, and is silting the bay by 81 cm/100 years.

The acute environmental problems that occur within many cities, particularly in the developing world, their underlying reasons, andihe scale of the clean-up task faced by urban authorities are well summarised hi the case of Manila Metro, capital of the Philippines. A 1990 population of 8 million rose to 13 million by the year 2000. All the city's rivers are biologically dead. Each day, 2000 tons of solid waste is left uncollected, to be burnt, thrown into waterways or moulder on the ground. Much of the garbage which is collected is dumped on 'Smokey Mountain', a 23-hectares open tip which represents a severe health hazard to the 20,000 people who reside oh its fringes and earn a living by scavenging from the dump. About 65 per cent of the country's 1,500 recognised industrial enterprises are locatedin the Manila Metro area, and only one-third to one-half of them are thought to comply with minimal air and water pollution emission standards. One million vehicles, more than half country's total, operate in the Manila Metro area. Just half of these vehicles are thought to meet even minimal emission standards. The annual cost to the economy due to congestion alone is estimated to be more than US$50 million, which is low by the standards of other Asian capitals, while the economic burden of air pollution may be an order of magnitude higher.

The basic cause of Manila Metro's severe environmental problems is that 8 million people are using infrastructure, much of which dates from the US colonial period, estimated to be adequate for about 2 million people, at most. A large proportion of the solid and liquid wastes are simply inaccessible for collection by virtually any means due to the density of squatter settlements, inappropriate collection systems and the simple lack of services such as septic tank dislodging. The problems of physical infrastructure are exacerbated by the government's inability to stop polluters, largely a function of serious understaffing at the metropolitan regulation agency (World Bank Report 1989).

2.4.2.3 Surface water resources

One of the most important environmental issues that stems from urban modifications to the hydrological cycle is that of poor water quality. Runoff from developing urban areas is usually choked with sediment during constructionphases, when soil surfaces are stripped of vegetation, and a finished urban zone greatly increases runoff due to widespread impermeable city surfaces of tarmac and concrete, and networks of storm drains and sewers. This drastically modified urban drainage network feeds large amounts of urban waste products into rivers and ultimately into oceans.

Many rivers that flow through urban areas are biologically dead. Hardoy *et.al* (1992-73) sum up the state of urban rivers in developing countries as follows: 'Most rivers in

Third World Cities are literally large open sewers'. They go on to point out that of India's 3,119 towns and cities, only 209 have partial sewage treatment facilities and just eight have full facilities. India's Jamuna Rivre, for example, contains 7,500 coliform organisms per 100 ml of water on entering New Delhi, a figure which rises to 24 million conform organisms per 100 ml after flowing through the city. For comparison, the WHO guidelines for such microbiological pollution are <10 coliform organisms per 100 ml for drinking water and <1000 per 100 ml for irrigation purposes. Industrial effluents combine with this domestic source of riverine pollution to make urban rivers the most polluted freshwater sources on Earth.

All the rivers flowing through Jakarta, Indonesia, are heavily polluted from numerous, mostly untreated, discharge sources: household drams and ditches, overflows and leaks from septic tanks, commercial buildings, and industries. Water-related diseases such as typhoid, diarrhoea and cholera increase in frequency downstream across th metropolitan are. Untreated sewage and discharge from 20000 classified water-polluting industries which feed into Bangkok's canal system have created a distinct sag in the dissolved oxygen profile of the Chao Phraya where the canals feed the river. Although the example of the Thames at London shows how such near-anaerobic river conditions can be improved, neither the money nor the political will are currently as forthcoming in Thailand.

The local hydrological impact of the Saudi capital, Riyadh, provides a very contrasting example to the depressing catalogue of river-incorporated disaster areas typically associated with large, rapidly growing cities. Discharge of Riyadh's wastewater feeds the Riyadh River, which scarcely existed 20 years ago, but now flows throughout the year down what was the seasonal Wadi Hanifa. The water, which is originally derivedfrom desalinated Gulf sea water, is partially treated before being released to flow down the steep-sided Wadi and enters open countryside, eventually disappearing 70 km from Riyadh. The new flow has created an attractive valley lined by tamarisk trees and phragmites which is becoming an important recreational site for Riyadh's 2.3 million populations. Beyond the Wadi, significant irrigated agriculture has grown up, drawing on the groundwatr around the river. This unique new feture is, however, under some threat from needs to further recycle the much-needed water resource.

Different types of environmental problems are encountered in permafrost areas where surface water and soil moisture is frozen for much, and in some places all, of the year. Frozen rivers and lakes mean that many of the uses such water bodies are commonly put to at more equable latitudes, such as sewage and other waste disposal, are not always available. The low temperatures characteristic of such regions also means mat biological degradation of wastes proceeds at much slower rates than those elsewhere. Hence, the impacts of pollution in permafrost areas tend to be more long-lasting than in other environments.

The nature of the permafrost environment also presents numerous environmental challenges to the construction and operation of settlements, challenges which have been encountered in urban developments associated with the exploitation of hydrocarbons and other resources in Alaska, northern Canada and northern Russia. Disturbance of the peimafosttrieniial equilibrium - irregular, hummocky ground. The heaving and subsidence caused can disrupt building foundations and damage pipelines, roads, rail tracks and airstrips. Terrain evaluation prior to development is now an important procedure in the development of these zones, following expensive past mistakes. Four main engineering responses to such problems have been developed: permafrost can be neglected, eliminated, preserved, or structures can be designed to take expected movements into account Preservation of the thermal equilibrium is achieved in numerous ways, such as by insulating the permafrost with vegetation mats or gravel blankets, and ventilating the underside of structures which generate heat (e.g. buildings and pipelines).

2.4.2.4 Ground Water

The water needs of urban population and industry is often supplemented by pumping from ground-water, and pollution of this source is another problem of increasing concern in many large cities. Seepage from the improper use and disposal of heavy metals, synthetic chemicals and other hazardous wastes such as sewage is a principal origin of groundwater pollution. The quantity of such compounds reaching groundwater from waste dumps in Latin America, for example, is thought to be doubling every 15 years (World Bank Report). Aquifers do not have the self-cleansing capacity of rivers and, once polluted, are difficult and costly to clean.

A frequent outcome of overusing groundwater is a lowering of water-table levels and consequent ground subsidence. In Mexico City, use of subterranean aquifers for rpore than 100 years has caused subsidence of up to 9 m in some central areas (Schteingart, 1989), greatly increasing the flood hazard in the city and threatening the stability of some older buildings, notably the sixteenth century cathedral.

Marked subsidence episodes in Tokyo have mirroDed phases of economic find industrial growth. The Tokyo Metropolitan Government suggests mat ground subsidence began in the city as economic activity grew after the First World War and came toa halt for some years in other coastal cities; depletion of aquifers has created problems of seawatar intrusion. Over pumping of groundwater hi the Tel Aviv urban area depleted groundwater levels to below sea level over an area of 60 km2 in the 1950s, requiring a programme of feeriwater injection along a line of wells parallel to the coast in an attempt to redress the saltwater/freshwater balance. The programme was successful, effectively stabilishing the aquifer and preventing saltwater intrusion.

A similar pattern of events occurred in Brooklyn, New York City, although here no attempt was made to prevent seawater intrusion. By 1947, pumping of the increasingly saline groundwater had ceased and all freshwater supplies were provided by surface sources. Cessation of pumping gradually allowed the water table, which had been reduced to about 1 1m below sea level, to rise again. During the half century of pumping however, deep basements, building foundations and subways had been sunk, and these were subject to flooding as die groundwater levels rose, necessitating expensive remedial measures.

Rising groundwater levels have become a critical problem for many ‘post-industrial* cities as manufacturing industries have given way to service industries which are much less demanding of watr, and legislation has been introduced to control subsidence problems. In London, where loss of water from aged pipes is an additional reason for groundwater levels rising, the period of change from a generally failing to a rising water table occurred in die late 1970s. The potential effects upon the fabric of London’s urban environment are now being assessed, with particular interest being shown by the insurance industry. A report issued by the Construction Industry Research and Information Association estimated that the cost of puming to maintain groundwater levels below the level at which serious damage would occur was up to 30 million.

The rising groundwater problem has ateo been reported from many Middle Eastern cities where rainfall is commonly low, potential evaporation high, and natural recharge small and sporadic. Inadvertent artificial recharge from leaking potable supplies, sewerage systems and irrigation schemes has caused widespread and costly damage to structures and services and represents a significant hazard to public health.

2.4.2.5 The urban atmosphere

Urban areas have a diverse catalogue of effects on local elements of climate which are well documented *(e.g.* Landsberg, 1981), but the most serious environmental issue pertaining to the urban atmosphere is that of quality. The principal sources of air pollution in urban areas are derived from the combustion of fossil fuels for domestic heating, for power generation, in motor vehicles, in industrial processes and in the disposal of solid wastes incineration. These sources emit variety pllutants the most common of which have long been sulphur dioxide (SO_2), oxides of nitrogen (NO and NO_2, collectively known as NQ_x), carbon monoxide (CO), suspended ‘articulate matter (SPM) and lead (P_b). Ozone (O_3), another ‘traditional’ air pollutant assoited with urban areas and the main constituent of photochemical smog, is not emitted directly by combustion, but is formed photochemically in the lower atmosphere from NO_X and volatile organic compounds (VOCs) in the presence of sunlight Sources of the VOCs include road traffic the production and use of organic chemicals such as solvents and the use of oil and natural gas.

These atmospheric pollutants affect human health, directly through inhalation, and

indirectly through such exposure routes as drinking water and food contamination. Most traditional air pollutants directly affect respiratory and cardiovascular systems. For example, CO has a high affinity for haemoglobin and is able to displace oxygen in the blood, leading to cardiovascular and neurobehavioural effects. High levels of SO2 and SPM have been associated with increased mortality, morbidity and impaired pulmonary function, and O_3 is known to affect the respiratory system and irritate the eyes, nose and throat andto cause headaches. Certain sectors of the population are often at greater risk: the young, the elderly and those weakened by other debilitating ailments, including poor nutrition.

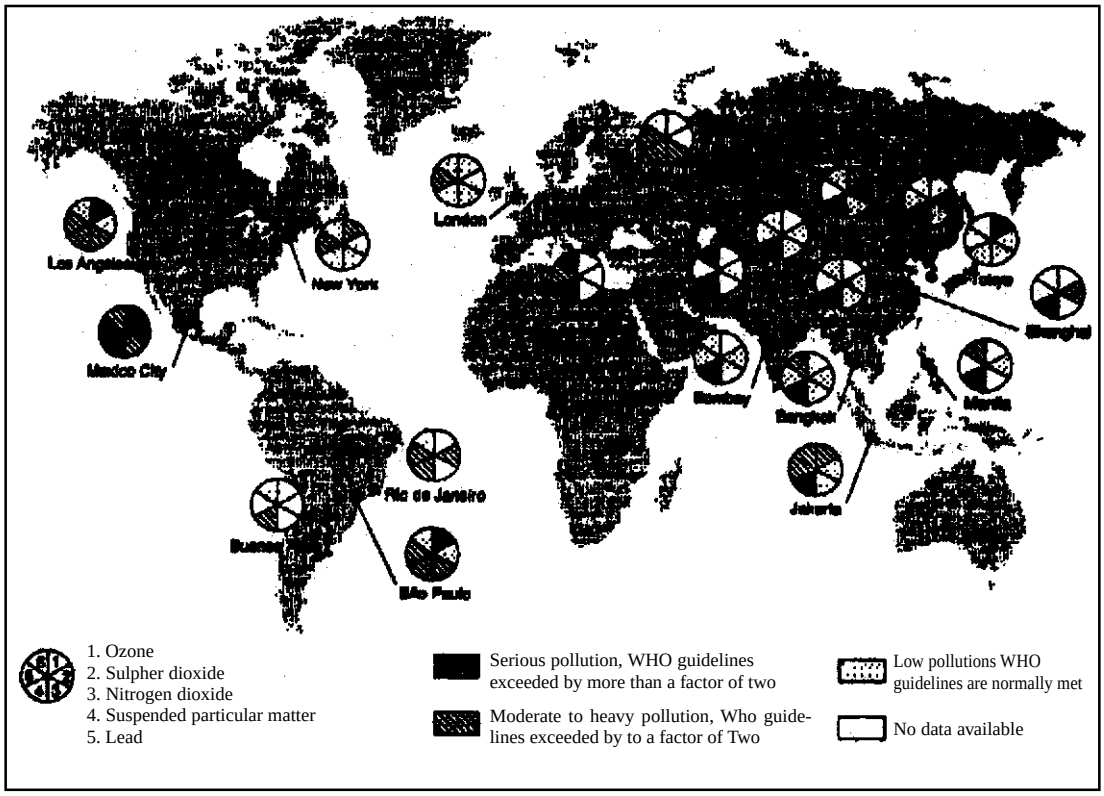
Elements of the natural and build environment can also be adversely affected Sulphur and nitrogen oxides are principal precursors of acid deposition (see Chapter 9), SO_2, NO_2 and O_3 are phototoxic - O_3, in particular, has been implicated in damage to crops and forests and damage to buildings, works of art and materials such as nylon and rubber have been attributed to SO_2 and O_3.

In more recent times, these traditional urban air pollutants have been supplemented by a large number of other toxic and carcinogenic chemicals which are increasingly being detected in the atmospheres of major cities. They include heavy metals (e.g. beryllium, cadmium and mercury), trace organics *(e.g.* benzene, formaldehyde and vinylchloride), radionuclides (e.g. radon) and fibres *(e.g.* asbestos). The sources of these pollutants are diverse, including waste incinerators, sewage treatment plants, manufacturing processes, building materials and motor vehicles. Concentrations of these chemicals are generally low, where they are measured, but this occurs at few sites to date.

Few long-term air quality monitoring programmes have been implemented in cities, and runs of available data are often characterised by changes in the location of sample stations, but data from the former Soviet Union indicate that urban areas with high concentrations of heavy industry using outdated technology have had a ‘calamitous* effect on air quality (Shahgedanova and Burt, 1994). Some of the commonest pollutants present in excessive concentrations are highly toxic: benzopyrene, a carcinogenic coal-tar by-product, phenol and formaldehyde.

However, it seems unlikely that the acute air pollution problems of these urban areas” will receive much attention as long as financial resources are limited and more pressing national problems such as housing and food supply continue to head government priorities.

Monitoring of urban air quality has been undertaken at a global network of mega-cities by-UNEP and the WHO since 1974. Available data indicate that while cities in the industrialised countries have made significant reductions in air pollution during the past four decades, rapidlygrowing urban areas in the industrialising countries pose serious threats to the millions of people who live in them. The clear distinction in urban air quality between rich and poor countries is indicated in Figure below.



Figure—2 : Air quality in 20 world mega-cities (WHO 1992)

Mexico City emerges as the worst affected city, with WHO guidelines exceeded by a factor of two or morefor levels of SO2 (see Fig. 14.4), SPM, CO and O_3. Levels of P_b and NO_2 are almost as bad, exceeding WHO limits by up to two times. The city's poor air quality is exacerbated by location, in an elevated mountain-rimmed basin where temperature inversions occur on average 20 days per month from November to March, which impairs dispersion of pollutants. Although data are sparse, no particular trends in the ,sjx pollutants monitored are discernible in Mexico City, despite the city's rapid growth. This can be attributed to use of cleaner fuels, better emission control, replacement of old industries, and technological improvements (Reports - UNEP/WHO, 1992). Older taxis, for example, are being replaced with newer models equipped with catalytic converters.

Not all efforts to control air pollution in the city hav been successes however. Concern over rising atmospheric P_b levels, which averaged 8 gm^3 in 1986 (five times the national standard), resulted in the national oil company reducing the lead content of gasoline sold in the city in September of that year. An unexpected side-effect was a dramatic increase in ozone concentrations, a result of the reaction between atmospheric oxygen and the replacement gasoline additivs in ultraviolet sunlight.

The severe pollution conditions observed at several mega cities could have been much worse if control measures had not already been introduced. Examples include Beijing, Delhi, Seoul and Shanghai, and the need for such measures is well illustrated at Shanghai where the male lung cancer mortality rate has doubled from twenty-one to forty-four per 100 000 men from 1963 to 1985.

The beneficial effects of tighter legislativ controls on air quality are indicated by London's annual mean SO concentrations, which have fallen from 300 - 400 g/m^3 in the mid 1960s to around 20 - 30 g/m^3 in the late 1980s. The introduction and enforcement of 'Smoke Control Orders' under the 1956 clean Air Act (amended in 1964 and 1968), a response to the infamous London smog of the 1950s, is the most important factor responsible for this steady 30-year fell in ambient concentrations. Similar successes have been recorded for most of the six pollutants measured in Los Angeles, New York and Tokyo, although Los Angeles still has the most serious O3 problem in the USA. Pollution rises with initial industrial development, to be brought under control through legislation on emissions. Air quality then stabilises and improves as development proceeds, to be reduced to below acceptable standards by high technology applications.

2.4.2.6 Garbage

The rapid, and often unauthorised, growth of urban areas has in many cases outpaced the ability of urban authorities to provide adequate facilities, such as the collection of household garbage. Many other urban areas similarly afflicted are not included due to lack of adequate information. Although the environmental problems associated with garbage do not disappear with its collection uncollected garbage exacerbates many of the environmental hazards covered in this chapter. It can be a serious fire hazard; it attracts pests and disease vectors, creating health hazards; and local disposal by burning or dumping adds to pollution loads and clogs waterways, so increasing the dangers of flooding. Several animal species, particularly rats, have become adapted to the urban environment by scavenging from urban refuse. Larger species, too, have been drawn to garbage bins and dumps, and are also regarded as pests, such as the urban foxes which inhabit many British cities and polar bears in Churchill, Manitoba, northern Canada. In Uganda's capital city Kampala, carnivorous Marabou storks roam about in the streets like normal citizens, living off garbage and doing a useful job in controlling smaller pests.

Some degree of waste recovery occurs in most cities. In many cities of the ceveloping countries, large numbers of residents are self-employed in the business of garbage recycling. Mexico City and Cairo are just two exampls where large squattr communities live and work on official or unofficial rubbish dump sites. In the case of Cairo, the Zabbaleari religious sect has cornered the market in garbage collection, scavenging and recycling, feeding edible portions to their domestic livestock and selling inorganic materials to dealers.

Elsewhere, metropolitan authorities run similar programmes. In Beijing, for example, a state-run recycling scheme has been in operation since the 1950s, and in New York City, Local Law 19, brought into force in 1989, requires all residents, institutions and businesses to separate a variety of materials for collection and recycling.

2.4.2.7 Hazards and Catastrophes

The high concentrations of people and physical infrastructure in cities make them distinctive in several ways with regard to hazards. Where money is available, cities are worth protecting because of the large financial and human investment they represent. Adequate provisions of water supply and sanitation are designed to offset the risks of disease, and other infrastructure, such as expensive flood protection schemes, protects against geophysical hazards.

In developing countries, where escalating urban growth rates and a lack of finance make such provisions inadequate, it is usually the poorest sectors of urban society that are most at risk from environmental hazards. Rapid urban growth and rising land prices have used up the most desirable and safest sites in most Third World cities, leaving increasingly hazard-prone land for poorer groups. Such hazards include the pervasive dangers of high pollution levels and the intensive dangers of industrial accidents. The accidental discharge from a pesticide production plant in Bhopal, northern India in 1984, for example, killed more than 3,000 shanty-town dwellers. It was primarily caused by inadequate management and lax safety procedures.

High concentrations of poor housing are built on slopes on hillsides prone to sliding (e.g. Caracas), or in deep ravines (e.g. Guatemala City); on river banks susceptible to flooding (e.g. Delhi), and on low-lying coastlines prone to marine inundation (e.g. Rio de Janeiro). Even the destruction caused by citywide hazards, such as earthquakes, can be magnified in these unstable sites: in Guatemala, 65 per cent of deaths in the capital caused by the 1976 earthquake occurred in the badly eroded ravines around the city.

In other situations, however, the damage and loss of life caused by earthquakes can be greatest in more built-up parts of the urban environment, when buildings themselves become hazardous if they are not constructed to withstand earth tremors. The widespread failure of relatively new constructions in urban areas of Armenia in the 1988 earthquake echoed the experiences of Mexico Cityin 1985. Seemingly, more sophisticated technology able to withstand tremors had not been incorporated into new buildings for reasons of cost Failure of urban infrastructure following earthquakes is one of the commonest causes of damage and loss of life. The most serious earthquake disaster in the USA, in San Francisco in 1906, was largely a function of infrastructural failure. Disruption of gas distribution and service lines caused the outbreak of many fires and interrupted water distribution, so making it difficult to put the fires out.

The most critical environmental problems faced in urban areas of the developing world, however, stem from the disease hazards caused by a lack of adequate drinking waer and sanitation. In 1990, at least 170 million people in urban areas worldwide lacked a source of potable water near their homes and 375 million did not have adequate sanitation (World Bank, Report in 1992).

Water-borne diseases (e.g. diarrhoea, dysentry, cholera and guinea worm), water-hygiene diseases (e.g. typhoid and trachoma) and water-habitat diseases (e.g. malaria and schistosomiasis) both kill directly and debilitate sufferers to the extent that they die from other causes. Again, it is the less-well-off sectors of urban society that are most at risk. The effect of improvements to water supply and wastewajer disposal on life expectancy have been clearly shown in the industrial countries, when services wee improved during the nineteenth and twentieth centuries, The trend shown for three major French cities is typical in this respect, with life expectancy increasing from about 32 years in 1850 to about 45 years in 1900, with the timing.

2.4.3 Model Questions

1) Make a discussion on the significant environmental impacts of the big dams.
2) Discuss the ways in which the big dams can be beneficial as well as detrimental for the natural and human environments.
3) Discuss the main problems with the big dams and their impacts upon the environments of the upstream and downstream areas of a river basin.
4) What do you consider the political impacts of the big dams?
5) Assess the major environmental problems that normally occur due to urban-industrial expansion.
6) Discuss the possible environmental hazards created by the urban expansion with particular reference to surface water resources, ground water and atmosphere.
7) Discuss with examples the problems of urban-industrial expansion that associate the problems of atmosphere and garbage.

2A4 Select Readings

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NETAJI SUBHAS OPEN UNIVERSITY

STUDY MATERIAL

POST GRADUATE GEOGRAPHY

PAPER – 7

GROUP : B

REGIONAL PLANNING AND DEVELOPMENT

PREFACE

In the curricular structure introduced by this University for students of Post-Graduate degree programme, the opportunity to pursue Post-Graduate course in any subject introduced by this University is equally available to all learners. Instead of being guided by any presumption about ability level, it would perhaps stand to reason if receptivity of a learner is judged in the course of the learning process. That would be entirely in keeping with the objectives of open education which does not believe in artificial differentiation.

Keeping this in view, the study materials of the Post-Graduate level in different subjects are being prepared on the basis of a well laid-out syllabus. The course structure combines the best elements in the approved syllabi of Central and State Universities in respective subjects. It has been so designed as to be upgradable with the addition of new information as well as results of fresh thinking and analysis.

The accepted methodology of distance education has been followed in the preparation of these study materials. Co-operation in every form of experienced scholars is indispensable for a work of this kind. We, therefore, owe an enormous debt of gratitude to everyone whose tireless efforts went into the writing, editing and devising of a proper lay-out of the materials. Practically speaking, their role amounts to an involvement in 'invisible teaching'. For, whoever makes use of these study materials would virtually derive the benefit of learning under their collective care without each being seen by the other.

The more a learner would seriously pursue these study materials, the easier it will be for him or her to reach out to larger horizons of a subject. Care has also been taken to make the language lucid and presentation attractive so that they may be rated as quality self-learning materials. If anything remains still obscure or difficult to follow, arrangements are there to come to terms with them through the counselling sessions regularly available at the network of study centres set up by the University.

Needless to add, a great deal of these efforts is still experimental—in fact, pioneering in certain areas. Naturally, there is every possibility of some lapse or deficiency here and there. However, these do admit of rectification and further improvement in due course. On the whole, therefore, these study materials are expected to evoke wider appreciation the more they receive serious attention of all concerned.

Professor (Dr.) Manimala Das
Vice-Chancellor

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POST GRADUATE GEOGRAPHY
[M.Sc.]

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PGGR-7	:	B

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NETAJI SUBHAS OPEN UNIVERSITY

PGGR 7
Regional Planning and Development

Group B

Unit 1 ❐ Concept of Regional Planning

Structure :

1.1 Introduction, Concepts and Paradigms

The efficient and planned utilisation of natural resources (physical and material) and human resources (social, cultural, economic, financial and institutional) for the welfare of the people forms the core of development planning. The basic objectives of such development planning are to create opportunity for jobs and living of the people. The whole planning process is a rational decision making process with regard to such development. The decision making process and designing a course of action for resource utilisation to achieve above stated objectives, involves a rational inventory of all kinds of resources, analysis of the existing situation, direction for the preparation of a plan and implementation, monitoring, evaluation and feed back experience of such plans, etc. Based on the analysis of the present status and of the situation, the planning problems are identified first. The problem solving strategics are formulated and employed to begin with.

The planning process is not an end in itself but a means to attain the stated objectives; it unfolds the needed course of action. A series of decisions are to be taken so as to tackle any contingency that may arise in the plan implementation stages, to make it futuristic and to realise the goals to be are dynamic in nature achieved. The goals and objectives of the society will change depending upon the action taken in the plan implementation and execution.

The concept of development planning derives its essence from the activities augmented, and the investment made to generate and initiate such activities for gainful employment of the people. The desired economic structure has to be conceived

and provisions for social and community infrastructure have to be made to integrate all activities for the maximum social welfare. Thus, planning is defined as a way of thinking, arriving at rational decisions and designing a course of action needed to solve the social, economic and physical problems encountered by the people. It aims at achieving goals and objectives set by the people. The planners are not decision makers but they help the authorities/government under democratic set, up to take rightful decisions. The planning is a process to order the development works and help the authority to bring about deliberate social and economic change in the social space be it rural, urban or regional. Economic growth is the precondition to such changes. For economic growth and social justice requires investments, technological inputs and very many factors of development. In early stages of development, inequality in per capita income, spatial disparity more concentration of wealth in the hands of a few takes place. And only a selected number of beneficiaries are benefitted. There has to be inbuilt distributive justice in the development process that involves strategic planning to achieve balanced regional development. In other words, the goals should be "equity with growth or vice versa," and not, growth first and, distribution later. Of course, "equity without growth" is sharing poverty only. "Growth with social justice" has been a philosophy of Indian economic planning process.

1.2 Concept of Regions

Regions have been defined by the scholars to serve the purpose for which they are identified. So, all kinds/types of regions are purposeful to carry out the exercise so as to identify the spatial dimension of the objects of study. Geographers have defined a region in terms of spatial pattern of geographical factors and their role in characterising the physical space. The geographic regions are of two types: (i) homogeneous, uniform or formal regions, and (ii) functional or nodal regions. Economic regions are defined in terms of spatial and functional interaction of economic activities. Unlike geographic regions, economic regions need not be spatially contiguous where concept of space is absent. Physical regions in most cases are geographically homogeneous, where homogeneity is achieved by spatial integration of elements i.e. physiography, soil, climate, vegetation flora and fauna including various natural resources. Social regions evolve through time and space by achieving social cohesiveness and cultural climax and are defined by social or community structure.

While we try to conceive cultural homogeneity; cosmopolitan, cross cultural and regions of diverse culture in a spatial frame are also considered where in the distinctiveness of a particular culture or sectoral (sects) group is not important but the totality or unity in diversity is the definitive criterion. This type of complex cultural/ social regions are framed with a long social history; the regions evolve through a long social history and such regions are stabilised in the spirit of social ecology. The best example is the Indian society.

The Planning Regions are problem solving, purposeful and goal oriented areas specially designed to plan for development purposes. Such regions vary in size from multinational to local areas. They could be categorised into macro, meso and micro regions within the spatial structure of a country. A country could be sub-divided into planning regions depending upon the objectives at hand. These regions are delineated by employing various methods mainly with the intention of considering the regional variation for developing them. The spatial variations are observed in economic, social, cultural, and natural resource endowments and according to levels of development. They may be hierarchical in nature in the framework of spatial system or cutting up the country into distinctive characteristics.

Regional Development Planning is carried out at sub-national level with the objectives of implementing the national plans carried out at regional level i.e. spatial dimension of national plans, where-in different sectors' activities are carried out on regional basis. Regional planning is carried out with the objective of developing its natural resources in respect of their prospects and potentiality and the advantages prevailing in the area. While such regional plans aim at the fulfilment of the regional aspirations and goals, they also contribute to the national economic goals and objectives as building blocks to the national plans.

The regional planning units may be the largest sub-national administrative units/ Union Territories namely states, provinces, districts, or groups of districts or even lower order areas. Some of the resource regions such as river valley regions, or refugee resettlement areas, or canal irrigated areas or some other problem areas are identified as planning regions for specific or for multi-purpose planning.

These regions are given, their structure need to be analysed and proper planning and executive authority organised to carry out the formulation, implementation, monitoring and evaluation of the development plans. There are a number of examples

of such regions and regional development authorities organised for the purpose of planning and development. Planning to be effective and fruitful, the exercise need to be carried out within the legislative and administrative organisation of the country. If such organisational structure becomes highly bureaucratic and cumbersome, adhoc or development authorities could be created to by-pass the long chain of bureaucratic administration to derive quick benefits wherever the problem is urgent and call for immediate attention. In recent times, to cut short the long administration and centralised planning and plan administration, even the decision making processes are decentralised with authoritative power. This recent trend of decentralised planning has been a much needed strategy in development planning process. Hence, in the line of decentralised structure of government the need is for decentralised planning and decision making process in a hierarchical manner.

1.3 Rural-Urban Regional Development Planning

Professional physical planners distinguish two types of settlement planning -city planning and regional planning or town and country planning. The city or town planning deals with the location of economic activities and organisation of space for different uses at settlement level where as regional planning deals with resource development for productive use, location of economic activities in regional space for income and employment generation in rural regions and organise needed social and economic infrastructure, develop linkage system to integrate them — termed as spatial or country planning. Rural development planning as an integral part of spatial/regional planning deals with the problems of rural people as well as to develop rural-urban interrelationship. There are two approaches to rural regional planning - resource development oriented and rural problem oriented. The first approach requires correct inventory of resources so as to ascertain the types of activities that could be organised with the basic objectives of providing reasonable per capita income and gainful employment. The second approach is aimed at immediate solution to the problems such as rural-urban poverty and to design a best feasible solution where there is resource scarcity and to tide over the crisis.

Problem oriented planning has to follow the undermentioned steps:

- ❒ Identification of social, economic and physical planning problems and their spatial coverage,

- ❒ Devising needed strategy for resolving such problems,
- ❒ Identify the projects, schemes and policy relevant to such planning problems,
- ❒ Estimation of cost involved in solving such problems and make a feasibility study with benefit-cost analysis,
- ❒ Set the targets to be achieved in a time frame,
- ❒ Identify priority areas within the overall objectives,
- ❒ Phasing of the plan implementation with plan administration machinery,
- ❒ Budgeting and financing the projects along with the identification of the funding authorities and their commitments,
- ❒ Simultaneous evaluation with the implementation of the schemes, monitoring concurrently and adjusting the schemes as needed,
- ❒ Examine the final results and impact study with feed back experience.

Planning at any level pre-supposes a set of objectives to be achieved within a specific period and resources to be allocated to the best possible manner for that purpose. Such objectives are defined by the planners for the society to decide upon their acceptance. This is the social responsibility of the planners. Planners' commitments to prepare acceptable plans must be supported by ihe political will of the decision makers (government) speedy implementation, and allocation of resources needed. Otherwise plans will fail to deliver the goods and serve the people's aspirations; with the planners and the decision makers blaming each other for the failure. While beneficiaries i.e. the people at large and the target groups if any, as such would remain, outside the purview of the planning process and wait at the receiving end who have not, been involved at any stage of plan making.

People's participation in the planning process has been talked about by the planners and but exact nature of their involvement has not been explicit.

1.4 Typology of Plans

The crystalised thinking of planning process is put to prepare a plan. A Development Plan is a perspective plan which defines broad long term objectives to be achieved in 15 to 20 years time frame where goals are not clearly defined or spelt

out. A structure plan may be prepared within the perspective plan giving clarity to the goals and a detail working procedure is evolved to effectuate the plan. The details of the plan are worked out along with the implementation procedure.

The five year or annual economic plans have specified time frame within which certain targets (physical) are to be achieved.

These plans are sectoral in nature but spatial only in directives. These macro level national plans are highly centralised in nature where in the state/regional plans or sectoral plans of each ministry of the Govt. are worked out within the frame of national plans. The national plan in a way is supposed to be aggregative of states, or/ and national sectoral plans but in fact the national plan is disaggregated into such components. It is expected that these sectoral plans will have trickle down effect on the local and area level beneficiaries but in reality it does not happen. The centralised plans are comprehensive in nature and deal with the investments on production, consumption and services and account for saving, capital formation and balance of payment at the national aggregate level. These plans give us the overall and sectoral growth rates of per capita income and employment generation and quality of life to be achieved, etc. Regional and local level plans have specific spatial dimension and may be aggregation of interrelated projects. A project comprises of a set of activities to achieve a specific objective(s) within a given time frame. "A perspective plan" to be precise is a plan that is binding on the persons for whom it is intended". Some sort of compulsions are imposed on the targets and implementation. An Indicative plan contains a set of targets to be achieved hopefully where Govt. does not impose any force on the implementation. An advocative plan suggests a certain line of action to achieve specified objectives based on resource utilisation. The spatial plans are prepared to achieve specific objectives at area level such as land use plan (rural or urban), town plan, highway plan, rural economic development plans. The allocative plans are those which merely allocate the available resources among the competing demands on some agreed formula or on set priorities.

Every plan has a life span or cycle from formulation to implementation but life cycles may not complete and plans need to be reformulated if necessity arises when things do go wrong or formidable constraints emerge say foreign exchange crisis, or incidence of international conflicts or natural calamities/disasters. Implementation of a plan inclusive of phasing, programme scheduling of projects, coordination and

integration of projects and programmes and identification of task and activities, monitoring and concurrent evaluation of on going schemes or at the final stage, may necessitate to change the course of action because of disadvantageous consequences resulted from the projects under implementation.

Regional economies being open-ended and dependent on the national economies, economic and social planning at the regional or sub-national level are to be worked out, within the overall frame of national development plans.

1.5 Resource Planning and Development

Resource Planning is a rational inventory for its efficient utilisation for the well being of the human society. Management relates to minimization of waste in production and consumption, conservation of valuable resources, and preservation for future use by discovering substitution replacing the nonrenewables by the renewable resources. Productive power of natural, human and man made resources, are to be maintained and developed through positive control and direction.

Exploitation of natural resources leads to economic development where as its over-exploitation leads to exhaustion, ecological imbalances and environmental degeneration.

The natural resource endowment is a dynamic concept and the resource potential of a region could be enhanced by its development and or discovery of new ones. Up till now more importance is given to the conservation and management of resources because of its scarcity in supply and its non-replaceability but the renewable resources need also serious attention. A sustainable path of development is to be designed through continuous regeneration of renewable resources to remove income disparity between and within the regions.

1.5.1 Regonal Economic Growth: The Conceptual Framework

The regional economic growth takes places at the impact of two types of forces——one those relate to the growth impulses generated from inside and the other those exogenously set from outside, although there is no discernable dichotomy in them. As a matter of fact both the forces are complementary to each other and could be distinguished only in terms of their relative role in regional development.

Regional development as an integral part of national economic development has an objective of long term improvements in the welfare of the people to achieve equity in the share of national wealth. Such equity is viewed in the perspective of balanced regional development. Growth has a, tendency to occur at certain centres/areas favoured initially with various types of economies such as economies of scale, external economies, initial leadership, comparative advantages in terms of resource endowments, etc. Such growth overtime gets polarised and agglomerated creating regional disparity in the levels of development. Of course theoretically speaking such growth would be supported by "trickle down" process or "spread effect" to ultimately achieve balanced development given unlimited time frame. But no region would have time to wait for such an uncertain long time nor would it work in a systematic way. The regions thus developed, go on developing and those lagging behind would suffer in the long run unless some deliberate action is taken to reduce the development gaps between the "advanced" and the "lagging" regions.

E.M. Hoover, and Joseph Fisher have observed that a region grows in sequence of development stages. To start with, a region may be having a, self-sufficient subsistence type of economy and the population is distributed according to the distribution of natural resources. With the development of economic infrastructure and transport network, the region produces surplus in some products to trade with the neighbouring regions and starts specialising in some products say. agriculture or extractive industries. Multiplier effect generated from such regional surplus product from inter-regional trade would raise income and employment level of the people. Such development would lead to diversification of the economy and specialisation in some product leading to higher level of economic development followed by the reorganization of population distribution and urbanization by rural-urban migration and industrialization. In this process of regional economic development, the transport and energy resources play a vital role and resource potential gets enhanced leading to continuous development.

Similarly, to explain the mechanism of regional growth, North, D.C. has developed the theory of Economic Base. It states that by exporting natural resources surplus is being created. The effect is to increase the propensity to import as well as some inflationary pressure pushing the wages higher and creating employment opportunity for the new migrants. Increased import will stimulate new activities in the field of import substitution. Thus cumulative process sets in with, new enterprise and new

class of industries will be attracted. Such industries if diversify the export -basket, the regional growth will be continuous. However, there might be some problems in case the resource endowment gets exhausted or there is a sudden change in the demand structure of natural resources, or if the socio-political condition of the region is not conducive to the establishment of new activities. In that case, the region may slump back into stagnation.

W.W. Rostow has developed the Stages of Growth Theory in similar line. He has propounded that a region grows in sequential stages from a subsistence economy to a more advanced or matured one based on the product diversification and specialisation.

According to him a region passes through the following stages:

Traditional Stage: A region having untapped resource potential and with little external trade will have a subsistence economy. The region produces as much as it needs or in other words, the level of demand is determined by the availability of regional produce.

Transitional Stage: The subsistence economy drives way to the extractive or processing economy with the growth of transport network and opening up the region to external trade. The region with its comparative resource-advantage or surplus generated from such extractive economy enters into inter-regional trade with some export possibility.

Take-off stage: The growth of the primary sector and trade benefit would shift the secondary and tertiary activities of processing type supported by the external economies and transport and other infrastructural development to product specialization. Once the regional economy takes off, it would lead to the next stage of development.

Drive to Maturity: Diversification of regional economy with balanced sectoral development between the primary, secondary and tertiary sectors would lead to highly specialized activities.

The Stage of Mass Consumption: The specialization and diversification work hand in hand leading to tertiary sector expansion. This stagial growth process is being supported by the division of labour, diversification of the employment market and urbanization coupled with the migration of people. The location factors such as transport cost, availability of power, etc. would create industrial clusters and territorial

production-cum-urban complexes. In spite of many limitations to the above mentioned mechanistic growth theories, the generality is observed in the growth process and is far from spontaneous. The growth need to be guided with the introduction of technological innovations, entreprcneurship development, capital investment; and above all the regional socio-political structure should support such growth.

What is the prime mover in the regional growth process is the resource endowment and how such endowment is being utilized by the people for sustaining the development. Misuse of resources, or wasteful utilization may exhaust the resource base or the development gets delinked from the resource structure. Under such circumstances there is a need to make correct inventory of resources, utilise them most efficiently and minimise waste. If the natural resources are exhaustible and irreplaceable, substitutions should be discovered to conserve the valuable resources for future need.

1.5.2 Resource Structure and Pattern of Development in India

From the theoretical construct stated above let us turn to the Indian situation. It has been observed in India that regional development has taken place based on the resource endowment. Some regions have developed to some extent, while many of the regions are still lagging behind.

A number of studies have been made on economic development in India but those studies have not analysed the linkages of the development with the resource base. Patterns of regional development emerged during the latter half of the last century of planned development are of unequal or imbalance nature and are the results of national policy directions towards resource utilisation to raise national income with particular emphasis on increasing production, employment generation and removal of poverty. Although the reduction of inequalities in income and wealth and more even distribution of economic power were the main corollary to national development policies, economic disparity accentuated. Social content of Indian economic planning being weak, the majority of the people remained deprived of the fruits of development and glaring regional disparity resulted.

If the development has to be rooted in the resource base, there is no other alternative except to adopt regional approach to national development. In India there is a network system of inter-connected elements of regional frame evolved through multi-level planning. This territorial system includes the villages as planning units at

the bottom to C.D. Blocks/Taluks, to districts, state, interstate and urban/metropolitan regions ultimately integrating the space economy to the national planning for economic development at the hierarchical framework. These administrative units have been used to regionalisation and to identify various types of regions. On the other hand, the regional planners have identified planning regions on the basis of levels of development and planning problems—such as dynamic, prospective, problematic and even frontier regions. Besides, regions with specific problems such as socially and economically backward regions i.e. tribal regions, hilly regions, etc. have also been identified; The regions based on resource endowment are also identified such regions are resource specific and location of such resources are space bound. Resource exploitation and management of development should be carried out through spatial planning approach. The human activity pattern should be integrated with the structure of natural resources and then only the development will be endogenous and self-sustaining.

In 1962s, the Regional Survey Unit of the Indian Statistical Institute prepared a tentative regional framework for resource development based on synthesis and analysis of physical resource complexes, cropping pattern, mineral wealth and urban-industrial development. In Indian regional planning, many adhoc regions were also formulated such as S.E. Resource Regions, Dandakaranya Region, Damodar-Valley Region etc. based on natural resource potential, but no actual plan for development was prepared or implemented. The resource regions thus identified had industrial raw-material and potential for power resource development. In other words, the regional development cannot succeed without the planned utilisation of the natural resources.

Some of the resource rich regions of India such as the Central India. N.E. or The Foot Hills of Himalayas are quite backward. The backwardness is the result of cumulative process of under-development where neither the regional economy nor the society are geared to development. The effects become the cause and there is no other way out except a drastic intervention with a "big push" to the regional economy with heavy capital investment. The absorbing capacity of such investment is low, infrastructure is poor, initial constraints to development are formidable but real thrust has to be given to the resource development and exploitation to break away from the backwardness. It is paradoxical that the backward areas being endowed with rich resource potential could not be developed where under-development is increasing

thus stalling the development process. Rosanstein-Rodan's concept of "Big Push" theory need to be applied; otherwise as the backward regions are left to themselves to the evolutionary development process, the backwardness itself will stand on its way to development.

Many planners have opined that the lack of infrastructure is the stumbling block to the development of backward areas but if infrastructure is developed without the planning for the structure of economic development which would require such infrastructure, it will strengthen its backwardness rather than energise the regional economy. The development must be ingrained in the resource base.

The "Resource Endowment is continuously redefined by changes in national (final and intermediate) demand, production technology and economic organization. The relative growth of a region is directly related to its relative advantages in the production of goods and services for the national market. They may result, from resource endowment on the one hand, or from a favourable degree of access to the national markets on the other—more generally from a combination of the two" (Perloff).

Administrative Region

Administratively the nation in disaggregated into administrative regions which are states and union territories, Districts, blocks and groups of villages and villages. The data base of the aspects of development including census data are available according to these administrative units. For specific purpose of planning and organisation of development programme, units are regionalized to form specific planning units, viz, River valley regions which are inter state regions or Dandakaranya Refugee rehabilitation or where there are problem specific, big tribal regions or industrially backward regions are regionalized by taking different administrative units like community development blocks which was augmented in 1952 or even inter district regions. According to the spatial dimension of the planning problems such administrative regions are formulated and adhoc development authorities are created for planning and administering the development process.

Unit 2 ❐ Concept of Multilevel Planning

Structure :

2.1 Introduction

In the centralized planning system, regional planning is the spatial dimension of national planning process. Decentralized planning is directed by the national government to accrue benefits directly to the people. The top-down process has failed to achieve the desired goal because of diverse physical, economic and social conditions. Balanced regional development as one of the basic goals of regional planning could hardly be realized. Hence, there is a need to have bottom-up approach simultaneously to correct the maladies of top-down process of development. Removal of regional disparity requires decentralized planning process. Centrally sponsored program for area development, poverty alleviation and employment generation addressed to specific problem areas and target groups with selected economic activities is not a decentralized planning—as these projects/schemes are centrally thought out, centrally directed and implemented by the bureaucratic administrative machinery without any involvement of the beneficiaries.

Centralized top-down planning process need to be supplemented with bottom-up decentralized planning approach for balanced regional development.

Villages and municipalities are the lowest level planning units for comprehensive development at local level. The States/UTs are the administrative planning units for regional planning. Community Development blocks and the Revenue Districts are intermediate units for area planning. In the frame of multilevel planning, villages, CD

blocks and the districts form the micro-level planning units, States/UTs and interstate sub national units form the meso level regional planning units. The national level planning is mainly sectoral at macro level with spatial coverage of the whole nation and the national economy.

Planning regions are purposeful, problem specific and goal oriented spatial units for disaggregation of national plans. Regional development objectives are to be realized by efficient utilization of physical and human resources within the framework of regional development policies such as location of industries, backward area development policies, etc.

Rural development planning has to be carried out within the regional planning framework so as to reach the beneficiaries directly. The micro level planning techniques are employed to achieve the rural area development.

The success of rural development planning depends on people's participation in the entire decision making process from formulation to implementation of the plans. Rural people are closely tied with the land resources and hence their development is integrally linked with the land related economic growth.

In India, even though Community Development Blocks were created during the First Five Year plan (1951-56), these spatial units were used not for plan formulation but for administering only the centrally directed and sponsored projects. During the nineteen seventies and eighties a number of area/people based program were launched. The enactment of 73rd and 74th Constitutional Amendment Acts gave the statutory standing of the Village Panchayat, Panchayat Samity (CD Block) and the Zilla Parishad at District level and at towns and municipalities for planning and development respectively at each micro-level. The decentralized planning has to stay to involve people directly in the planning process. As far back as in 1969-74, the Planning Commission issued the guidelines for district level planning and Dantwala Committee recommended guidelines for block level planning. These guidelines were not seriously employed. Since 1993, most of the States have launched bottom-up approach to rural planning starting at Gram Panchayat levels but there are varying success/failure stories.

We have tried to highlight two success stories of people's planning process for rural development in West Bengal and in Kerala. Both the States are run by the coalition of left oriented political parties—but they vary greatly in pattern of social and economic development. While Kerala scores a high human development index with social indicators, her economy is far from progressive. In case of West Bengal,

rural economic development has taken place by effective land reform and agricultural modernization but her industrial situation has deteriorated during the last two decades or so. Its human development index is low and its economy other than agriculture has a declining trend. (At present Kerala Govt. is run by the coalition of congress and other political parties).

2.2 Multi-level Planning Process

There are two approaches to multi-level planning : spatial and functional. In the spatial hierarchy of development planning, the lowest level is the micro-level regional planning, the top level planning is at the macro-level or national level. No single level planning process is exclusive of the other levels. In the context of multilevel planning, planning at various levels is an integrative process. The micro, meso and macro-level planning processes are the spatial components of comprehensive planning geographically covering the entire country. The decision making process at one level influences all other levels of planning as an interactive one.

Similar to spatial hierarchy, there is functional hierarchy also. The functional approaches relate to social and economic activities. The economic activities and civic amenities have also a hierarchical system in which the functions which have jurisdiction over the entire country are at the top of the hierarchy, while the functions which have regional and local area coverage, could accordingly be qualified to be of that particular level. A few examples will clear the concept of such hierarchy : while locational decision regarding the primary health centre (PHC), or primary school or small scale and cottage industries is taken at, micro level so as to make hundred percent area coverage; hierarchically general hospital, middle and secondary school or medium scale industries pertain to regional level while the location-allocation and operation of functions of national importance such as higher education with specialization in science, art or technology, or medical institutions of high technology or major industries i.e., aviation equipments, nuclear power plants to name a few, are decided by the national government. After all it is the governance which matters at a specific spatial and functional level.

The spatial structure of a country's governance and desegregated structure of decision making process determine the nature of planning hierarchy. India lias established the hierarchical structure of governance and its administrative apparatus in the decision making process of planning for development at Central, State and district levels. At every level of administrative hierarchy there is a government. The

lowest level government at the District and below has been provided with the constitutional guarantee by the 73rd and 74th Constitutional Amendments Act of 1992. Until then, planning for economic development had been the joint responsibility only of the central and state governments; the State plans are categorised as Regional Plans for all practical purposes. These plans were sized up not based on correct inventory of resources or need but are financed by national allocation policies. Economic policy decisions at State level was very much directed by the Centre and budgetary allocations are made in accordance with the agreed formulae laid down by the Central Govt. time to time.

It is not true that there was no micro-level planning prior to the enactment of the Constitutional Amendments Act (73rd and 74th). As a matter of fact, the creation of Community Development Blocks (CD Blocks) by reorganising the settlement structure (village) was a step towards micro-level planning. The whole country was covered during the last four years of the First Five year Plan period (1952-56) for down to earth level development planning. Such administrative reorganization of human settlements at the bottom level was supposed to serve the decision making process from the bottom—a bottom up approach. Except the extension of the bureaucratic administration, maintenance of law and order, and revenue collection and organisation of P.D.S. for essential items as a poverty alleviation programme and doling out certain provisions such as remedial health care and to some extent social services like drinking water supply, food crisis management relief measures, etc., the socio-economic development planning decisions could not be taken up at the CD level. The decision has to be taken by the government but there was no govt. at that level nor even at the district level where online administrative officers, of personnel were deployed to administer the decision taken at the higher level state or more powerful central govt. at. the behest of the Planning Commission at national level. Economic planning in India was primarily sectoral where in State plans (allocation of resources or activity) were the spatial dimension of the national level sectoral plans whose ultimate decision laid on the onus of the national government.

Devolution of resources and financing the state plans following the guidelines of the Finance Commission didn't satisfy the State (Regional) govt. For a healthier Centre-State relation and sharing of the national development goal objectives Sarkaria Commission has been set up, which has gone to a great extent particularly the examination of the Centre and State subjects laid down in the Directive Principles of the State Policy. Such disaggregation of the national economy into State and Central sector or even concurrent sector could hardly solve the Centre State conflicts

as the Central govt. is powerful enough to change such sectoral decision by transferring resources from State to central sector or vice versa, or creating a concurrent sector such as the higher education. The third sector mainly private sector could operate only within the broad policy frame of the Central government.

2.3 Conceptual Framework of Regional Planning

The very basic objectives of centrally planned economic development pro gramme in an emerging independent economy like that of India through its adoption of five year plans are to bring about desired social and economic change. The impact of such development would be felt first, in the urban industrial scene because industrial development is conceived to be the pre-requisite of overall economic growth, and secondly, because urban areas with their existing infrastructure could take the lead to contain such development. The rural-agrarian component of the economy consequently gets energized at the response of the growing demands for foodstuff, agricultural raw-material for industries and utilization of available cheap rural labour and at later stage, by converting itself into a market for urban-industrial goods. Such consequential changes in the rural-agricultural economy normally takes time and if not properly guided may lead to adverse effects and create an 'exploitative relationship' between the urban-industrial and rural agricultural regional economies at least at the initial stages. The planning instruments employed in bringing about planned economic growth in the developing economies must be remodelled and judiciously used first to offset such adverse effects and imbalances and second, to bring about symbiotic relationship between the sectoral and spatial economies.

In the Independent India's developing economy, we have experienced both sectoral and spatial imbalances in development and such imbalances have been increasing. It is not true that we are not aware of such trends in the development process but the instruments devised and employed at the earlier part of the planned economic development are those firstly that are grossly inadequate, and secondly, are centrally thought out and directed to employ exogenously on the local economies without testing their relevancy to the varied and changing social, political, economic and physical scenes and levels of regional development. Thus, most of the instruments devised and thought to be relevant at a particular plan period for correcting such imbalances in social and economic change, instead of solving the problems raised many controversies and necessitated revision of many of them, abandonment of some and adoption of a number of new instruments.

A short review of such instruments employed in regional development planning has been attempted in terms of their relevancy and effectiveness in bringing about the social and economic change for regional development in India. It is also endeavoured to devise most appropriate instruments of social and economic changes, particularly those which involve the people in the participatory sense in the planning process. Various approaches to regional development do contain many good elements in them but have not been very effective, may be because of various vested interests or because, their relevancy or effectiveness have never been questioned.

INSTRUMENTS OF REGIONAL PLANNING

Centralised sectoral economic planning in the developing countries like India from the very beginning has not been able to reach the people at the lower rung of the income ladder or below the poverty line. Such top-down process of development did not trickle down the benefits to the economically and socially deprived people. Regional Development policies have been oriented towards industrialization with the modern factory sector for rapid economic growth with the philosophy of 'import substitution and/or export promotion' leading to international transfer of technology. Such technology transfer while could benefit the modern factory sector to some extent, it affected adversely the traditional rural small and medium scale industrial sector. Thus modern factory sector shared such a sizeable amount of total investment that a very little amount of resources were left for the rural areas. As a result, the capital accumulation in the rural sector has been poor and the rural economy remained far from self-sufficient. Income accumulated in the modern factory sector has been impounded in the urban sector itself among the urban elite and powerful minority developing consumerism in them and depriving them due share to the majority of the rural mass. Imported international skill-based technology being labour saving and capital intensive again helped only a few technically trained workers leaving aside the majority unskilled/semi skilled rural labour market (a resource endowment degenerated into an unbearable liability), and has successfully destroyed the labour intensive indigenous technology.

The modem factory-based industrialization particularly in the resource rich backward areas was conceived as a means to achieve regional balance in development as it was thought that lack of industrialization was the prime cause of regional backwardness. Although it has always been thought in the developing countries that agricultiiral sector has greater equality in income distribution because of its rural

base, the imported technology in agriculture i.e., 'green revolution' in India in the mid-sixties coming as a saviour of the rural economy super-imposed on the 'iniquitous rural social structure, further exacerbated the problems of inequality' (Haque, Mehta, etc. UN, p3).

Hence we have observed that regional planning policy instruments have neither been able to:

1. Reverse the polarization of income distribution nor could spread effectively fruits of development among the rural mass.
2. The rural mass never could be an object of planning but remained a subject matter.
3. The development have been imposed on them not by the committed leadership but with vested interests for immediate gain through leakages of the investment resources. The bureaucratic administrative apparatus had to assist such leakage mechanism otherwise would be subjected to political and/or administrative subjugation.
4. Development impulses have not been rooted in the rural area by the rural people in the participatory sense and hence dissipated quickly.
5. Recent venture of decentralization of decision making power which was always desired to be the only remedy and would reverse the top-down planning process, has created factionalism in the political decision making process rather than developing committed leadership at the local level.

Economic self-reliance as one of the basic objective of the National plans was meant only for the national economy. What about State, District and Village economies? These economically dependent sub-national units of space although might have provided physical locations of economic activities so as to contribute to the national economy have hardly experienced any regional multiplier effect of such locations. These units while on the one hand remained subservient to the national economy far from being mutually integrated, could successfully perpetuate the phenomena of rural poor sub-servient to rural rich and to the 'city bred' administrative officers (rural intelligentsia being trained in the bureaucratic state administrative apparatus also gradually alienate themselves from rural mass and join the city bred officers (suffering from somewhat inferiority complex to the latter and distinct superiority to their rural deprived brethren). Such collective exploitation of the rural deprived mass by the

rural elite and the 'city bred' masters continued and in the name of self-reliance at the national level resulted in draining out the rural productive base to support the mercantile urban economy. Even for survival the rural village economy depends on the relief doles of the national economy.

Our conception of self-reliant village economy is not synonymous with the traditional concept of self-sufficient subsistence villages. The village-centred rural economy has to be also self-reliant by developing appropriate technology rooted in its traditional past; at the same time delivering goods more than its need so as to guard itself against exploitation by the imported labour saving highly efficient mass production technology. Such technological innovation achieved internally must be mass-based and local resources and skill-based with deep social implications.

Regional planning policy instruments in India thus, need to be rural development oriented not simply because three fourth of our people inhabit in the rural areas, but because we cannot afford any longer the wastage or under-utilization of such a valuable human resource whose potential is immense in developing itself, to serve itself and the country at large. Rural development is the key to social development and without proper integration of economic and social development it shall not be possible to reach the goal of removal of poverty and save our rural mass out of the peril of perpetual deprivation. Hence is the task to evolve such strategies of rural development by which rural people will be able to discover their own solution to their problems and become self-reliant so that no outside interference will be necessary to release them from the bondage of poverty, sub-servient to the few rich and imported labour saving, skill-based and capital intensive technology. There is no conflict between modernization of productive technology with the mass-based production as long as the technology makes the rural labour efficient and productive.

2.4 Community Planning

Rural Development would essentially mean desired positive social and economic change both quantitatively and qualitatively. It is an 'areal' concept inclusive of integration of variety of elements of human life and activities. It also means development of rural areas within the framework of national goals and objectives and without prejudice to the development of urban areas. As a matter of fact, such development would include the development of small and medium size towns located in the rural areas in an integrated manner so as to achieve a symbiotic relationship

between urban and rural settlements. Further more, rural development means structural change in the socio-economic situation in order that human development which is the prime goal of all development is secured at the earliest and that the society would assimilate such changes in the realm of man-environment relationship, population growth and distribution and appropriate self-reliant technology.

Rural Development programme in India in its beginning was based on the community development approach combining its welfare aims and social and economic changes through self-help and self-reliant techniques. The philosophy of rural community development had its origin in the preindependence struggle for political freedom. The community leadership had a vision of all round development in making village India not only self-sufficient but also self-reliant. Our first rural development programme had started in the early fifties as a comprehensive self-help movement embracing education, health, agriculture and cottage and small scale-industrial development, provision for community facilities, etc. It was conceived as people's programme mobilizing their energies, resources and labour for the general social upliftment of all. (Haque, '75 pp. 22). In this approach National Extension Service (NES) was the means through which delivery system was operated and was desired to extend all services including finance and technical know-how to the common people. This 'multipurpose approach' was based on the principle of comprehensive development. The bureaucratic administration hence was extended to the village level. Such government apparatus in close alignment with the rural elites and new born political leaders coming primarily from the middle class families did not deliver the goods to the people. Thereafter various social legislation and economic policy measures helped the bureaucratic administration to consolidate and strengthen their exploitative apparatus as every new development programme was fitted to the inherited structural set up. The rural mass was being alienated gradually. All the social reforms including land reforms policies whatever radicalism may have in them could hardly touch the people. The rural poor including landless were caught in the spider net of small gains.

The concept of comprehensive people-based rural development in food shortage country degenerated into a set of projects for increasing agricultural production. Deviations from the normal civil administration were found only in the favoured agro-climatic areas with the concentration of subsidized technological inputs including irrigation and assured support price of the agricultural products. In such areas farmers

being progressive and with good management skill could derive some benefit by keeping the labour cost minimum, by using more of the seasonal migrant labour who worked long hours with negotiated low wages compared to local labour.

Agricultural development super-imposed on a structured society in those areas was a necessary evil, and was supported by the philosophy of production first and then distribution. Besides momentous discovery of HYV seeds brought about what popularly known as 'Green Revolution' with the unfolding of the high growth possibilities. Such technology was certified to be 'size-neutral' and hence was thought to bring development among all kinds of farmers (rich or poor), and hence will be able to reduce horizontal as well as vertical disparities. Unfortunately only agricultural kulaks (feudal landlords) with the capacity to purchase the capital intensive technology, could derive benefits. The national economy had no other option except to subsidize the rich farmers' production and poor man's consumption which caught the concept of balanced development and reduction of income disparity at the wrong end. Result was the increasing inter-regional and inter-income group disparities.

Size-neutral technology was far from eco-friendly, and instead of benefiting the small and marginal farmers, helped the early adopters namely large farmers with labour saving technology who could grow in size counteracting the land reform measures. The result was the eviction of the poor marginal and landless farmers. This process of change rendered small and marginal-owner cultivators and landless agricultural labourers on their own land and hence economic polarization even in the society of successful agriculture continues with all its ills of social tension. At the same time, on the plea of high input costs or minimum support price, the price of some agricultural produces viz. cotton, wheat, sugar and produce (of those farmers who are organised) was adjusted upwards leading to further subsidy by the govt. This upward revision in support price of certain agricultural goods complicated the situation farther, and even the highly subsidized price stood beyond the reach of the rural poor. In the process, small farmers were relegated to marginal farmers and in turn marginal farmers to landless agriculture labours overtime.

2.5 Panchayati Raj Institution

In 1958, Balwant Rai Mehta Committee reviewed the working of the Community Development Blocks (CDB) and suggested the formation of the Panchayati Raj

Institutions having a three tier integrated organic structure. Even though there was no statutory recognition, the Panchayati Institutions started off working in the States of Maharashtra, Gujarat, Karnataka and West Bengal but in all other states they had little freedom to operate. The Administrative Reforms Commission emphasized the need for District Planning. In 1969, at the beginning of the Fourth Five Year Plan, the district planning guidelines were issued by the Planning Commission to the states. The concept of district plan and methodology of drawing up such plans was introduced to draw annual, midterm and perspective plans. The scheme of strengthening of planning machinery at State level had started in 1972-73 with the organisation of State Planning Boards and District Planning Committees. M.L.Dantwala Committee (1978) recommended Block Level Planning (CD blocks) and issued guidelines for the preparation of block level plans. This was followed by the Ashok Mehta Committee to review the functioning of the Panchayati Raj Institutions and recommended the training of the district level officials enabling to prepare district plans and placement of such officials under the Zilla Parishad. The pattern of block level and district level functionaries varied from state to state depending upon the directives of the state governments. There was no uniformity either in exercising power or in efficiency to address to the problem of rural poverty, employment generation or increasing per capita income. The delegation of functions or power to these area levels depended upon the sweet, will of the State government. While parallel centrally sponsored schemes of rural development continued with many ramifications administered by the bureaucratic administrative machinery.

In 1985, the Planning Commission appointed a committee headed by G.V.K. Rao, member to review the administrative arrangements for Rural Development and Poverty Alleviation Programme (RDPAP) and to suggest needed structural (RDPAP) mechanism for the preparation of integrated plan and their effective implementation. The Zilla Parishad should be the principal body for management of the District Plan. The district shall be the highest level planning unit for micro-level planning in the context of multi-level planning. There are 500 Zilla Parishad. 5000 Panchayat Samities and nearly 250,000 Gram Panchayats having a hierarchical structure of govt. at each level.

In 1988, the Planning commission had undertaken an exercise with a view to agricultural planning to identify agro-climatic regions. There are 15 such regions with 80 sub zones on the basis of homogenous agro-climatic and soil parameters. The

Agro-climatic Regional Planning (ACRP) units have been used for preparation of agricultural development plans and are being institutionalized in Tamil Nadu, West Bengal, Assam and Orissa to internalize the experiences of land and water resource utilization.

The performance of such schemes or working of the state-delegated projects was far from satisfactory. The uncoordinated schemes and multiplicity of the authorities culminated in the formation of the 73rd Amendment of the Constitution of India for the rural part of the District and sub-district blocks while the 74th Amendment Act for the urban areas. Such amendments provide great significance to socio-economic planning. These concern with the preparation of development plans, implementation of the schemes, power to levy and collection of taxes and with the help of the Finance Commission ascertain financial position of Panchayats and recommend financial allocation accordingly. The functional jurisdiction of the Panchayat and Municipal govt. has been outlined in the 11th and 12th schedule of the Amendment Act. Accordingly a district planning committee is to be constituted in every state which will consolidate and coordinate the plans prepared by the Panchayat and the Municipalities in the district and prepare a plan for the district as a whole. The procedure will be as follows—the Village or Block Panchayat would prepare draft plans for their areas at district level these will be aggregated and integrated and had to be approved/sanctioned by the Zilla Parishad. The Block/Village Panchayat will be responsible for the implementation of the approved plans.

Such planning should be integrated with the district planning first for strategy formulation followed by the formulation of schemes.

2.6 'New Instruments' of Rural Development

The need for new strategies/instruments for rural development in India, was strongly felt in the early seventies when an increasing number of people were relegated below the poverty line. It was the self realisation on the part of the government on its failure to improve the lot of the common people inspite of sizeable economic growth and because its political pillars were found to sink in the soft foundation of the common poor people. The govt. got functionally detached from the people. Our failures in the fifties and sixties have provided a sense of direction to our approach to rural development. This very social and economic situation led to the devising of

a more 'limited purpose' approach with its concentration on the more demanding aspects of economic and social development—target sector approach needed to be transformed into target area and target group approach. Distorted rural development policies got a new opportunity to correct the mistakes and direct intervention at the grass-root level was advocated bye passing the existing plan-administrative machinery.

The new programme included the establishment of specialized agencies to apply corrective measures and redefine the concept of rural development. It was conceived as an approach designed to improve the economic and social life of a specific group of the people—the rural poor of various types. They formed the target groups who seek livelihood in the rural areas. They include small and marginal farmers, share croppers, agricultural labours, local artisans, schedule caste, schedule tribe and other socially deprived and economically poor rural workers. Attention to these groups of people led to the formulation of some special programme, such as SFDA and MFAL, Tribal Development Programme to directly ensure a minimum level of living to the rural poor. Various area based programme for comprehensive development such as RDPAP, CAD, Hill Area Development, PIREP, CADP (WB) and other crash programme were designed and executed through such agencies with supports of a new type of multipurpose institutions in the rural area, such as IRDP, ARC, DRDA, FSS—cooperatives and reorganising rural credit and insurance.

The programme emphasis in rural development had to be shifted to a considerable degree towards rural poor in order to extend the development facilities. These lessons have been learnt in a very hard way as many successful economic development programmes did not affect the majority. The success of HYV seed and improved farming technology in raising agricultural production proved that growth is not synonymous with development.

The programme of the seventies have had also limited success as they lacked popular base. The schemes had suffered from leakages in subsidy and credits. In the absence of integrated planning, there was no co-ordination between the different agencies involved. All of the schemes were centrally thought out and directed programmes. The people were not given option to choose their own course of action or power to act. Such micro planning from the top can never be real planning from the bottom.

What is required is not directive, but the power to initiate and act. The need for

dispersal of power in relation to planning decision has been claimed from various corners particularly by the non-official planners and academicians and also some sections of the deprived rural people whose demand was interpreted politically and socially down-graded. For them it was a last fight for survival whereas those at the helm of power saw it a political threat. A plan for rural development will be realistic only when it is, worked out locally by those whose future is involved. The matter does not rest merely with the local adoption or initiative, but for its formulation and implementation also requires decentralized action. Such people's involvement would reduce the development cost substantially.

Such types of venture have succeeded to a limited extent as in the milk cooperatives: AMUL in Gujarat, or Vijay in Andhra Pradesh, or Himul in North Bengal. The objective is not to analyse the factors of their success but draw lessons from them, and the experience gained there, has to be carefully considered as these ventures are qualitatively different from other economic sectors. Besides, because of committed and skilled leadership, these cooperative ventures could succeed as they could cut across social and economic boundaries; land reform (land being the basic immovable property) was not involved (hence its reform measures did not touch the vested interests); the items produced were being non-political and non- controversial and poor could be benefited without touching the rich (Haque, 75). The decentralization of the management by breaking their monopoly market politically or interference with the mercantile trade of the city-based business community (as in case of Vanaspati or Mustard oil or Onion growers in the western states of India) might create internal tension. Such beneficiaries oriented schemes have greater chance of success when they are linked with rural area development measures and the provision for infrastructure are made.

2.7 People's Participation and Rural Development

People's participation here has been conceived as a process of changing the people from subject to object of planning. The task is most difficult as we are putting ourselves to test. We must accept that there is every chance of our own eviction from the planning process and policy planning system.

The process of plan preparation has to be cumulative. Let there be a plan at the lowest level i.e., the villagers prepare a production plan on the basis of their resources

position, past experience and felt need and such plans are integrated at village cluster level, be it a CD block or part of CD block. Such plans would form the integral parts of the next higher order plan i.e., at the District Level. Viability and consistency of such plans are to be judged only at the next higher level so that simultaneous bottom up and top-down process with several iteration always raising a level every time, ultimately integrating them to the national plan could be achieved. In this process, self-reliance is tested against interdependence, and resource allocation is made with full participation of the people.

2.8 Village Based Community Planning

An average village in India has about 200 families with 400 adults. A village Panchayat may have 200 families (1000 people) where as an average CD block would have about, 20,000 families or 100,000 people. A village could identify itself in the frame of the CD Block not so much with the district or state. So village people could participate effectively in the decision making planning process at village and gram Panchayat' level and could integrate up to the community level at CD block. People's participation has been conceived as direct involvement of all not by their representatives as in the village Panchayat once the development problems are identified and discussed by them in a broad based open meeting, could delegate their power to the people's representatives to formulate and implement the plans at ground to earth. Relevant data for planning could be collected by a structured questionnaire by the rural youth. After alysing the socio-economic data an exercise of plan preparation in taken up by the village people for the comprehensive development of the villages. The basic objectives of such plans will be

1. to make the ordinary people aware and develop consciousness among them with respect to their own role in the development process,
2. to enhance their self-confidence so that they will be able to decide their own future,
3. to organise themselves more effectively and strengthen such organisation,
4. to be able to claim their due share in the current social system for their own well-being and resolve the conflicts if any, and above all,
5. to enable them to construct a new progressive society as they desire.

Essential instrument will be let the people identify themselves who require what-type of development program. These programs however must be need-based at least at the beginning. Let them spell out their own needs and also identify the possible solutions according to societies' actual and potential means and capability.

The village Panchayat is the lowest level government at grass root level. A Gram Sabha is a local body consisting of about 1000 adults (above 18 years). This Gram Sabha has 10-15 members elected directly by the people of which one third seats are reserved for women. The Village Level Worker (VLW) is the Secretary to the Village Panchayat. Each Gram Sabha has a president known as Gram Pradhan. These Pradhans form the Anchal Samity or Block level Panchayat whose members get portfolio for development in various sectors — i.e., agriculture, health, sanitation education etc. but in aggregate prepare a comprehensive plan. The BDO is responsible for planning, implementing and monitoring the Block level plan directly funded from the Zilla Parishad (District). Village people are directly involved in data collection, analysis and plan formulation a.nd implementation. The village youth need to be trained in in the basics of plan making methodology including data collection, compilation and data analysis and data preservation for future use also. They will be able to draw up the development plans for specified time frame. This is a new dimension of people's involvement in rural planning.

2.9 Committee on Micro-level Planning

The NDC set up a committee on Micro-level planning and involvement of People at Grass Root Level to delineate the procedure and steps to make Micro-level Planning operationally effective and viable and to suggest rational and pragmatic ways for the involvement of people at Grass Root Level. Its report in April 1993 recommended

(i) The adoption of the Block or Taluka or even a group or cluster of villages (mandals) as the smallest unit of planning.

(ii) Monitoring and evaluation of the schemes by the Micro-level Body itself.

(iii) Revision of the Centrally sponsored schemes and strengthening of planning machinery to be shared equally by the Central and State govt.

(iv) Appropriate training of personnel or capacity building of the trainee.

(v) Implementation of employment-related programme and schemes such as JRY, IRDP, DDP, MNP and Local level works under micro planning.

(vi) Merger of Institutions such as DRDA, DPB with the PR where ever feasible.

(vii) Investment outlay to foster people's involvement.

(viii) Allocation of Untied Fund amounting to 5% of State's Annual Plan to district and lower level,

(ix) Contribution of 5% of total Plan outlay of the State for Micro Level Planning towards MNP.

(x) Reservation of at least 1% of State's annual outlay for scheme like poverty alleviation and employment generation needed to be planned and funded at village level.

(xi) Transfer of at least 30% of the State Plan outlay to Sub-State level bodies in addition to the flow of funds already enumerated, and

(xii) Separate budget head for identifying the flow of fund to sub-state level bodies.

Even though most of the states agreed to use Blocks, Talukas or even cluster of villages as smallest planning units, feasibility was questioned. All states have agreed to the training of personnel for plan making.

Although there were varying responses by the State Govt. with regard to delegation of power and finances, while the state govt. is claiming for decentralization of power from the centre to the states on their part they are reluctant to decentralize farther to below the state level.

This grass-root approach to rural planning—a bottom-up approach seems to be ideal but the success story varies from area to area. Democratization of the planning process at the grass-root resulted in interpersonal and inter community conflicts and politicization of the planning process. Many a times the plan's are not born what to speak of implementation. These conflicts sometimes turn to political rivalry and party politics take a toll on the activists. The problems need to be solved locally but political interference complicates the issues.

We shall not go into the details and nor suggest any conflict resolution techniques or conflict management but would like to highlight only the positive aspect of the

people's movement/campaign for rural development. We have mentioned only two models of Village Panchayat based rural development planning—Kerala model and West Bengal model.

2.10 Kerala Model of People's Movement in Planning

The Peoples' Campaign (Aug 1996) was launched as an attempt to genuine participatory planning from below, where-in people's involvement is maximized first in plan formulation and thereafter in implementation. Sustainability of this campaign is assured because of people's continuous monitoring the implementation. This has been feasible because of democratic decentralization of the planning process as an effort to consolidate and articulate public opinion in favour of this process. Its success of course depends upon the State Government's facilitation of various measures by devolution of power and resources with complementary changes in the administrative procedure and practices. As an example that could be highlighted is that about 30-40 per cent of the State's Ninth Plan outlay shall be distributed among the local bodies to finance development projects evolved from below with people's participation (MA-Oommen-1999 pp. 94). Devolution of power, (responsibilities and resources) is only essential condition, not sufficient to succeed in people's planning process. The basic objective is to motivate and empower the local govt. to take up the challenge of development planning. This campaign is an attempt to conceptualize, operationalize and institutionalize a system of multi-level, people centred planning process—may be unique in the case of Kerala wherein a highly enlightened educated community with unique cultural setup cutting across caste, religion or political affiliations could involve themselves from plan formulation to implementation and maintenance of the assets created. The Decentralized Planning Process has been summarised in the flow chart from 1st phase of Gram Sabha meeting ensuring maximum participation of the people especially women and weaker sections of the society to implementation (flow chart of Kerala model).

2.11 West Bengal Model of Rural Development

The State Planning Board was setup in 1971, which took up the project for Comprehensive Area Development (CAD) with the enactment of WB Comprehensive

Area Development Act, 1974. The task was entrusted to the CAD to draw up and implement the projects for comprehensive development of selected areas in the State. The CAD had identified a set of 20 pilot areas spread over the entire state (at least one in each district) for developing methodology of rural area planning with primary emphasis on agricultural development. The selected project areas with assured agricultural inputs such as irrigation, fertilizer, provision for better variety seeds and insecticides, etc. covered an area of about 1000 ha with 10,000 people. The CAD project technical cell prepared a crop plan specific to each agro-climatic condition in consultation with the local people (beneficiaries) so that year round agriculture could be practised with a view to raise production and hundred per cent land coverage. All the available land need to be used for some purposes or the other including grazing ground for the animals. Although the plan was area and people based, it could not be replicated because of lack of political support subsequently and change in the State governance.

Until recently the govt. officials or university scholars or students used to collect socio-economic data from the villages with structured questionnaire. Such data or information were used externally to prepare rural development schemes and were imposed on the villages, blocks etc. for implementation with the line administration. Neither such implementing personnel nor the villages/rural people were involved in plan preparation, so no commitment could be expected out of them in the implementation. The benefits were far from satisfactory. The beneficiaries were only at the receiving end. To reverse this process of top down approach to rural planning a new model has been conceived in the framework of village planning.

With a gap of a decade or so, the Midnapore District Zilla Parishad (Midnapore Planning and Development Association) in collaboration with the Rural Development Centre of IIT Kharagpur launched a program of "Village Planning by the Villagers" in 1980. It has been conceived that an integrated village development plan could be prepared and implemented by the villagers in general and their representatives in particular. The basic objectives are (i) to utilize fully the unutilized or under utilized resources (primarily land) available at local level to increase income and employment, and (ii) to remove rural poverty caused due to inaccessibility to such resources to the poor.

A model village plan could be prepared at different stages or phases with the information collected by the villagers

(i) 1st Stage: To prepare a village register with the name of head of each household and their categorization according to social structure i.e., scheduled caste, scheduled tribes, backward classes and minorities and caste Hindus or upper caste with landholding pattern and their sources of income.

(ii) 2nd Stage: To prepare Village-wise agricultural plan. The plan preparation and planning process require complete information of land resources with their classification and suitability to different crops. Information regarding irrigation system and possibilities, soil characteristics, type of crop produced and that could be produced, technological inputs required, etc.

(iii) 3rd Stage: Land characteristics, soil condition and irrigation facilities are directly dependant on geographic condition but people could find out their role in changing the potential and prepare a crop plan and crop calendar.

(iv) 4th Stage: Relates to the planning for non-agricultural plan preparation particularly the small scale cottage industries for off-land employment based on the available local skill, local resources and demand from local markets. Such non-agricultural development plan includes not only industries but also the infrastructure planning namely rural roads, linkage between the producing village to the markets, water supply, educational, health and sanitation, drinking water supply, etc.

All the development schemes including agriculture need to consider the ambient environment and ecofriendlyness for sustainable development.

Appendix 1

People's Planning Process: Kerala Model—1996

Phase I: Gram Sabha/Ward conventions to identify local development Problems—(i) ensure maximum participation of people especially women and weaker sections, (ii) identify the needs and priorities, and gaps in the local govt.

Phase II: Objective assessment of resource potential and current status of their use. A list of tentative solutions to the development problems.

The development report—consolidation of Gram Sabha reports, review of the on-going projects, data collection from the secondary source, geographical study and short history of the village—a bench mark study.

Training of state to local level resource persons.

Generation of database by comprehensive study.

Phase III: Sector wise Task Force—participation of officials and technical persons—on-line administrative person—the convenor.

Special Component and Tribal Sub-Plan prepared following the guidelines of the Planning Board

Standardized Task Force reports to maintain uniformity:

Sections are: Introduction
Objectives
Beneficiaries
Activity Analysis
Financing the plan
Benefit-cost analysis
Monitoring mechanism

Phase IV: Sector wise plans put in shelf for ready reference
Prioritize the projects Resource mobilization
Development strategy for the identified problems
Project wise monitoring mechanism for implementation

Phase V Preparation of block plans
Preparation of District plan integrating the local plans
Statistical handbook
Training manual
Method of integration from local to higher level

Phase VI: Techno-economic viability of the local plans examination
Necessary modifications incorporated.
The Voluntary Technical Corps with vast experience at Block and District level shall examine the technical feasibility and economic viability.

The District Planning Committee will approve the gram panchayat and municipal plans. Recommended fund shall be allocated without delay. The whole planning exercise will take about one year.

On-line administration and voluntary organisation shall implement with the supervision of the Panchayat.

Appendix 2

People's Planning Process: West Bengal Model Planning stages

Stages I: Village panchayat meeting will be held with maximum participation of the members. Explains the need of such plan preparation. Preliminary discussion on the development problems. Preparation of the Village Register: Check list of all the house holds categorised according to class, caste, religion, name of the head of the household/family, age-sex structure of each family, land holding pattern, occupational structure-land less labourers, owner cultivator, share croppers, other occupational groups.

Stage II: Analysis of land resources and current status of land use. Agricultural situation in the Gram Panchayat. Land classification and soil condition-land capability status.

Stage III: Identification of the poorest of the poor and analyse the problem— find out the ways and means to tackle immediately.

Stage IV: Status of Village industries, employment structure, wages, number of days of idle labour per year.

Landless agricultural labour-No, of idle mandays per year.

Stage V: Selection of 30-40-village workers-male and female and organise meeting, assign the task and arrange training,

Conduct survey—socio-economic and resources.

Stage VI: Preparation of landuse plan, crop plan according to crop calendar, analysis crop wise inputs, infrastructure, output-estimate based on hundred per cent of land coverage for food and non-food crops, etc.

Stage VII: Planning for subsidiary occupation other than agriculture available skill, raw material and local market. Investment re required for plants and equipments, working capital, no. of employment generated.

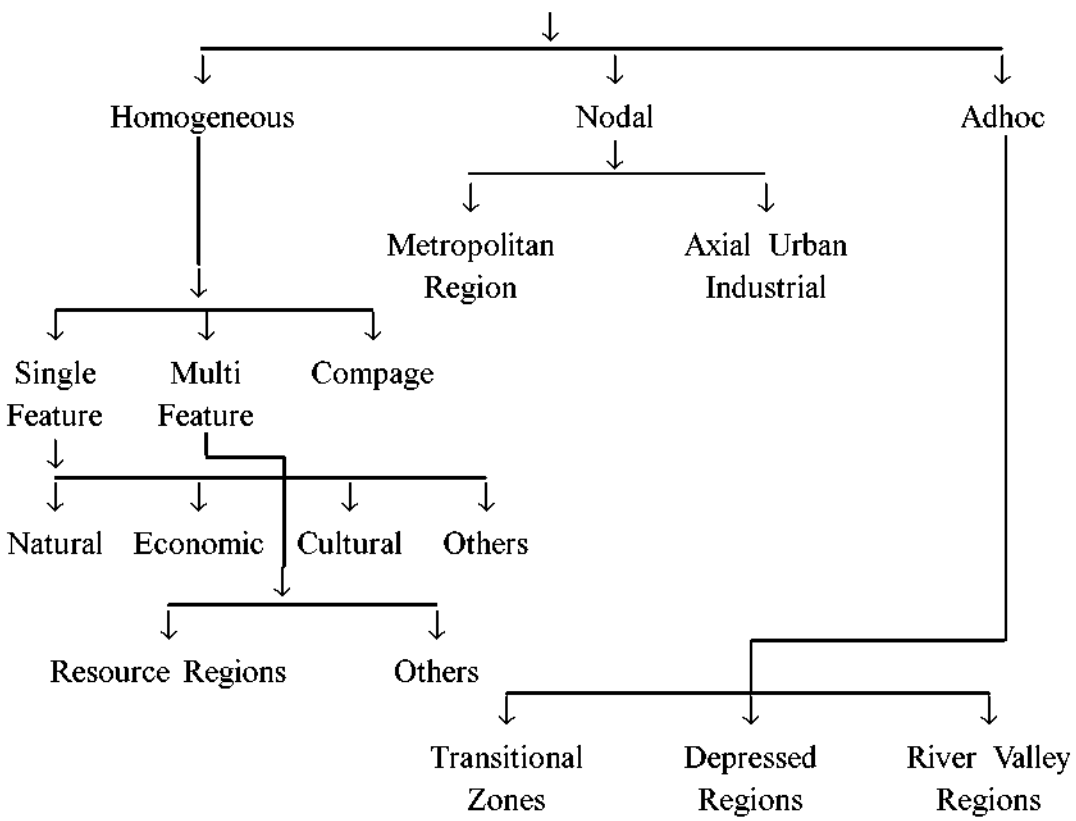
Stage VIII: Identification of gap in infrastructure and estimate the requirements based on economic structure.

The village Panchayat Plan prepared shall be examined by the Block Level Samity and recommend for approval by the Zilla Parishad with necessary modification and the approved plan is funded. The village panchayat will supervise the implementation.

The whole exercise need to be completed by one year and implemented.

Hierachy of Regions

Regional Units

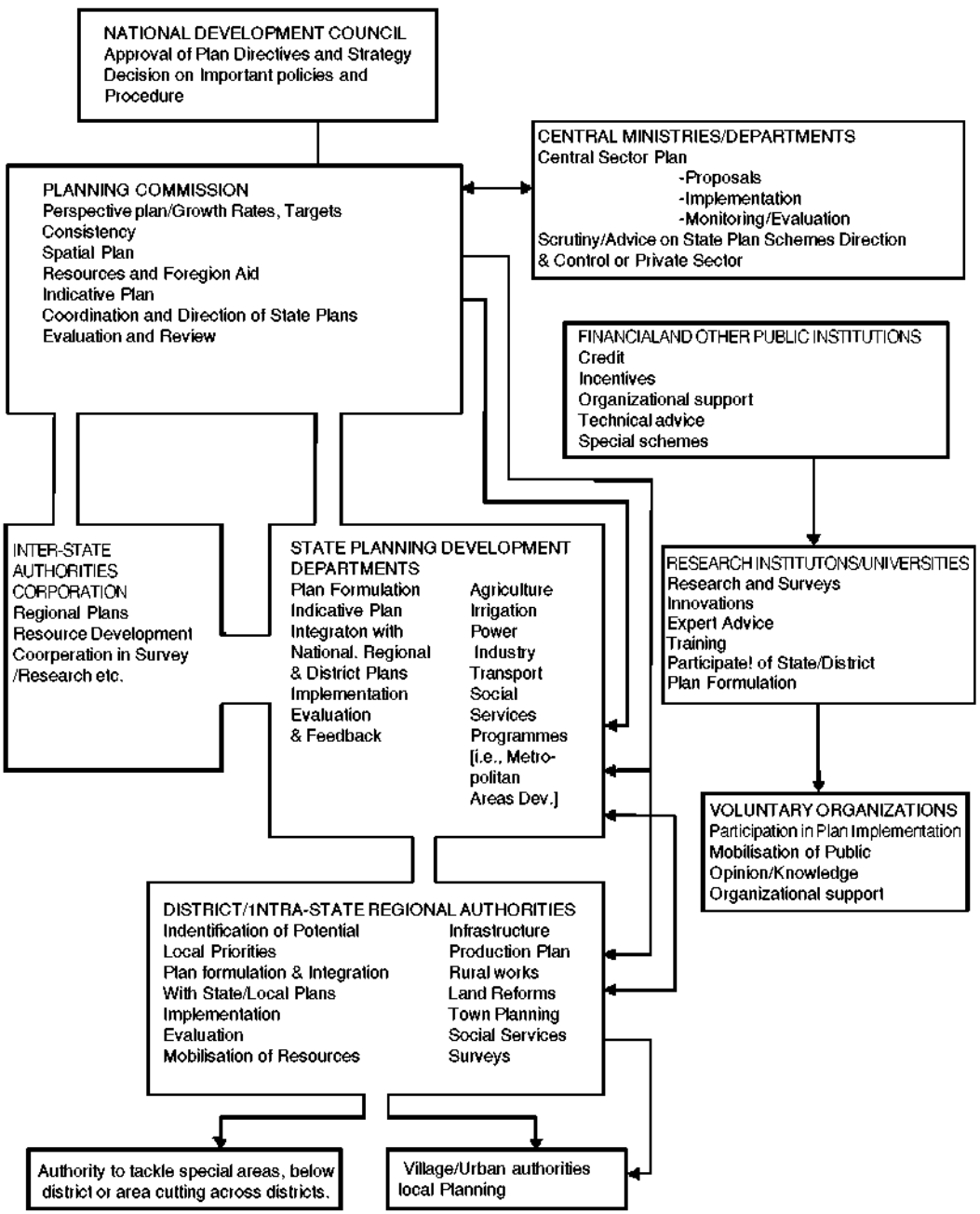


Regional Hierarchy—

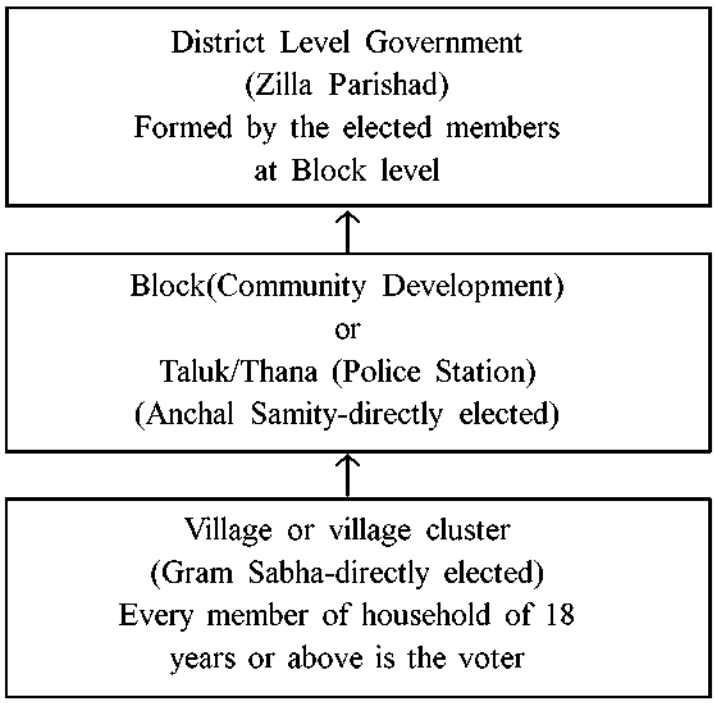
Administrative (Mainly Rural)	**Urban** (Metropolis)
↓	↓
Distric-Block-Cluster of Villages-Villages	City
	↓
	Town

Government : Panchayati Raj and Rural regional Local Municipal Government

MULTILEVEL PLANNING ORGANIZATION



Panchayati Raj (Local Self Government)



Appendix 3

Rural Development Programmes In India Since Independence

SI. No.	Programmes	Year of Commencement
1.	Bhoodan Movement	1951
2.	Gramdan Movement	1952
3.	Community Development Programme (CD)	1952
4.	National extension Services (NES)	1952
5.	Applied Nutrition Programme	1958
6.	Panchayati Raj (PR)	1959
7.	Intensive Agricultural District Programme	1960
8.	Hill Area Development Programme (HADP)	1972
9.	Tribal Area Development Programme (TADP)	1972
10.	Intensive Agricultural Area Programme (IAAP)	1964

(Contd...)

Appendix 3 (Contd...)

SI. No.	Programmes	Year of Commencement
11.	High Yielding Variety Programme (HYVP)	1965
12.	Intensive Cattle Development Programme (ICDP)	1964-65
13.	Intensive Area Development Scheme (IAD)	1965
14.	Small Farmers Development Agency (SFDA)	1969
15.	Agency for the Development of Marginal Farmers and Agricultural Labourers (MFAL)	1969
16.	Drought Prone Area Programme (DPAP)	1970
17.	Rural Works Programme (RWP)	1971
18.	Crash Scheme for Rural Employment (CSRE)	1971
19.	Pilot Intensive Rural Development Projects (PIREP)	1972
20.	Employment Guarantee Scheme (EGS)	1972
21.	Minimum Needs Programme (MNP)	1974
22.	Twenty Point Programme	1975
23.	Habitat Movement (HM)	1976
24.	Rural Functional Literacy Programme (RFLP)	1976
25.	Food for Work Programme (FW)	
26.	Antyodaya	
27.	Desert development Programme (DDP)	
28.	Operation Barga (OB) in West Bengal	
29.	Command Area Development Programme (CADP)	
30.	Comprehensive Area Development Programme (CADP)	
31.	Integrated Rural Development Programme (IRDP)	
32.	National Adult Education Programme	
33.	National Rural Employment Programme (NREP)	1980
34.	Training of Rural Youth for Self-Employment (TRYSEM)	1980
35.	Bio-Gas Programme (BGS)	
36.	Self-Employment to Educated Unemployed Youth Programme (SEUYP)	1983
37.	Rural Landless Employment Guarantee Programme (RLEGP)	1983
38.	Tribal Development Programme (TOP)	
39.	Revised Minimum Needs Programme (RMNP)	

SI. No.	Programmes	Year of Commencement
40.	Hill Area Development Agency (HADA)	
41.	Rural Manpower Employment (RME)	
42.	Peoples's Action for Development (PAD)	
43.	Industries, Services and Business Component (ISB)	
44.	Spacial Livestock Production Programme (SLPP)	
45.	Rural Nutrition Programme (RNP)	
46.	Rural Women's Programme (RWP)	
47.	Whole Village Development Programme (WVDP)	
48.	Special Programme for Women and Children (SPWC)	
49.	Programmes for Depressed Areas (PDA)	
50.	Tribal Development Agency (TDA)	
51.	National Seeds Programme (NSP)	
52.	Scheme for Development of Women and Children in Rural Areas (DWCRA)	1982
53.	Intensive Pulses Development Programme (IPDP)	
54.	Summer Moong Production Programme (SMPP)	
55.	Intensive Cotton Development Programme (ICDP)	
56.	Village Small Industries (VSI)	
57.	Khadi and Village Industries programme (KVIP)	
58.	Dairy Development Programme (DDP)	
59.	Entrepreneurs' Development Programme (EDP)	
60.	Fodder development Programme (FDP)	
61.	Intensive Cattle Development Programme (ICDP)	
62.	Livestock Production Programme (LPP)	
63.	Make India Green Programme (MIG)	
64.	Minimum Yield Guarantee Programme (WGP)	
65.	Modified Area Development Approach (MADA)	
66.	Programme for the Development of Community Nurseries (DCNP)	
67.	Rural Artisans' Complex Programme (RACP)	
68.	Jawahar Rojgar Yojana (JRY)	1989
69.	Integrated Rural Energy Programme (IREP)	
70.	Indira Awas Yojana	
71.	Swarna Jayanti Rojgar Programme	2001

Appendix 4

CONSTITUTION (SEVENTY-THIRD AMENDMENT) ACT, 1992

"ELEVENTH SCHEDULE"

(Article 243-G)

1. Agriculture, including agricultural extension
2. Land improvement, implementation of land reforms, land consolidation and soil conservation.
3. Minor irrigation, water management and watershed development
4. Animal husbandry, dairying and poultry.
5. Fisheries.
6. Social forestry and farm forestry
7. Minor forest produce.
8. Small scale industries, including food processing industries.
9. Khadi, village and cottage industries.
10. Rural housing.
11. Drinking water
12. Fuel and fodder
13. Roads, culverts, bridges, ferries, waterways and other means of communication.
14. Rural electrification, including distribution of electricity.
15. Non-conventional energy sources.
16. Poverty alleviation programme.
17. Education, including primary and secondary schools.
18. Technical training and vocational education.
19. Adult and non-formal education.
20. Libraries.
21. Cultural activities.
22. Markets and fairs.
23. Health and sanitation, including hospitals, primary health centres and dispensaries.
24. Family welfare.
25. Women and child development.
26. Social welfare, including welfare of the handicapped and mentally retarded.
27. Welfare of the weaker section, and in particular, of the Scheduled Castes and the Scheduled Tribes.
28. Public distribution system.
29. Maintenance of community assets".

Appendix 5

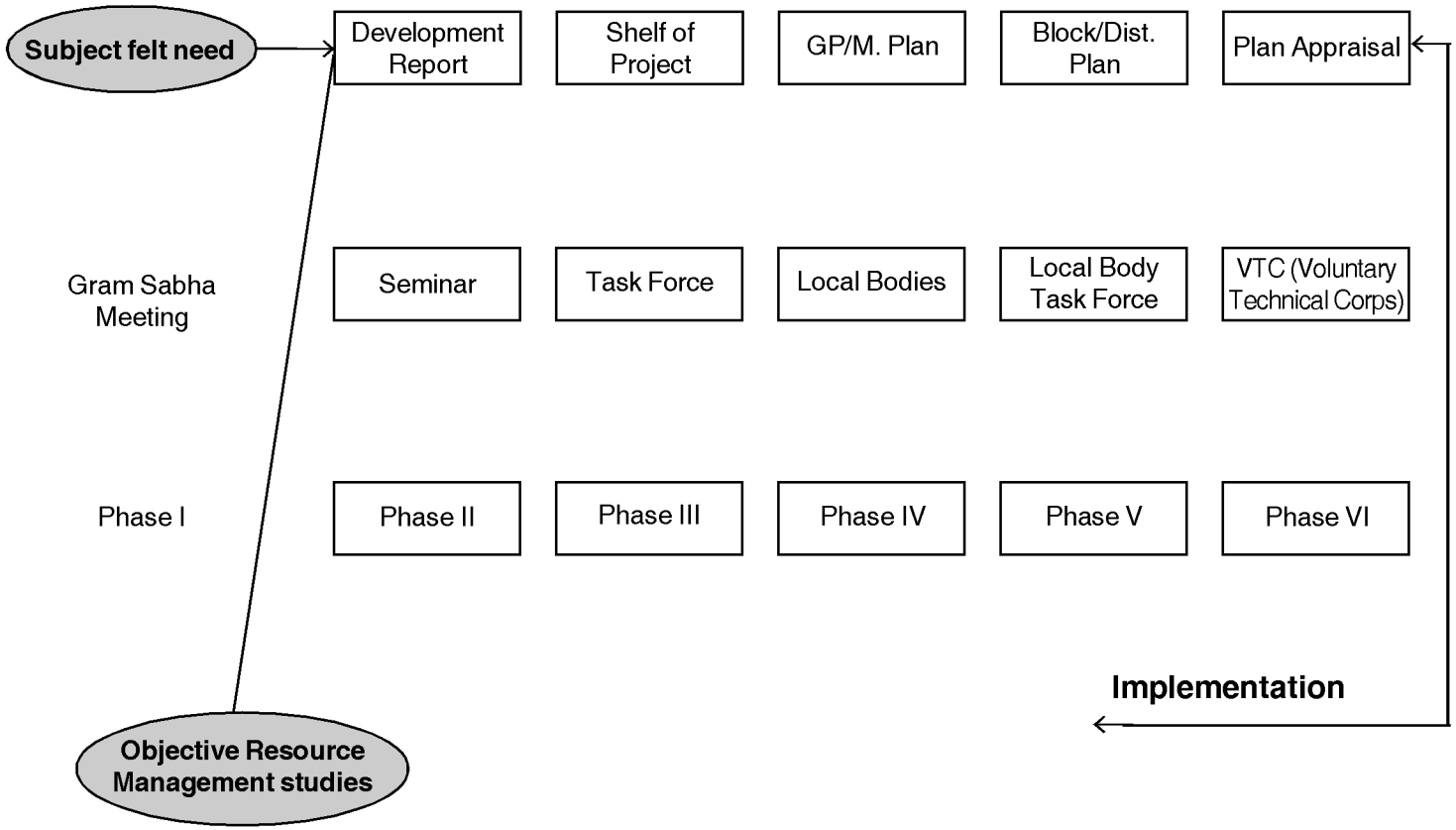
CONSTITUTION (SEVENTY-FOURTH AMENDMENT) ACT. 1992

"TWELFTH SCHEDULE"

(Article 243-W)

1. Urban Planning including town planning.
2. Regulation of land-use and construction of buildings
3. Planning for economic and social development
4. Roads and bridges.
5. Water supply for domestic, industrial and commercial purposes.
6. Public health, sanitation conservancy and solid waste management.
7. Fire services .
8. Urban forestry, protection of the environment and promotion of ecological aspects
9. Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded.
10. Slum improvement and upgradation.
11. Urban poverty alleviation.
12. Provision of urban amenities and facilities such a parks, gardens, playgrounds.
13. Promotion of cultural, educational and aesthetic aspects.
14. Burials and burial grounds; cremations, cremation grounds and electric crematoriums.
15. Cattle ponds, prevention of cruelty to animals.
16. Vital statistics including registration of births and deaths.
17. Public amenities including street lighting, parking lots, bus stops and public conveniences
18. Regulation of slaughter houses and tanneries.

PEOPLE'S PLANNING PROCESS : KERALA MODEL



Unit 3 ❐ Economic Base Theory and Theory of Growth Centre and Growth Pole

Structure :

3.1 Economic Base of Cities

Cities exist to perform activities and satisfy social, economic religious, political needs. They exist and grow because opportunity for making living, employment depend on their economic base. Its measure and interpretation are of major concern. Their focality or nodality are distinctive feature in economic physical from outside area - in terms of production, transfer and distribution of goods and services. It determines the area of influence over which goods and services are sent out compared to its own consumption. John Alexander has reviewed economic base study. Roterus & Calef developed methods of area dilimitation and application of the method.

Tiebout criticised it purely on economic ground. Alexanderson proposes alternative methods by using proportion of employment in each. Isard developed input-output techniques of analysis to cities and regions from national data on production, consumption and movement.

The Economic Base - basic and non-basic concept traditionally developed on livelihood data but for space relationship is developed here.

Cities Economy Develop in Response to Demand from Other Places

City serves its region. Such inter-connections between city and region - is a type of space relationship. Extension of service area, intensity of its demand on city and characteristics determine city growth - hence interdependency growth.

Dichotomy - Basic	Non-Basic
money bringing	secondary, city serving
primary, city building	urban support

growth factor supporting
external service

Aurousseau (1921) - Primary & Secondary

F.L. Omstead (1927) - Primary & Secondary

R. Hartshrone (1931) - Basic 8-10%, 92-90% non-basic
(St. Paul Mineapolis)

Research staff of Fortune Magazine - payment/credit to local/non-local
(Oskaloosa study) (1938)

Homer Hoyt (1939) Brockton, Mass. & New York Metro Region: Urban Growth & Urban Service ~

Methods -
1. Persons in major employment category.
2. Determine employment in manu. for outside service.
3. Determine employment in non-local govt., transportation, etc.
4. Percent of national income earned by the city in trading, financing, professional, and related activities for consumption.
5. Compare these with local employment - excess will be urban growth.

Sample: If 15 mm people in the nation are engaged in all functions and "A" city is having 1% national income, it should have 1% employment i.e. 150,000. Suppose its actual employment is 200,000, the excess 50,000 employment is in urban growth.

Harold McCarty (1943) expanded occupation pyramid, base is not predicted by other type of industrial occupation. Employment in other industries would determine the basic industry.

J.H. Jones said (in Britain) Economic planners should give priority to basic activities which determine city's economy.

Robert Dickinson (1947) - city is the seat of industry and service for regional market over and above local need by occupational structure.

Comment

1) Data not published the way city and region are bound economically.
2) Basic employment come first, then service follow in which govt. role is very important.

3) Concept permits classification of cities defining urban regional economic functions. Non-basic functions are similar to most of the cities.

4) It provides B/N ratio - can be used for comparative study.

5) It entails a new classification of individual income/sale in and outside city. Mail order is basic, local school is non-basic but higher learning basic.

Application:

Chauncy Harris applied the concept in his Ph.D. thesis (1940) on Salt Lake City, Homer HOyt (1944) to N.Y. City (100/215). Detroit (44) -100:117. Cincinnati (1946) - 100:170. Firm by firm approach in Oshkosh; Wise. employment prorated. If application to small towns lead to considerable error so is national proportion.

Further Research

1) Is B/N ratio truly meaningful? Does it vary city to city? according to city size, city type (industrial, commercial) location wise? Does it vary overtime? Does it vary with city growth rate or vise-versa? Are non-basic functions similar city to city? What urban community would form study unit - urbanized, municipality, or metropolis?

If B/N ratio is a measure of economic interdependency change in city-limit may change ratio. As size of the city area increases interdependency decreases. Although distinction between B/N is difficult to measure it is a descriptive tool, indicates the process of city growth - a notion of multiplier. "The support of a city depends on the services ife performs for itself but for a tributary area". It reflects an aspect of national economic life; but this is a mental abstraction is to ignore the base on what it rests. Actually cities in U.S. rest on taking one another's washing".

Charles M. Tiebout: Urban economic base reconsidered. No single criteria for study - not possible to study all aspects of urban eco. totality - only methods of aggregation - export - local.

National economic forecasting may be used. Premises are:-

(1) The level of some activity depends on the level of other activities in the system.

(2) Some activities are independent set by outside force - govt.

(3) Stability of the variables, i.e., relation between income/expenditure is stable overtime.

Keynsian Theory - Income, consumption and investment.

Consumption is f (function) of income, investment is independent.

If consumption is 0.8 of income.

then, y = C+I where I = 20, C = .8y

then, y = .8y + 20 or y – .8Y = 20 or .2y = 20

y = 20/2 x 10 = 100 – change in I will change y – is multiplier effect.

Multiplier Model to predict city's economic growth.

$E = E_N + E_B$ 1

We can rewrite $E_N = \left(\frac{E_N}{E_B}\right) E_B \frac{E_N}{E_B}$ = coeff. of base ratio

Then 1 becomes $E = \left(\frac{E_N}{E_B}\right) E_B + E_B$ 2

$$= E_B \left(1 + \frac{E_N}{E_B}\right) \quad \text{.....3}$$

Solve right hand side by replacing 1 by $\frac{E_B}{E_B}$

then EB is common denominator

$$= E_B \left(\frac{E_B}{E_B} + \frac{E_N}{E_B}\right) \quad \text{.....4}$$

then by $Eg = E - E_N$ and divide numerator and denominator by E

$$= E_B \left(\frac{E_B + E_N}{E_B}\right) \quad \text{.....5}$$

$$= E_B \left(\frac{E}{E - E_N}\right) \quad \text{.....6}$$

$$= E_B \left(\frac{1}{1 - \frac{E_N}{E}} \right) \qquad \text{.....7}$$

$$\text{or} \quad E = E_B \left(\frac{1}{1 - \frac{E_N}{E}} \right) \text{ is the multiplier}$$

3.2 Theory of Growth Centre and Growth Pole

The Growth Pole theory was orginally developed by Franever Perrouse (1964). Spatially imbalanced development socio wise do a role with concengtrated development in space. Such agglomenation of economic development takes place as growth does not appear everywhere all at once, and gets concentrated in centres i.e., growth pole taking Varging indensidy role such growth spreads along the channels or corridors with varging speed to achive balanced development.

The concept of growth according to Perrouse is concerned with the qualitative & quantitative development including the process of structural change. The nature of growthpoles provides the propensity of the key factors to adopt innovation, assumes their development, with rear development & rear processes which are driving forces of development. Perrouse has defined economic space which command the location of key economic activities on a geographic space. It includes comprehensively the geographical dimension Hermansen (1977) asserts that a nodal region qualified to be called as a development pole when it contains propuslive leading industries. Hoseley (1974) and Glasson used the term 'Growth Centres" next to growth pole to ascertain their grographical identity — as subsidiary centres to diffuse growth impulses.

Concepts of leading and propulsive Industries

The growth poles provide the location of keyindustries and propulsive firms which dominate the economic space/units. They together may lead to the formation of industries compulsive with the propulsive firms and leading industries. They are functionally and spatially interlinked : (i) The leading industries are relating by new

& dynamic in nature having advarsed geographical inputs relating life blood of the regional growth. It has to loss high income elasticity of demand for its products sold in the national and international market. Such industries have strong inter-industry linkages with forward linkages where its intermediate foods/products are sold to other industries or backward lingakes which provide basic inputs to the industry.

(ii) The propulsive firm or industry which is large in size, generate significant growth impulses into its environment with ability to innovate and inject the growth impulses to the fast growing industry.

The two aspects of growth pole are easily discernable :

(i) Spread effect and (ii) polarisation.

Spread affect is observed by G. Myrdal and Hirschman into two different paths — Growth impulses radiate outward into the surrounding areas to extend its spatial spread or trickle down effect when by necessity the growth has to there with lower order centres.

Polarisation process concentrates the economic activities in the growth pole having afflomeration economics. This process leads to geographical polarisation with the flow of resources to and concentration of economic activities in a limited space with the centre having a geographical frame. Agglomenation of economics are of various types but mainly of four types :

(a) Econmics internal to the firm : Cost of production becomes lower with increasing scale in the rate of output which is "economics of scale" — technological innovation, job specialisation and various management,marketing & financial economics.

(b) economics external to the firm but internal to the industry. Cost reduction per unit of production as the industry expands at a particular location. This is called localization economics with the advantages of a large scale & skilled labour pool, very interchange of products process waste material and development of specialized services availabe to the firm.

(c) Economics external to the industry but internal to the urban area. The reduction of average cost of each firm many industries shall grow. This urbanization economics including development of labour markets, access to a large market with production of a wide range of services by both the private or public sector for both people of

industry. This process would expand the infrastructure base transport, communication, social cultural facilities, schools, medical, cinema etc.

(d) This polarisation process has two types of input one industries are notgoing to be decentralized and seriously would reduction regional disparity. By policy planning economic decentralization could take place either by trickle down process both having complimentary effect and also with competing industries located in the region because of comparative advantages both in labour and capital choice there might be dis-economics of scale entered into the pole economics. Which may be termed as trickledown effect. Todaro was worked at length on this issue. The process may strengthen the polarised economy or complement its future growth pattern. This decentralization of economies in the backward hinterland may bring about development and energies the hinterland economy. The process instead of having backwash effect on the hinterland economy would expand the growth poles and resulting hinterland regional frame for sustainable growth of the pole and also of regional development where in there is diffuised unemployment.

This process is beneficial to both the growth pole and its region for balanced regional development.

Growth Centre :

The location and decentralization of economic growth away from the pole in the region has been identified by Berry as a diffusion process, Growth centres offers a specific instance of innovation and diffusion as a filtering process from the large centres to the smaller ones. Growth Centres will have growth impulses diffused from the polses at the peripheries within the orbit of the metropolis. This would lead to rapid integration of the national economy to regional economies, through the development of economic and spatial linkages of all types.

Some of the scholars — India find to apply growth pole & growth centre strategy for developing the backward regions but hake obberned the inadequacies of the strategy of various grounds particularly in the developing countries in India and elsewhere becasue of various constraints (Misra, Sundaram & P. Rao 1974). In Latin American Countries of Brazil & Ciudad Guayana in Venezuela where the metropolies peripheries are partially popularised and natural resources base not very advantageous. While applying this hypothesis to Venezuela, Friedmann observed the constraints and developed a model known as core-periphery where core develops, the peripheral

areas do lag behind. There is no spill over or spread effect from the core region. In India some leading industries i.e. Iron & Steel, Cement Power plants are located in the resource rich backward areas. They contribute to the national economic growth without integration to the regional economies. Because locational planning was piece real and not planned to comprehensive regional development. The growth of such industries did not diffuse growth impulses to energing the backward regional economies.

These new industries during the plan period were not geared so energise the local economy even though they are having backward linkages to the regional natural resources. The hinderland regions are structurally backward, probably "Big Push" theory of Rosenstein Rodan may help to break the structural backwardness. Growth pole located in the backward region may develope industrially without strong manufacturing base but would remain uninterupted with the regional economics usless some deliberate attempts are made to achieve spread effect. The growth poles in the developing countries like in India make so play a very important role by providing services, economic growth & social changes. The application of spatial diffusion or developed by Hagerstand (1964) may help in achieving a break through. Whether we should take the help of centre place theory in achieving balanced regional development is also under scanner. The central place hierarchy may be a strategy worth trying. In the context of India a five stage hierarchy of growth facias a stragegy may be attempted.

In1970's with the technical help of the Ford Foundation, a number of 20 case studies on growth centre was undertaken. The optiquoted the growth centre study of Miryalguda Talanka (Sen 1971) of NIRD, Hyderabad may be sited.

1. Lowest order may be central village forming a market & service centres with a population of 6000 people or more.

2. Service centre making a micro-level unit with basic infrastructure for diffusion of innovation as well as small scale processing & manufacturing industries each with 30,000 people in the rural areas. Both those units are having service function with limited growth potential.

3. Growth points are having five or more service centres serving a population of 1,50,000 in the rural areas. They are growth points having potential to grow and create employment opportunity with investment. The size may vary from 10,000 to 25,000. They may have agro-industrial functions to spacialise — with police station,

extension service centres, branch P.O., bank (rural), even junior college, warehousing, cold storage, repairing services godown, connected with all weather road.

4. Growth centre is higher up in upto level with a population of 50,000 to 500,000 thousand to service a mesolevel region of 1,200,000 people spread over a subnational area. Its functional character would be influenced by the development of quaternary along with small scale industries. They are the urban centres having growth potential while all growth centres are also service centres. Growth points or service centres or central villages are only service centres only.

These centres may grow to regional capitals, state administration and functionally diversfied and may have potential to grow as growth poles in course of time & stock region & being at the apex of the hierarchy range from 500,000 to 2,500,000. They are the cities of national and regional importance. It may serve a regional population of about 20 million.

The predominant functions of the growth poles are tertiary, trade & commerce, financial headquarturs, higher educational, engineering & medical colleges for the macro-region.

If they growth further and cross over 5 million people may be identified as Megacities such as Mumbai, Calcutta, Bangalore, Madras (Chennai), Hyderabad and Delhi. The last one has exterdid its influence area to four state National Capital Region.

The Mega cities are super growth poles located far apart from each other being primate cities in the regional context. There problems are to be treated separately. They are national cities located regionally. Thus the growth pole and growth centres need to be conceived as generators of employment infines of growth and command over their service areas which vary according to the rask growth potential and centres of economic momentum.

Unit 4 ❐ Metropolitan concept, Metropolis, Metropolitan Area & Metropolitan Regions, Mega City and Megalopolis

Structure :

4.1 Metropolitan concept

Lewis Mumford (1938-66) defined first it as a mother city, where more than 70% of urban population reside. They are the centres of administration, political & military establishment and commercial hub with a concentration of non-agricultural workers professionals. In the 20th century, the metropolis is found to dominate the process of urbanization whereby agglomerasion of labour, workers, traders & commercial people agglomerate to give a unchallenged structure. They are normally have more than a million population with specialization of economic activities leading to division of labour. A Metropolis has a defined area with crowded population who have been agglomerated due to centripetal force and couple of push-pull forces of migration. One celebrated author has said about an exploding retropolis in 1960s. The population concentrates heralded a new phenomenon in urbanization process-brought about the million cities. According to population census in India 2001, there are 35 such metropolises. They are incrising in number. The growth of the metropolis is not limited to population size of areal extent. They become multifunctional where by the domance of secondary sector of urban economy is challenged by the growth of the tertiary and quaternary sector of the economy. More important is that the service sector or informal sector provide refuse to the migrants who have no defined job. The metropolis in the post-Independence period is the 20th century when most of the colonial countries have been emerging as Independent nations.

4.2 Character of the Traditional Metropolis :

The modern metropolis has acquned the new characters. It is the central place having specialization in material production and terciary services. Its transport system extends to the larger region facilitating commutation of workers. It is a conglomeration of peoples fusetions and spatially segregated functional and land use areas. The worers have wide choice of occupation & work. The metropolis achives agglomeration economics and economics of scale. There will be competition among the function for space and location having maximum at the core and with dealing intensity with distance to the periphery. The metropolises grow to Mega city with conglomeration of people having morethan 5 million. All mega cities are also metropolis but all metropolises are not mega city. While metropolises grow in size its growth is accompanied by qualitative & quantitative change of its CAD, inereating spatials differentiation of place of work & place of residences facilitated by mass transit system. The metropolises are governed by local govt and administration/municipality changes its character to become corporation or special town authority.

4.3 The Metropolitan Area :

When the urbanization takes places beyond the municipal boundary or juricdiction and the metrocity expands territorially to include the urban fringe area or peri-urban area with a number of urban growth areas the process results in urban expansion where in the metro-city problems appear in very many forms and planning problems appear in the areas outside the administrative boundary, it acquired or name Metropolitan Area. In fact, Metropolitan Area is the planning area for rendering the urban structure. It is defined in very many ways in the urbanized countries. In India we shall site a few examples of metropolitan areas in India. In case of Calcutta Metropolitan Area in an illustration. The metropolitan area of calcutta (Kolkata) refers to three different terminology — CMD (Calcutta Metropolitan District delinased by the CMDA) for planning purposes, CMA (Calcutta Metropolitan Area) & CMSUA (Calcutta Metropolitan Standard Urban Area). The last one was consed in 1981 census with an area of 1468 sq km consisted of the following units (CMDA-1990).

(a) 3 Municipal Corporation, (Calcutta, Howrah & Chandannagar)

(b) 31 Municipalities,

(c) 3 Notified Areas,

(d) 70 non-municipal urban units of

(e) 390 Rural Mouzas with potential to become urbansoon.

The Delhi Metropolitan Area extends over 2073.68 sq km including the union territory of Delhi & some parts of UP & Hariyana which are functional dependent on Delhi & spatially linked with surface transport rail & road (even extending the metro system). Town such as Ghaziabad, Loni, Faridabad, Bahadurgarh, Gurgaon, Ballabhgarh & Narela. Its areas extend covers a radius of 25 to 30 km from the central city and established a close affirity and interlinking economies, housing, other infrastructure subscrients to central city. There has been sharp decline in population density. The trend is farther spatial expansion. The Delhi Metropolitan Area has extended the Megacity to form a planning region popularity known as National Capital Region. Similar is the case of Mumbai, Chennai, Bangalore and Hyderabad which shall be treated separately. The Metropolitan Areas are primary planning Area (PPA).

4.4 The Metropolitan Region

According to the population census, 2001 there are 35 metropolises in India, six of them have become Megacities. The metropolitan regions contain some rural settlements which are spatially linked to the metropolis. Various kinds of definition has been put forward to define Metropolitan Region. In USA, it is 'Umland' (Ullman, USA), City Region (in France by Dickinson 1964) extend upto 30 km radious. Daily commuters zone, influence zone or the macro-region forming the hinderland. Under all circumstances, the central city form the primate city in urban hierarchy. This areal extent is oriented towards the metropolitan centre. It is observed three levels of regional delineation in case of calcutta — while Calcutta-Howrah twin city forms the core. CMDA is the Metropolitan Area and the Metropolitan Region extend beyond the territorial limit of W.B and forms the hinterland region.

4.5 Concept of Mega City

In 1995, the concept of Megacity was put forward. Mega Means a very large city — whose population exceeds 5 million or so. The megacities are those metropolises which have super dominance in urban hierarchy in city system. They are primate cities in the region they are located. In 2001 clases we have identified six such cities of India which had population more than 5 million according to 1991 census plus those metropolises which are expected to reach 5 million by 2001. These mega cities

are Mumbai, Kolkata, Chennai, Delhi, Bangalore and Hyderabad. They will increase in number in the next census year 2011 (see accompaning literature for details).

4.6 Megalopolis

Jean Gollmann, a french geographer when studied the urbanization process in the NE Atlantic seaboard was overwhelming with the gigantic urbanized area extending from Boston on the north to Norfolk in virgined in the south was looking for a new name to identify such large urbaniged belt. He got the idea of a great city formed by the greek in its ancient settlement system. The Greek dreamt of a city which will command the material resources of the world & world form the centre of the earth of human settlement system. He discovered the word "Megalopolis"—a world city and given the name to his study area of NE Atlantic coast. As a matter of fact urbanization metropolitanisation and megalopolitanisation are the serial stages of the evolution of urban landuse, function and spatial organisation. Urbanization refers to the process of population shift from rural to urban areas with agglomeration process metropolitanisation refers to the spatial organisation resulted by urbanization process, the megalopolitamisation is a special case of urbanized belt having continuity in space of function of having polynucleated metropolitan complex. Even Lews Mumford in the classification of human settlements from lowest order from a village to market town, then to city, metropolis, megalopolis (the bloated city), tyrennopolis (i.e. tyrasical city) and finally to nekropolis (i.e. dead city). CA, Doxiades has extended the concept to dynapolis and ecumenopolis, each of them are having different structure and spatial dimension, each superseding the other and having distinctive planning problems & policies.

Even though the concept of megalopolis is old one but the dream of megalopolis was never materialised in the Ancient period. Now in the 20th century, such dream has become a reality and have resulted in a very complete system of human settlements.

4.7 Urbanization in India and the Management of Mega Cities*

Introduction

The urban India has been shaped up by the century long urbanization process during 1901 to 2001 and has still been evolving because of changing urbanization policies adopted in the recent years. In 1901, the urban structure of India depicted

only one metropolis (million city, i.e. the city of Calcutta) and a large number of small and medium size towns. The level of urbanization was low and the process of urban development was slow. Such lopsided urban pattern could be explained by sluggish economic growth under the colonial rule. In 1901 the level of urbanization was only 10.85 per cent (Table - 1). There was a set back in the process of urbanization in 1911, however, k was steady after 1921. The partition of India in 1947 had a great impact on the urbanization process not only in India but also in the newly emerged countries of the subcontinent, i.e. West Pakistan and East Pakistan (later these countries were renamed as Pakistan and Bangladesh, 1971).

The displaced migrants of both the nations found their destinations in and around the Metropolitan cities. The influx of refugees was directed towards the large cities. However, both the nations tried to contain such migrants in planned manner.

Table : 1 Urbanization in India during the twentieth century.

Census year (in million)	Total population per decade	Percent variation (in million)	Urban population per decade	Percent variation population	Percent urban to total
1901	236.3		25.7		10.9
1911	252.1	+05.7	26.6	+02.4	10.6
1921	251.4	-00.3	28.6	+07.3	11.4
1931	279.0	+11.0	33.8	+18.4	12.1
1941	318.7	+14.2	44.3	+31.1	13.9
1951	361.1	+13.3	62.6	+11.2***	17.3
1961	439.2	+21.5	78.9	+25.9***	18.2
1971	548.1	+24.5	109.11	+38.2	20.0
1981	683.3	+24.66	159.5	46.4	23.3
1991	846.3	23.85	217.61	36.46	25.7
2001	1027.0	21.35	285.35	31.13	27.78

Source: Census of India, 1971 and 1991, general population tables part IIA and 2001

* Estimates

*** If the urban population of 1951 is adjusted to the 1961 definition of urban places, the quantum of urban population in 1951 would get reduced and the rate of urban population growth during 1951-61 will be 34 per cent.

* This lecture note is the revised version of the paper by the author "The Road Map of Urban India" published in the Indian Cartographer Vol.24., 2004, the Journal of INCA XXIV Inetmational Congress, October 2004.

Table : 2 Metroplitan Cties of India 1991-2001 and Decadal Growth Rate 1971-2001.

		Population in '000			Urban area	
		1991	2001	1971-81	1981-91	1991-2001
1.	Agra	955	1321			38.32
2.	Ahmedabad	3,297	4519	45.94	28.94	37.06
3.	Allahabad	858	1064			24.01
4.	Amrksar	709	1049			47.95
5.	Asansol	764	1008			31.94
6.	Bangalore	4,086	5687	75.56	39.87	19.18
7.	Bhopal (MC)	1,063	1455	74.35	58.51	36.87
8.	Calcutta	10916	13216	23.90	18.73	21.07
9.	Chennai	5361	6424	35.31	24.99	39.83
10.	Coimbatore	1,135	1446	25.01	23.38	27.40
11.	Delhi	8,375	12791	57.09	46.18	52.73
12.	Dhanbad	817	1090			33.41
13.	Faridabad	613	1055			72.10
14.	G Bombay	12,571	16368	42.94	33.43	30.20
15.	Hyderabad	4,280	5534	42.65	67.04	29.30
16.	Indore	1,014	1639	47.85	33.13	61.63
17.	Jabalpur	887	1117			25.93
18.	Jaipur	1,511	2324	59.42	49.18	53.50
19.	Jamshedpur	834	1102			32.13
20.	Kanpur	2,111	2690	23.53	28.81	37.45
21.	Kochi	1,139	1355	48.82	38.14	18.96
22.	Lucknow	1,642	2267	23.79	62.97	38.06
23.	Ludhiana (M Q)	1,012	1395	51.32	66.72	37.85
24.	Madurai	1,093	1195	27.58	20.49	09.37
25.	Meerut	847	1167			37.78
26.	Nagpur	1,661	2123	40.80	36.24	27.81
27.	Nashik	722	1152			149.58
28.	Patna	1,098	1707	66.71	19.55	55.46
29.	Pune	2,485	3755	48.55	47.38	51.10
30.	Rajkot	651	1002			53.91
31.	Surat	1,517	2811	87.40	64.21	85.30
32.	Vadodara	1,115	1492	67.36	42.54	33.81
33.	Vaianasi	1,026	1212	25.50	28.77	18.13
34.	Visakhapatnam	1,051	1329	66.08	74.27	26.45
35.	Vijayawada	845	1011			19.64
	All Total	70,661	107,882	51.35	67.76	52.67

Table : 6 Mega Cities of India - 2001

Urban Agglomeration	Population in '000			Decadal Growth in%		
	1981	1991	2001	1971-1981	1981-1991	1991-2001
1. Delhi	5,729	8,419	12,791	57.09	46.18	51.9
2. Greater Mumbai	8,243	12,596	16,368	42.94	33.43	29.94
3. Kolkata	9,194	11,022	13,216	23.90	18.73	192
4. Chennai	4,289	5,422	6,424	35.31	24.99	18.49
5. Bangalore	2,921	4,086	5,687	75.56	39.87	39.18
6. Hyderabad -Secundrabad	2,545	4,280	5,533	42.65	67.04	29.30
TOTAL	32,921	45,825	60,019	39.10	39.19	30.97

Source : Population Census of India - 1991 & 2001

With the introduction of planned economic development in 1951, followed by steady economic growth in 1951 the level of urbanization increased to 17.3 per cent in 1951 in India. The share of city population (with 100,000 population) in 1951 recorded 44.4 per cent, correspondingly the shares of medium size towns (with 20,000 to 100,000 population) and small towns (with less than 20,000 population) were 25.8 per cent and 29.8 per cent of total urban population respectively in India, The share of city population in 1991 increased to 65.20 per cent with corresponding decline in the share of medium and small size towns to 24.14 and 10.66 per cent respectively. By 2001, the urban population of the country increased to 285 million or the level of 27.78 per cent. The highest rate of urbanization was achieved during 1971-81 at 46.4 percent. There has been deceleration in the urbanization process in India since 1981 but there was no slackening in the growth of the metropolitan cities. They grew at much faster rate than other size class cities/ towns because of their strong economic base and having exerted pull on the migrants in the poverty stricken rural hinterland areas.

By the end of the twentieth century, there were 35 metropolitan cities in India in 2001 against only one i.e. Calcutta in 1901 (Table - 2). The urban pattern in India

has been a consequential phenomenon of economic growth. The 21st Century India has inherited a spatially and structurally unbalanced urban pattern dominated by the metropolitan cities.

Urban Development Efforts During the Plan Period

During the First Five Plan, a need was felt to formulate a National Town Planning Act for urban development. The main task was to settle the refugees from Pakistan and producing a housing plan, slum clearance and restriction of slum expansion. There were efforts to construct new towns to accommodate the displaced people in the green field locations such as Chandigarh and also on the outskirts of the existing cities and towns. The Second Five Year Plan gave priority to set up the Industrial towns as the potential centres of urbanization. The preparation of Master Plans of 21 cities was taken up for coordinated urban development. The Town and Country Planning Act were formulated to revamp the civic administration. The concept of slum clearance has been revised to achieve slum improvement, as the slum clearance is not enough unless the slums are rebuilt and resettle the affected people. The bias was towards large city development and industrial towns. These capacity building of the institute responsible to such development. The thrust on the development of Small and Medium size towns continued during the Seventh Plan.

The National Commission on Urbanization (NCU) headed by Charles Correa was constituted in October 1985 to examine the state of urbanization in the country, to identify priority action areas and to formulate specific guidelines for an action plan for managing the rapid urbanization. The Commission submitted its reports to the Govt. on 19th August, 1988. Based on the NCU recommendations two important bills, viz. Nagarpalika and Panchayati Raj were passed by the Parliament in 1989 to revitalize the local bodies but could not be implemented because of political and economic uncertainties.

The efforts on urban development were rejuvenated during the Eighth Plan after a gap of two years in 1992. The emphasis was given on the strengthening the economic and physical infrastructure and for self-supporting sustainable urban government. The policy of urban development could not be conceived in isolation of rural development as both the systems of human settlements make a comprehensive whole and are interdependent on each other. The urban development policy has to be supported by simultaneous rural development policies. Hence, the 73rd and 74th

Constitutional Amendments Acts have been passed by the Government in 1992 to address the development of urban and rural areas at the same time. While the 73rd amendments are related to the development of rural areas, the 74th one was meant for urban development These enactments had coincided with the economic reforms and provided a fillip to the private sector initiatives for urban infrastructure development such as in telecom, electricity etc. The local bodies have been given power to raise resources by levying on the 'user charges', pricing of water supply and operation and maintenance of civic amenities.

The 74th Constitutional Amendment Acts: 1992

In view of the growing gap between the demand and supply of basic infrastructure services of safe drinking water, sanitation, sewerage, housing, energy, transport and communication, health and education because of increased urbanization and severe environmental problems an integrated urban management policy relating to development planning, resource mobilization, capacity building and responsible administration has been formulated. For this purpose, the Constitutional Amendments Acts-1992 has envisaged effective decentralization of the functions of the municipalities and the state governments to urban local bodies (ULB). The functions and responsibilities of the local bodies have been laid down in the Twelfth Schedule of the Amendment Act. The Legislature has to provide the legal provisions authorizing the ULBs to levy, collect appropriate taxes and duties to augment revenue / resources so that the ULBs need not depend solely on the govt. grants. The State Finance Commission shall review the principles of determining taxes, duties and grant-in-aid to the Municipalities but even after a decade there has hardly been any improvement of the ULB's financial capacity. Besides, revenue from non-tax revenue sources has been lagging behind. The ULBs are very much dependent on external sources and are not financially viable. The beneficial impact of the 74th Amendment is yet to be experienced.

The Mega City Program

The Mega City Project was launched by the Central Govt. in 1993-04 taking the queue from the NCU recommendation for the four metro cities- Calcutta, Mumbai, Chennai and Delhi to upgrade the infrastructure of these super metro- cities. Later on Bangalore and Hyderabad-Secundrabad have been added as they have potentiality to cross over five million population by 2001. Delhi was treated separately within the

framework of National Capital Regional Plan. Up to 1999-2000, 375 projects have been executed with a capital investment of Rs. 3,089.7 crores. In the Ninth Plan, sums of Rs. 500 crores have been allocated. To contain the population pressure due to heavy migration to Delhi obtained through direct/ indirect revenue generation with varying interest charge on the capital.

(iii) The basic services needed for maintaining quality of life in metro cities have to be provided. The poverty alleviation programme should not exceed 20% of the project investment and may be treated as grants.

The above projects have been designed on 40:30:30 basis to attain viability.

6. The scheme shall be administered through Ministry of Urban Development channelising the funds through specialised nodal agencies at State level.

The iflfrastructural assets created shall be maintained on continued basis. The nodal agencies are KMDA for Kolkata, BMRDA for Mumbai, MMDA for Chennai, HUDA for Hyderabad -Secunderabad and in Karnataka Urban Infrastructure Development & Finance Corporation for Bangalore.

The mega city project emphasizes the necessary infrastructure financing for urban management in large cities. The flow of capital for development purposes and social sector from international agencies and donor countries. Budgetary support and subsidies could be reduced.

The mega city project aims at self sustainable urban development through:

(i) A judicious admixture of Government and private capital

(ii) Planning for both remunerative and social welfare schemes.

As a matter of fact, the mega city project is not a spatial plan, but a funding scheme for development of large metro areas. The areal extent of the plan is left to the nodal agencies.

Conclusion

The process of urbanization has favoured only the growth of the large cities as urban ward migrants find their destination towards the large cities. Urban India depicts a structurally and spatially imbalanced urban pattern. The pattern is dominated by the large cities and metropolises. This pattern has been evolved due to spatial concentration of economic activities in the urban India, leaving behind the large rural

hinterland with low level of urban growth and under developed rural economy. The urban India has drained out the rural hinterland in exploiting natural and human resources. There has to be a change in the urban map of India if the rural hinterland participate in the urbanization process to make it multi-dimensional and urban decentralization, provided there is deceleration in the rural-urban migration of the people to metropolitan cities and the process of metropolitanization is thwarted.

A significant change in the structure and pattern of urban India has been envisaged in the urbanization policy. As a component of decentralized urbanization policy, IUDP was undertaken in 1974 and continued drrough 1980's and 1990's will make an in-road to the urbanization pattern. A comprehensive urban policy in India would aim at the revitalization of civic bodies, reform of Municipal Administration, strengthening of the IDSMT program by making it an investment oriented on the local economy, effective implementation of employment generation program such as NRY (1989), slum improvement program including EIUS and UBSP, etc. These programs are to be operationalised in all the states. The urban policies could directly contribute to achieve the goals of poverty alleviation and removal of unemployment and under employment. The urban informal sector caters to the largest share of the labour force. This sector needs to be upgraded and integrated with the urban economy.

The metro-cities have been accounting for a large share of urban population growth. One significant fact is that the Mega Cities themselves have been growing slowly but cater to the sizeable portion of urban population. They have been expanding horizontally having rapid but haphazard growth of the fringe areas.

Unit 5 ❐ Basic Principles of Regional Planning

Structure :

5.1 Introduction

The basic principles of regional planning include correct inventary of resources, their efficient utilisation, transport and communication network to make goods & services intra-regionally & interregionally, employment generation and providing living to the people.

A long term regional plan takes into account capabilities over a long period of time & help the formulation of normal development plan, fixing the achievable target of economic development—agriculture, Industry, roads, railways, forests & minerals, fishing, thursing, animal husbendary to sustain it on a long term basis.

The regional planning is a means to national development of which it is a cimponest. The national economy is conceived as a system on which regional economics are sub-system of national economy. The principle objective of regional planning is to achieve integrated and comprehensive development to raise the standard of living and strengthen the regional economy as far as possible self-relient development.

A regional plan be it an adhoc region or administrative unit of a nation may have following structural elements —

1. Economic structure — with output and employment and income distribution. Types of production units from agriculture, mining, small scale industries etc. to reorganisation of employment structure.

2. Social structure — Social development leads to manpower document all classes of people should be brought under the planning process to share the development benefits.

3. Peoples' participation and administrative structure

The regional and local govt should be involved in decision making process & administrating the plan execution and assets or evaluated in the context of objectives achived or not. Involvements of peoples' participation in the whole process & planning, decision making and evaluation of the benefits of planned development. The local bodies involvment bring transparency in the whole process.

4. Social & Economic Infrastructure

The infrastructure has two components : needs & demand. The health services, portable water suply, sewage disposal, roads other types of transport & communication, primary education, are to planned need based on social welfare oriented. Wheras the process of development would generate better income and would create its own demand for costly services. Specialized functions just as IT & comparatives higher technical education like medicine, engineering would be demanded and should be paid for. These are development based services.

5. Land use & Land development, mining, settlement pattern

The land and land related resources form the economic foundation of a region. The land resources inventing has to be needs of the society. Allocation of land for different types of use — i.e. for agriculture forestry/mines, settlement land & all other uses including for recreation, transport & communication has to be made satisfactory.

A regional plan is to be drawn up based on the analysis of the past situation, presently need & future demand. This should be dynamic analysis — having a foresight of the future situation. Relevant stratigies are to be involved to maximise the benefit and minimise the development cost. Project appraisal need to be carried out with the help of benefit-cost analyses. If the development objectives outstanding the cost, the project may be rejected. The programs of action have to be tested against their relevance, effectiveness & implementability. The planning process need to be evaluated constantly while the plan at land is being implemented. Like national plans, regional plans are to be evaluated in respect of priorities allocated to the new situation resulted. A regional plan has to provide a framework of identified goals & be drawn up integrating the local plans and projects in integrated manner. The planners themselves should have a broad professional training drawn from various disciplines. The views of the subject experts have to be given due supertance in drawing up plans even though a difficult task.

A regional development plans when implemented shall accrue benifits which need to be scrutiniged against the goals set at the inception. So the planning process has to be flexible enough to accommodate the realised goals and objectives and may need to reoriented as may be required.

The wholse process of regional plan preparation, implementation and simultaneous evaluation should be integrated. After all, the success of any regional plan has to be weighed against administrative and political will of the peoples. Every regional plan is both entegrative and comprehensive in the hiererchical framework of multi-level planning and has to cover the social, economic, physical, technical and administrative aspects of planning. The comprehensiveness of regional planing is multi-dimensional and interdisiplinary in nature. Each participating disciplines have their own orientation and views of the planned society. Finally a common ground has to be evolued to accommodate all the individual disciplines. Regional planning is an action oriented activity where in a compromise may be needed to maintain its comprehensiveness.

5.2 Regional Planning in India : Case Studies

Since the inception of India's economic planning in 1951, when the First Five Year Plan was adopted it was highly sectoral but some references were proposed to include some of the problem areas particularly the poverty stricken depressed regions and their problems were incorporated in the national economic developnment planning by re-organising the administrative structure from villages to community developments blocks (CD Blocks) to use these units as building blocks of India's development.

In 1956, the second Five year plan objectives were shifted from primary sector to secondary sector & economic development providing priority to the establishment of largescale manufacturing industries to lay the industrial economic foundation of Indian economy. These industries being natural resource base. These resources are found in the backward areas and it is expected that the location of the manufacturing industries in the resource rich but economically backward areas shall open up these regions for economic development and employment generation. The location of such industries while benefited the national economy, the regional economies have been bye passed having little multiplier effect on the regional economics. The result was imbalanced regional development and ineresed regional disparity in levels of regional development.

The location of capital intensive healthy industries such as Iron & Steel, Cement, Fertilizer and Coal based and Coal oriented industries was not part of the Regional Development Policies but they are based on technoeconomic advantages. So regional disparity persists even though there had been largescale industrial development. In the third Five year plan, to strengthen the industrial complexes down stream industries were located in and around the heavy industries. Industrial Estate programme of 1962 was supposed to decentralize industrial development, but in fact only those Industrial Estated located near the heavy industries and were functionally linked with them could succeed. Industrial Estates in the backward areas did not take off the ground. Even the price equalisation policy of iron & Steel, coal, cement & fertilizer failed to decentralize the industries. Of course the growth of the metropolital regional economics could be strengthened contrary to the process of regional planning for industrial location.

Here we shall discuss only the planning program undertaken in the Kolkata Metropolitan Regional Development and that of the Damodar Vally Region undertaken by the DVC along with the Planning Commiccion. Regional Development planning got added importance since the Fourth Five year plan (1964-74) with the recommendation of the Pandey Committee for indentification of industrially backward areas and that of Wanchoo Committee (1968) for location of industries in the identified backward areas and the states. A number of area based development programs have been undertaken for study and research with the technical assistance of the Ford Foundation and Commercially developing program. Multiplication of such area development programs with the identification of target-grouped, target sectors and target area was a diversfied approaches of regional planning. Thus economic planning was oriented to social development which was absent so far. The reorganisation of local areas and villages into community development blocks (CD) provided the base for bottom up approach to Indian planning which were so far sectoral one. In 1970s & 1980s many of the districts of many states were farther sub-divided into development blocks & a new districts. Thus the Districts level planning got importance.

These new units/areas did not have any statury gout to undertake the regional planning at ground level. Following the recommendations of Balwant Rai Mehta's Committee a Panchayat Raj (1958-59) many states have insistrated planning from below towards the end of 1970s. The state of W.B. and kerala went ahead with the process of multilevel planning.

Eventhough in 1989, the Govt. passed the enactment for decentralized planning, it has to wait untill 1992 when the central govt. made Constitutional Amendments Acts (73rd & 74th) and ratified by most of states in 1993. These Amendment Acts were implemented by the creation of Government at village level, Blocklevel & District level who could take decision having constitutional power. The decentralization of planning is possible when there is decentralized power (Govt.) and disaggregated local level planns. The main strength of the decentralized planning lies on the decentrlized power to act and implement their decision subject to approval of the next higher order govt. The multi-level planning is possible when the functions are also decentralised. This new approval to regional planning augmented peoples' participation in the decission making process.

5.3 Development in the Damodar Valley Region, India

5.3.1 INTRODUCTION

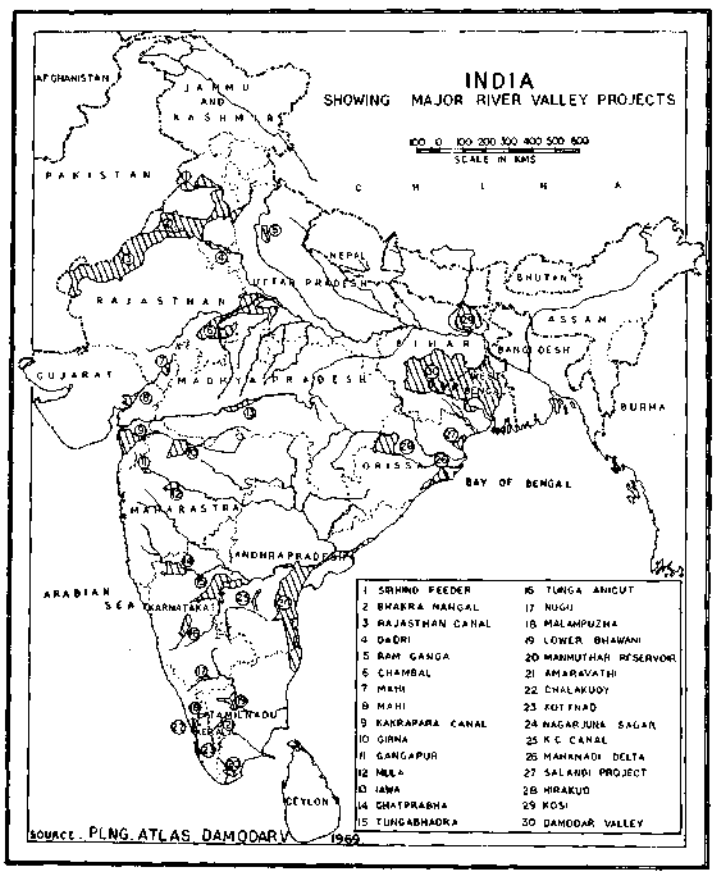
The Damodar Valley Corporation in India (DVC) had celebrated its 50th birthday on 7 July 2008. When one looks back to ascertain the performance of the Corporation towards the realisation of its basic objectives during its life-time, one fails to understand the causes of the unprecedented flood that has devasted the lower West Bengal, rendering millions homeless ahd destroying crops worth Rs. 500 million (£30 million) at current prices in West Bengal alone in 1945. The Damodar used to traditionally wreak havoc in Bengal year after year; but this should have been a fairly distant memory with the advent of the DVC. In the last week of September, 1978 when all its reservoirs were full to the brim, about 72 cm. of rainfall occurred incessantly for three days because of cyclonic cloud burst of the retreating monsoon over the Damodar Basin causing plight among the inhabitants. Portions of the South Eastern Railway were washed off, the whole of the lower West Bengal was deluged with flood water, and the rest of Central and South India remained cut off from Calcutta for months together. We need to look back particularly at what was wrong with the DVC: why could the DVC not control or moderate the flood?

Of course, the DVC has never admitted that the danger from flood has been removed once and for all, as it was never allowed to complete the original project proposed in Voorduin's plan. The DVC had suggested a separate treatment for its

lower valley tributaries and other rivers in an integrated manner as those rivers also contribute to the West Bengal flood.

5.3.2 SITUATION PRIOR TO THE ADVENT OF THE DVC

The river Damodar rises from the Khamarpet hills at the meeting points of Ranchi, Palamau and Hazaribagh districts of the Chhotanagpur plateau, at an altitude of about 2000 ft. (Fig. 1.) The river flows for about 336 miles eastward to join the Hooghly near the ill-famed 'James & Mary' sands before entering the Bay of Bengal. As early as 1757, the Damodar had flowed directly eastward to join the Hooghly near



Triveni north of Calcutta. Through the years, the silt built on the northern bank and on the channel itself caused the Damodar river to follow an escape by veering sharply to the south midway of Burdwan and join the Rupnarayana before its confluence with the Hooghly about 30 miles south of Calcutta, increasing the river length by 14 miles or so. The Damodar system drains a total area of about 9,400 sq. miles - two thirds

of which are in the hilly and undulating plateau. For the first 150 miles, the Damodar flows through Jharkhand with a slope of 18 ft per mile and flattens out to three feet per mile for another 100 miles and for the last 100 miles at less than a foot per mile. The area is heavily denuded of forests and vegetal cover and calls for land management, control of soil erosion and soil conservation, afforestation besides the controlling of its frequent floods. The lower valley had experienced about twenty major floods during the last hundred fifty years or so.

The average annual rainfall in the valley region is about 46 inches but most of it comes during the 4 -5 months of monsoon season. Besides its severe seasonality, with 84% run off coefficient, the river flow occurs as a 'flash flood' leaving no water after the rainy season for irrigation which is essential for even successful cultivation of kharif crop. Hence, the river which flows at higher levels than the surrounding area in the lower valley is often cut along the banks for irrigable water through old channels of the Damodar. The cuts, when made in the main river banks as heads for 'overflow canals' are 'Kanas'. The streams which used to have 'overflow' irrigation from the Damodar on the east during flooding season are called Kana Nuddees or Kana Damodar. "The main stream of the Damodar was closed at the right angular bend, and the whole supply of the river turned down south past Jamalpur, with heavy embankment on its left bank to protect the rich lands of southern Burdwan, Hooghly and Howrah. To irrigate these rich lands, seven canals were dug and the whole seven canals constituted a new delta. These canals or *Kanas* relieved the new Damodar, and between them they disposed of the whole excess supply which passed Burdwan".[1] The Damodar banks had assumed a fresh importance. These were known as 'Zemindari banks', breached by the peasantry after the flood is over to fill the old canals or 'dead rivers' with water and the country irrigated more or less perfectly[2] by the method known as Zemindari bank irrigation. The banks were frequently cut for irrigation, but reported as breached.

During 1847 to 1854, 168 breaches occurred. In 1855, the government took over the embankments and made them water tight. To protect the E.I. Railroad from Burdwan onwards a high embankment was constructed on the east bank of the Damodar to control the flood, and made a second bank. The Grand Trunk Road which used to breach before, was much raised and made a third bank and, later, the

1. Willcocks, Sir William, Lecture on Ancient Systems of Irrigation in Bengal, University of Calcutta, 1930, p. 14.
2. Ibid p. 21-22.

Eden Canal made two more banks (5 in all). However, in 1859 right bank of the Dam was removed for 20 miles as the land bordering the river was high. 'Lower down', the Damodar was 20 ft higher than the level of the country on the left bank; and further down still has breached its right bank and divided the Damodar into two streams. While the river freely overflows the right bank in flood time, the left bank of the Damodar is in water-tight embankments".[3]

Wherever the embankments were thrown-up, tanks and artificial lakes were choked with weeds and the crops suffered for want of fertilising silts. The districts of Burdwan and Hooghly abound in tanks and artificial lakes replenished with fresh and pure water of annual floods of Damodar providing drinking water and healthy environment. All this was changed when the Damodar was embanked to stop the inundations on the left bank; the escapes were in Kana Damodar, Kana Nuddee, Gya, Ilsura, Gargar, and the Banka with maximum discharge in Kana Damodar (1800 cu. ft./sec.) with 5 ft depth of water. All seven canals were shut down by 1864 "with malaria everywhere and fish nowhere," affecting 800,000 acres of land. The peasantry cried for help, hence Jamalpur Regulator opened to Kana Damodar and Kana Nuddee in 1875 and Eden Canal in 1881 which fed the Gya with a sluice gate to the rice fields. It provided irrigation free in the past, but since 1929 only if they pay for it, and provided to only 10,000 acres out of 700,000 acres.[4]

5.3.3 GENESIS OF THE DVC PROJECT

The Damodar is rather small in comparison with other rivers of India; but is proverbially known as the 'Sorrow of Bengal' —because of its turbulent flood creating havoc in the lower portion of Bengal where its flow is confined by narrow embankments.During the last hundred years the record shows the Damodar basin experienced serious floods almost once in every five years. The most devastating floods were recorded in 1898, 1913, 1935, and 1943. The latest, before the DVC came into operation, was during July 14 -16, 1943, and was caused by incessant rain in the middle valley for four days. The flood flow though only of 350,000 cu. ft. / sec. caused breaching of the embankments on the left bank and completely cut off Calcutta, a centre of war activities at the peak of World War II. Several days were necessary to restore communication between Calcutta and the rest of India through the Eastern Railway and the Grand Trunk Road (NH 2) which were badly severed.

3. Ibid p. 24.
4. Ibid.

The flood caused damage to property worth Rs. 500 million (£3.1 million). The then Governor of Bengal (undivided) appointed a ten member Board of Inquiry (Damodar Flood Inquiry Committee) with the Maharaja of Burdwan as Chairman and Meghnad Saha, an eminent scientist, as a member. The Board's report to the Government of India (August 1944) suggested the creation of an authority similar to that of the Tennessee Valley Authority (TVA) in the USA.

A river basin was taken up as a unit for regional planning and development first in the USA in 1933, with the creation of the TVA. The Tennessee river is about 900 miles long and with its nine tributaries drains an area of about 40,000 sq. miles in the Appalachian Region. The region was economically depressed but was endowed with good potential for development. The TVA, a corporate agency of the Federal Government was organised as multipurpose development authority with basic objectives of flood control, inland navigation, and power generation. The authority constructed 9 dams on the main river and 20 on its tributaries having hydropower potential as high as three million KWh. Besides it had a programme of forestry development and fertilizer production. The process of development in the valley region was far from a smooth one and was subject to severe public criticism with regard to its performance and management. However, the experiment being a pioneering one, had, despite its shortcomings, been able to bring about remarkable changes in the physical and socio-economic landscape of the region.

In the course of resource development the basin had changed its economically depressed character to a dynamic economic region with the development of its agriculture and urban-industries, although the role of the TVA has at present been reduced to only a power-producing body.

The idea of having a TVA-type development programme in India had been there since the late thirties but it was given a practical shape ten years later after the devastating flood in the Damodar Valley in 1943. Compared to the TVA, the DVC is a very small organisation, conceived within a different socio-political and economic framework in British India, and loses the validity of such comparison particularly in Independent India when these development programmes became the integral parts of the planned economy. The prototype of the TVA development plan was taken as a guiding star in the preparation of the Damodar Valley Development Plan. It was, however, not realised that the TVA had itself changed its strategy through time; nor

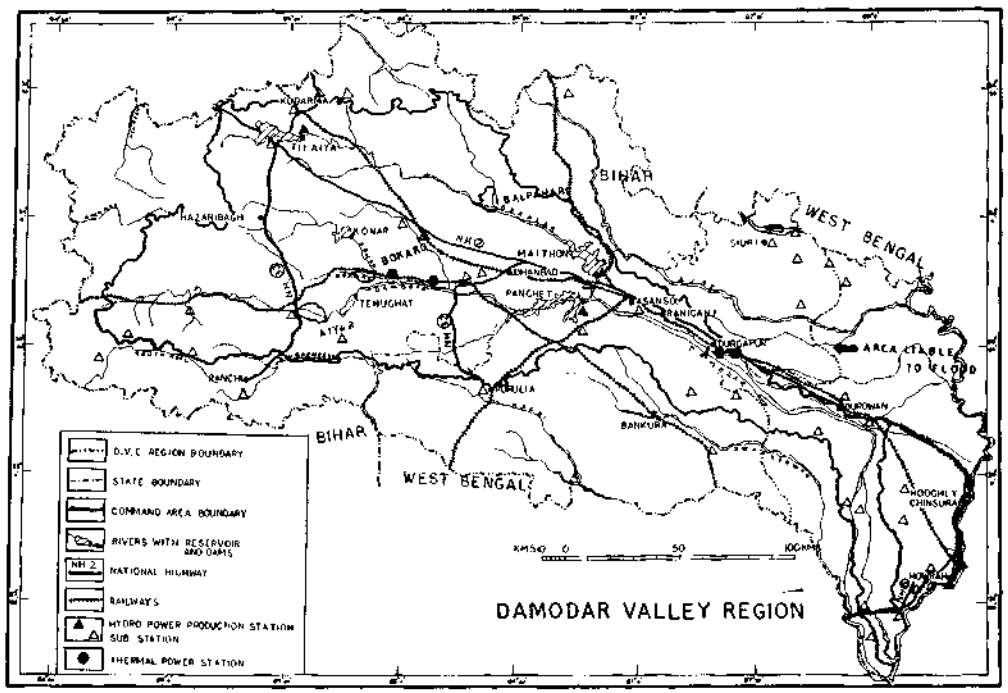
was it realised that the DVC would have to manage the increasingly complex activities generated as a result of its own policies and programme. At the end, it met with the same end as that of the TVA in the USA.

With the recommendation of the 'Committee for Prevention of Flood in the Damodar' (Bagchi (1967)) and that of the Governor of Bengal, the Central Technical Power Board appointed W. L. Voorduin from TVA in 1945 to prepare a project report for flood control. The memorandum drafted by Voorduin (known as Voorduin Preliminary Memorandum (1946)) was designed to achieve multiple objectives such as flood control, irrigation, power generation and navigation etc. for the unified development of the Damodar basin.

After careful deliberation of the Voorduin memorandum, and the expert committee report of the US Technical Mission, the governments of Bengal and (the then) Bihar and the Central Government agreed to set up a Corporation for designing and executing the long-range development programme in the Damodar Valley. In March 1948, the Damodar Valley Corporation (DVC) was set up and was organised in July 1948 as a statutory autonomous organisation by an Act of Central Legislature (the then Constituent Assembly) with unlimited power-even more than the constituent states of Bihar and Bengal. The Corporation was charged with the responsibility of preparing and executing through the existing public agencies a comprehensive resource development plan, but the primary objective was flood control. The project drew its inspiration by and large from the TVA and prepared an integrated scheme of flood control, promotion and operation of irrigation and water supply, generation and transmission of electric power, navigation, afforestation and soil erosion control, and promotion of public health, agricultural, industrial, economic, and general well being of the Damodar Valley and its area of operation.

5.3.4 THE DAMODAR VALLEY PLANNING REGION AND ITS DEVELOPMENT

The DVC demarcated a relatively small area covering only 8,500 sq. miles and designated as 'Commanded Area' (Fig. 2). This Commanded Area was too small for coordinated regional development as the influence of the Damodar Valley project was felt over a much wider area. Hence a planning region needed to be delineated for investigating planning problems in the river basin, and for formulating and implementing the regional development plan.



The Joint Committee for a Diagnostic Survey of the Damodar Valley Region was set up in 1957 at the instance of the Planning Commission, Government of India, and the work was entrusted to the Technical Advisory Committee (TAC) consisting of the faculty members of the Department of Geography, Patna and Calcutta University and the Department of Architecture and Regional Planning, Indian Institute of Technology, Kharagpur. The study area was delimited by about 22,000 sq. miles extending over five districts/sub-districts of South Bihar and six districts/sub-districts of Southwest Bengal and has since been mapped. We have delimited again the region to cover nine districts with an area of about 21,343 sq. miles (excluding a subdivision in each of Palamau and Birbhum districts because of their remoteness from the planning activities of the region) with a population of 15.64 million in 1961 and 19.26 million in 1971 (Table 1). The upper region is sparsely populated and the people are mainly tribal. The lower portion is thickly populated with agriculture as the predominant occupation. Along the valley axis, a number of urban-industrial centers have grown. The mineral resources have decisive influence on the industrial growth of the Region; The coal fields of the valley account for about 66% of the reserve and more than 65% of national production (Table 2 and 3) and the coal is of exceptional quality. Besides, the region is endowed with good deposits of important

minerals like limestone, fireclay, mica, bauxite, china clay, and a large number of abrasive and refractory minerals.

The proximity of the Damodar coal, the iron ore of the Chhotanagpur plateau and other important input raw materials, the excellent accessibility to Calcutta market by the Eastern Railway and the G. T. Road (N.H.2), a flat valley bottom and water front location, cheap power supply from the DVC (thermal and hydro-projects), and the governmental policy for developing a resource region have led to the industrial development of the region. A number of public sector undertakings were developed, particularly during the second plan period. The expansion of already existing industries - iron and steel at Burnpur and Kulti, Chittaranjan Locomotive, J.K. Nagar Aluminum, and the establishment of a steel-chemical complex at Durgapur, iron and steel at Bokaro, the Heavy Machine Tools Factory and High Tension

Table 1. Total and urban population in the Damodar Valley Region—(1961-1991) (figures in thousands)

	1961		1971		1981		1991		2001	
Name of the District	Total	Urban	Total	Urban	Total	Urban	Total	Urban	Total	Urban
Howrah	2038	825	2417	1013	2866	1245	3399	1529	4273	2150
Hooghly	2231	579	2872	760	3697	998	4758	1310	5042	1687
Burdwan	3083	561	3916	892	4975	1418	6320	2254	6895	2547
Bankura	1665	122	2031	152	2478	189	3024	234	3192	235
Purulia	1360	92	1603	132	1889	189	2226	271		
Santhal Pargana (Deoghar and Jamtara Sub-divisions)	807	67	963	86	1148	110	1369	142		
Hazaribagh	2396	201	3020	389	3806	751	4797	1452		
Ranchi (only Sadar Sub-division)	899	164	967	243	1039	360	1118	533		
Dhanbad	1159	290	1466	658	3122	1404	3951	3090		
TOTAL:	15638	2901	19255	4305	25020	6664	30952	10815	4449	1113

Table 2. Coal Production in India, D. V. Region, Bihar and West Bengal

Year	Bihar		West Bengal		D. V. Region (Bihar - Bengal)		India
	Quantity produced in Million Tons	% of the Total (India)	Quantity produced in Million Tons	% of the Total (India)	Quantity produced in Million Tons	% of the Total (India)	Quantity produced in Million Tons
1960-61	21.24	38.15	18.59	33.39	39.83	71.54	55.67
1963-64	20.28	31.14	21.61	33.18	41.89	64.32	65.13
1967-68	30.37	43.60	20.01	27.81	50.38	70.02	71.95
1968-69	32.31	42.85	19.64	26.05	51.95	68.90	75.40
1969-70	35.38	46.71	20.29	26.79	55.67	73.50	75.74
1970-71	33.82	46.36	18.61	25.51	52.43	71.87	72.95
1971-72	31.51	43.51	17.04	23.53	48.55	67.04	72.42
1972-73	33.29	43.11	19.08	24.71	52.37	67.82	77.22
1973-74	33.22*	41.19	19.38*	24.79	52.60*	67.29	78.17
1974-75	36.93*	41.77	21.14*	23.91	58.07*	65.68	88.41
1975-76	41.76*	41.89	23.72*	23.79	65.48*	65.69	99.68
1976-77	42.31*	41.87	24.10*	23.85	66.41*	65.73	101.04
2006-07					341.50		441

* 2006-07—Provisional

Insulator plant at Ranchi (HEC), Indian Explosives at Gomia (Hazaribagh), Sindri Fertilizer and chemical plants, etc. and the expansion of Hooghly riverine textile and engineering industries - have contributed significantly to the industrial development of the region.

Industrial development in the region has been closely linked with the resource base, particularly coal, both in qualitative and quantitative terms. Good quality coal is exploited in the

Table 3. Coal Reserves in India, D. K Region, Bihar, West Bengal and Coal-Fields of D. V. Region (Bihar-Bengal)

State/Coal-Field	Gross Reserve in Million Tons	% of the Total (India)
West Bengal	*20103.90*	*24.02*
Raniganj	19565.14	23.38
Barjora	538.76	0.64

State/Coal-Field	Gross Reserve in Million Tons	% of the Total (India)
Bihar	*35230.19*	*42.11*
Jharia	12817.41	15.33
East Bokaro	1992.95	2.38
West Bokaro	3323.38	3.97
Ramgarh	936.15	1.12
Giridih	37.28	0.04
North Karanpura	8668.74	10.36
South Karanpura	4446.71	5.32
Auranga	118.64	0.14
Hutan	80.75	0.09
Daltanganj	87.91	0.10
Deogarh	38.30	0.05
Rajmahal	2681.97	3.21
D. V. Region (Bihar-Bengal)	*55334.09*	*66.13*
India (Total)	*83674.00*	*100.00*

coal fields of Raniganj (WB), Jharia, Dhanbad, Bokaro, East and West Karanpura fields, and Giridih (Bihar), comprising more than 65% of India's total production of 104 million tons (1976 -1977). Thermal power plants at Chandrapura, Bokaro, Patratu, Durgapur and Santaldihi based on Damodar Coal and hydro-power stations at Tilaiya, Maithon and Panchet-with a total installed capacity of 1300 MW-have created added advantage for industrial growth.

The above mentioned present-day industrial trend in the Region was largely initiated at the beginning of the second Five Year Plan when the Industrial Policies (1956) were firmly laid down with emphasis on public sector heavy industries. About 25 industrial subtypes (or 13 groups) have been identified in this region. They employed about 228,000 workers in 1958, which was almost doubled over the next ten years, and now employ more than 600,000 workers. Machineries and electrical, gas and steam industries have shown maximum growth followed by basic metal and transport equipment. While modern industries have grown at a considerable rate, the old and

traditional industries on the Hooghly side have shown decline in employment. The factory industries have grown in the Damodar Valley Region forming a series of industrial complexes.

Any further programme for industrial development should fill in the intervening areas of the industrial complexes giving rise to a continuous chain of industrial centres from Durgapur on the east to Ranchi on the west swinging along the river Damodar.

The structure and pattern of human settlements are closely related to the regional economic activities and largely influenced by the physical and social conditions prevailing in the region. The coal mining activity and industrial development have recently attracted a large number of rural migrants to the collieries and industrial centres in the region and have swelled their urban share of population. The level of urbanisation measured by the percentage of urban population in the Damodar Valley Region has risen from 14.78% in 1951 to 18.55% in 1961 and to 22.36% in 1971 (Table 4). A rapid urban population growth (48.36%) in 1961 -1971 has been caused mostly by the impact of industrialisation. The valley region has maintained this pace of urbanisation even in the 1970s. The pattern of change is indicated in Figs 3, 4 and 5.

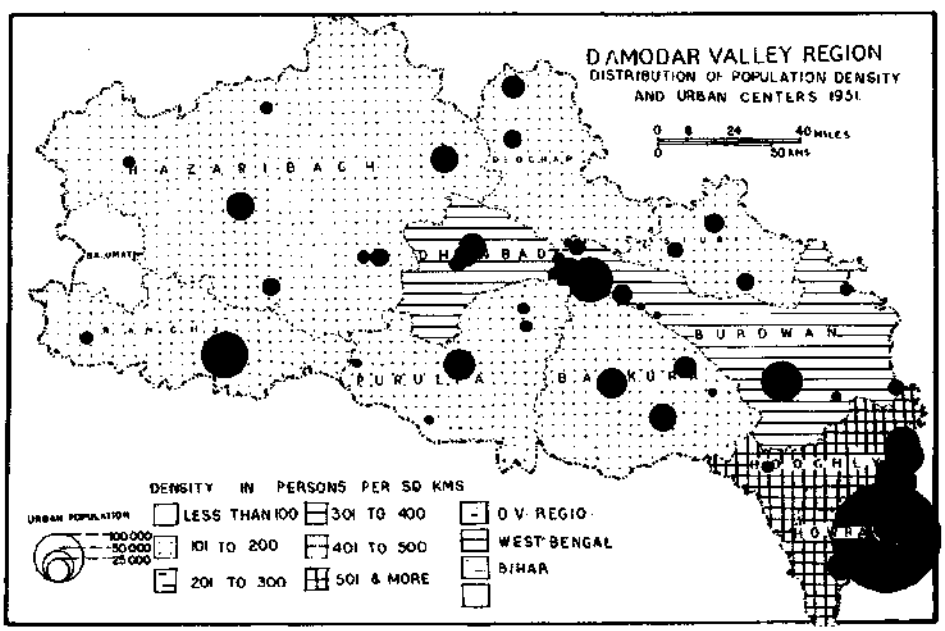


Fig : 3

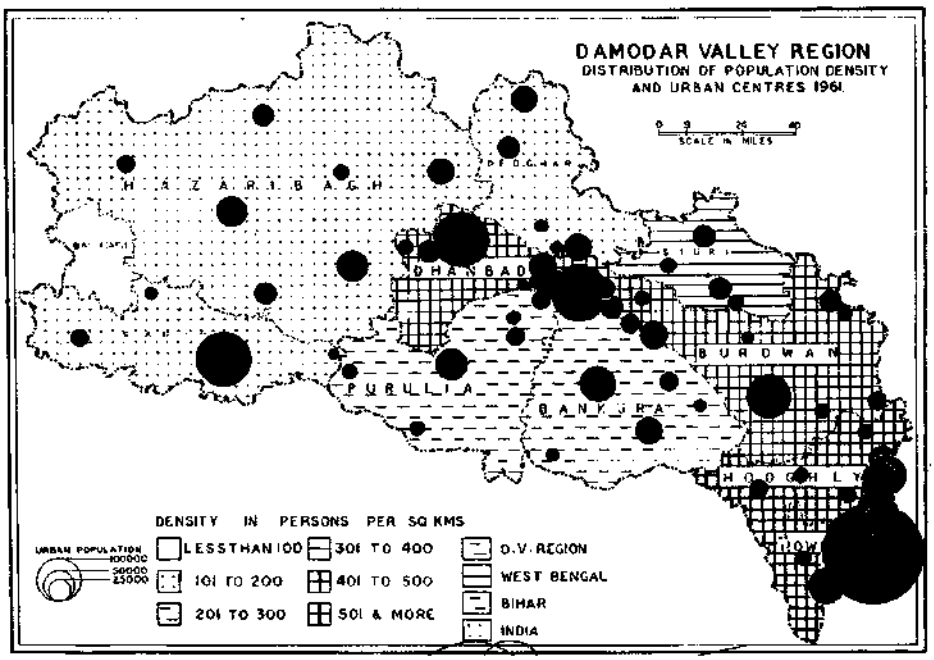

DAMODAR VALLEY REGION
DISTRIBUTION OF POPULATION DENSITY
AND URBAN CENTRES 1961.
SCALE IN MILES
HAZARIBAGH
DHANBAD
PURULIA
BANKURA
BURDWAN
HOOGHLY
DENSITY IN PERSONS PER SQ KMS
URBAN POPULATION
LESS THAN 100
101 TO 200
201 TO 300
301 TO 400
401 TO 500
501 & MORE
D.V. REGION
WEST BENGAL
BIHAR
INDIA

Fig : 4

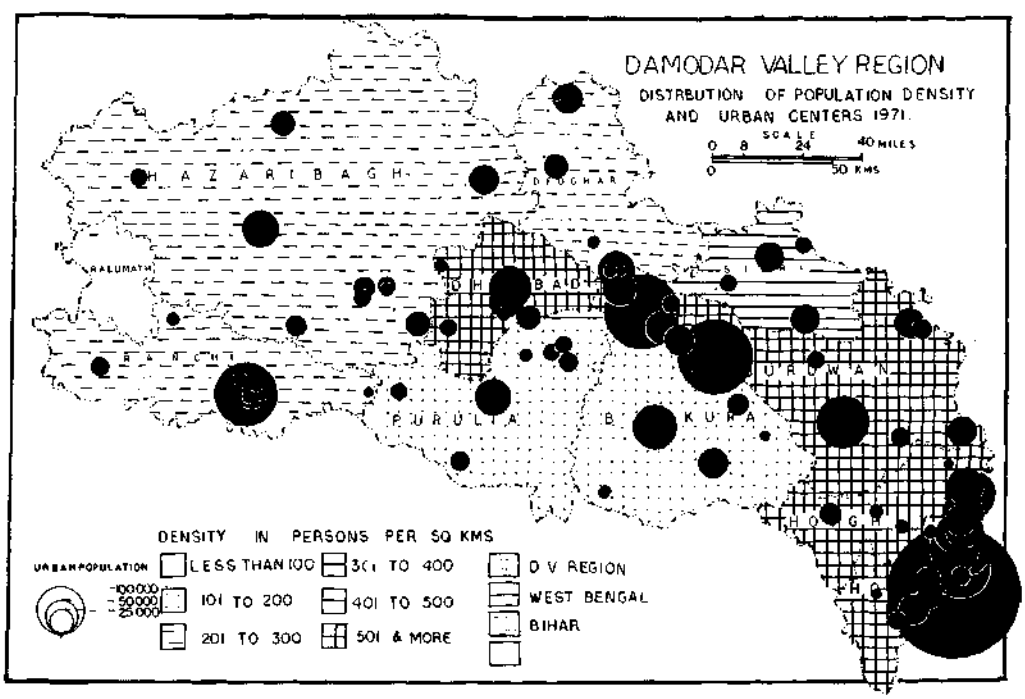

DAMODAR VALLEY REGION
DISTRIBUTION OF POPULATION DENSITY
AND URBAN CENTERS 1971.
SCALE
40 MILES
50 KMS
HAZARIBAGH
RAMGARH
DHANBAD
PURULIA
BANKURA
BURDWAN
HOOGHLY
DENSITY IN PERSONS PER SQ KMS
URBAN POPULATION
LESS THAN 100
101 TO 200
201 TO 300
301 TO 400
401 TO 500
501 & MORE
D V REGION
WEST BENGAL
BIHAR

Fig : 5

Table 4. Level of Urbanisation in the Damodar Valley Region

Name of the District	1961-1971 Total Population Growth Rate	1961-1971 Urban Population Growth Rate	% Urban in 1961	% Urban in 1971	% Urban in 1981	% Urban in 1991
Howrah	18.58	22.84	40.48	41.92	43.43	44.99
Hooghly	28.71	31.24	25.96	26.47	26.99	27.52
Burdwan	27.03	58.98	18.20	22.74	28.51	35.67
Bankura	22.02	24.21	7.34	7.47	7.61	7.74
Purulia	17.86	43.13	6.80	8.25	10.03	12.18
Santhal Pargana (Deoghar and Jamtara Subdivisions only)	19.24	28.46	8.27	8.91	9.60	10.34
Hazaribagh	26.03	93.25	8.40	12.87	19.74	30.26
Ranchi (only Sadar Subdivision)	7.52	48.14	18.23	25.12	34.60	47.67
Dhanbad	26.57	120.08	25.02	43.50	44.98	78.21
TOTAL:	23.13	48.36	18.55	22.36	26.63	34.94

In the Damodar Valley region as in the country as a whole, urbanisation is rather a consequential phenomenon to industrialisation, and has a time lag of about 10 to 20 years. Even in the rate of growth, industrialisation has been faster than urbanisation, with a definite trend of accelerated rate of urbanisation during the following decades. The resulting linear but belted urban pattern along both sides of the Hooghly River from Calcutta northward and only on the northern bank of the Damodar, westward, has been closely related to the industrial location pattern. While mining activities are negatively correlated with urbanisation, there is a high positive correlation between manufacturing and construction and urbanisation (cross-sectional data for 1961 and 1971).

The poly-nuclear origin and independent location of factory towns along the river Damodar has resulted in a belted corridor pattern of urban development. These factory towns with a tendency to grow toward each other are interlinked by the arterial rail and road transport. The economic base of these towns, being strengthened by the manufacturing industries, most have developed as company towns with factory and residential areas distinctly laid out. While a very low density development is a

characteristic feature in the new towns, urban life has been deteriorating in the older towns. Five urban-industrial complexes have grown in the valley region apart from the Hooghly-side Jute Cotton textile-engineering industrial agglomeration. These are (a) Asansol - Kulti iron and steel complex; (b) Durgapur chemical - steel complex; (c) Dhanbad - Jharia coal based fertilizer and chemical complex; (d) Bokaro and Patratu - steel and thermal power complex; and (e) Ranchi-heavy engineering industrial complex. These urban-industrial complexes have different industrial mix and structure in each and are at various stages of growth and development.

The Damodar Valley is the connecting link between the great metropolis of Calcutta, the Hooghly-side urban belt on the southeast, and the industrial magnets of Jamshedpur-Rourkela-Bhilai of S.E. Resource Regions on the southwest, and forms one of the world's largest industrial crescents. Within this huge framework of industrial complexes, a great system has developed of interrelated industrial cities centred on the port and market of Calcutta at the eastern most apex-a megalopolis in the making. The region is expected to urbanise in the following decades much faster than in the past decades of planned industrial development. It is expected that by the year 1991, about 35% of the population of this region will reside in the urban areas. Allowing the rate of urbanisation (48.36% in 1961 -1971) to be faster than population growth (23.13% in 1961 -1971), the region is going to more than double its urban population in twenty years. While the region is expected to raise its population of 19.26 million (1971) to about 25 million in 1981 and about 31 million in 1991, its 4.31 million urban population in 1971 is going to increase to 6.66 million in 1981 and to 10.81 million in 1991, raising thereby the level of urbanisation to 26.63% in 1981 and to 34.94% by 1991.

The valley region has been urbanising at a very fast rate (48% per decade) as a consequence of industrial development. Rural-to-urban migration has been very rapid, particularly in the large industrial towns to those developing from scratch and to the old industrial towns as well. Dhanbad, Ranchi, and Asansol town groups have grown very rapidly and there is no slackening in their growth rate. Durgapur and Bokaro have grown from scratch and within a decade have attained city size of more than one million or more. The impact of industrialisation on urbanisation has been felt most intensively in the region and many more people are going to migrate to the industrial towns than could be absorbed. In order to cope with the growing need for urban development, town planning activities have been multiplied. The new towns

have been planned from the very beginning and older ones have set up planning bodies. These industrial towns have provided ample scope for experimenting with town planning activities; but repetition of the same stereotype western sector plans in setting up company-wise townships have created parasitic rather than generative urban communities. The townships have been created to cater to the housing needs of the factory workers only, leaving the service people to take refuge in the growing retail slums and left-out villages in and around the townships. These townships are to be provided with all urban facilities and amenities of urban life by the companies. Hence the problems of economies of scale, high overhead costs and low quality services have cropped up, making living very costly for the residents. Although until now, the proportion of service population has been low, it is expected that their numbers will exceed the factory workers soon, demanding far more urban amenities. The town planning activities hence would require reorientation immediately to meet this challenge.

The existing pattern of urban-industrial development in the Valley Region has been closely related to geographical distribution of mineral and other natural resources, agglomeration effects, stable labour market, proximity of Calcutta metropolitan market, and the associated network of transportation facilities. The future pattern is expected to follow the present, with more intensification at the centres, and horizontal expansion along the transport routes. The region has already housed a large number of heavy industries: naturally forward- and backward-linking small and medium scale industries are to follow. Even though no new heavy industry is allowed to locate in the region in the immediate future, still the tempo of industrialisation is likely to continue. New industries need to be urban-based because of external agglomeration economies of the heavy industries; and as these large towns are going to shoulder the major responsibility of urban growth, they need to be planned so as to be able to absorb the increased population on the one hand, and on the other, to revitalise the smaller centres of new industries for sharing the urban load. Hence planning for urban development in the Region should be attempted at: (a) the major growth centres numbering about 30, the majority of which will have a population of more than 100 thousand by 1991, so as to arrest the deterioration of urban life in the old towns and to provide a good living environment; and at (b) the small towns which have been by-passed by the city-ward migration flows and which need to be provided with facilities for locating small- and medium-scale industries so as to strengthen their

economic base and arrest the city-ward migration (Pathak (1968)). This diversion of flow of migrant people would save the major industrial towns from congestion, ill-health, insanitation, and would functionally link the settlements at various levels.

5.3.5 ROLE OF THE DAMODAR VALLEY CORPORATION

In spite of tremendous public criticism and inter-state (West Bengal and Bihar) conflict in sharing the accrued benefit of the Damodar Valley multi-purpose river valley project, the DVC could claim substantial success in achieving its basic objectives of controlling flood, checking soil erosion, soil conservation and watershed management, power generation, and supplying irrigation facilities. However, in course of time, the DVC had to relegate some of its responsibilities and could not take up new responsibilities. The corporation has been sized up to a single major power producer and distributor to the industries, railways, collieries, and the nearby urban areas, including Calcutta metropolis. In 1964, the canal irrigation system was transferred to the Government of West Bengal for administration on agency basis. The fisheries development programme has been looked after by the Central Fisheries Corporation. Let us analyse the performance of the DVC under the following heads in which the corporation has maintained its dominant role.

5.3.6 FLOOD CONTROL

The original scheme prepared by W. L. Voorduin (from TV A, USA) recommended construction of dams at Salanpur (Panchet), Bermo and Aiyer on the Damodar, Maithon, Deolbari (Balpahari) and Tilaiya on the Barakar, at Bokaro on the Bokaro river, and Konar on the Konar river, and a barrage at Durgapur downstream for an irrigation project in the lower valley. The flood protection scheme aimed at moderating the all-time high 1,000,000 cu. ft./sec. of inflow to 250,000 at the Durgapur barrage point, with the creation of 5.3 million acre-feet in the eight dams. The scheme was criticised as a very ambitious one. By 1959, at the end of the first phase of its execution, four dams at Maithon, Panchet, Tilaiya, and Konar were constructed, yielding a total capacity of 2.9 million acre-feet, whereas to provide adequate flood protection a storage capacity of 5.3 million acre-feet is required so as to moderate the flow not exceeding 250,000 cu. ft./sec. at Rhondia with a upstream drainage area of about 19,900 sq. km.

Later on two Committees were formed: S. D. Khungar (1959) recommended the construction of Aiyar dam on the Damodar; instead, a dam at Tenughat was constructed

by the Govt. of Bihar to supply water to Bokaro Steel Plant and Thermal Power Station. K. V. Srinivas Rao (1971) recommended an increase in the reservoir capacity of the Maithon and the Panchet dams, and also the construction of a dam at Balpahari. He further recommended the expansion of drainage channel capacity from 60,000 cu. ft./sec. of water to 200,000 cu. ft./sec. in the lower Valley. The release of water from the DVC dams after the flood of 1959, has been done under the

Table 5. Projects reservoir capacity and equivalent flood benefit—1959

Projects	Reservoir capacity in 000' acre-ft.	Million m^3
Tilaiya	320	395
Konar	273	339
Maithon	1,104	1,363
Panchet	1,214	1,500
	2,911	3,597

Source: U. N. Report (1960), p. 10.

direction of the Office of the Central Water Commission at Maithon with automatic control system following the Reservoir Regulation Manual.

The vagaries of monsoonal rainfall, however, belied the DVC water release manual because of heavy downpour of 72 cm. during September 26-28 in 1978. The DVC reservoirs received an all time record inflow of 851,000 cu. ft./sec. According to manual, the DVC was to release 200,000 cu. f t. /sec. whereas it released only 160,000 considering the heavy rainfall; but at Durgapur barrage point it was 380,000 cu. ft./sec. threatening the Barrage itself. Besides, other rivers in the lower Bengal - like, Silavati, Darkeswar, Kansavati, Ajoy and Moyurakshi - were swollen and added to the Damodar flood. In this context, naturally the construction of extra dams is called for. But it was feared that the construction of any more reservoirs upstream might reduce headwater supply and adversely affect the regime of the lower Damodar Valley. Without a proper drainage system and the control of other rivers in the lower valley, the moderation of flood is not possible.

5.3.7 THE WATERSHED MANAGEMENT AND SOIL CONSERVATION

The Department of Soil Conservation was organised in the DVC in 1949 for the

promotion of afforestation and control of soil erosion (including training for soil conservation) mainly in the upper valley region of about 6,664 sq. miles. The upstream area is very rugged, and is characterised by outcroppings, deep gorges, gullies, and badly eroded waste-land where the Damodar system is very torrential in nature, impregnated with heavy loads of mud and debris. While in the lower valley region, below the confluence of Barakar and Damodar, the terrain flattens out into a fertile land. During the flood, vast stretches of the top soil and sand are eroded all over the upper catchment and are being deposited on the river bed itself. Only a little portion of the silt is being deposited on the flooded land. The accumulation of sand deposited in the channel bed has resulted in the choking of the river, frequently overtopping its banks and even changing its course-even as late as 1959. Soil conservation not only improves the productivity of the land but also reduces the silting rate of the reservoir to a great extent.

The DVC undertook a scheme of getting the entire upper catchment of about 7000 sq. miles photographed at the scale of 6 in. to a mile with 10 ft contour intervals and a master plan for integrated watershed protection has been worked out. The above area was divided into 39 sub-catchments for the reduction of soil erosion and to select the critical areas needing immediate rehabilitation. The plan also calls for complete soil conservation treatment of agricultural uplands, waste lands, denuded forest lands, and management of the wooded forest.

Based on the intensity of soil erosion, priority areas of 1.46 million acres have been identified. Murthy (1976) has estimated an area treated under different measures up to 1973: 0.66 million acres under upland treatment and about 143,000 acres under engineering treatment, comprising about 45% of the problem area. Approximately 2,000 check dams and small reservoirs have been constructed in the upper valley for controlling the siltation. Such a treatment programme has been able to reduce the sediment load into the reservoir by about 20% at a total expenditure of about Rs.116 million (£7.5 million).

Of the 466,000 planned acres, afforestation has covered about 216,849 acres (46%) creating a resource worth Rs.280 million (£17.5 millions). About 295,000 acres have been treated for upland agriculture creating a resource worth five million rupees and generated employment for additional 850,000 man days including the cultivation of high yielding variety crops. Various other measures such as foreshore cultivation (in about 15,000 acres) in the reservoir shores during dry season and water managements are under way.

5.3.8 IRRIGATION

The canal irrigation from the Damodar Valley Project had been confined only to the lower portion of the Basin in West Bengal. In 1956-57, the project provided irrigation only to 11,000 acres during Kharif and to 8,000 acres during Rabi season. In 1977, the area under canal irrigation had been raised to 761,000 acres and 205,000 acres during Kharif and Rabi seasons respectively. While the figure for Kharif season is on the increase, the Rabi season acreage has been shrinking because of excessive demand for the river water for non-agricultural use - such as industries and urban supply. The management and control of the Durgapur barrage and the entire canal irrigation system of about 2,495 km. length have been transferred to the Government of West Bengal on an agency basis since 1964.

An irrigation system is being devised at Konar and Tilaiya by the DVC for irrigating the upper valley but it will be limited to the nearby areas down-stream of the reservoirs. Three small irrigation schemes have been completed in the upper valley - Charwa, Gonda, and Jamunia which together irrigate about 3,500 acres out of which only 1,200 acres are of Rabi crops, mainly by the last one. The Government of Bihar has recently taken-up an irrigation scheme in Giridih, Dhanbad and Hazaribagh district to provide much-needed irrigation from Konar and Tilaiya reservoirs.

In an agreement between the Government of West Bengal and that of Bihar it has been resolved to transfer the management and operation of the Tilaiya and Konar dam projects to the latter for canal irrigation development in their command areas. The impact of such transfer on the functioning of the DVC and on the whole project is yet to be appraised.

First, the DVC project through the Government of West Bengal has been able to ensure one Kharif crop (mainly paddy) in the deltaic Bengal, which used to depend entirely on rainfall, through canal irrigation. The canal irrigation is being supplemented by tubewells in the districts of Burdwan, Hooghly, and Howrah for the second crop. It is to be remembered the second crop cannot be grown without irrigation as during its growing season very little rain occurs.

5.3.9 THE POWER PROGRAMME

In 1943, the total installed electric-generating capacity in the Damodar Valley was 137,098 kW, and within the transmission distance of the valley another 515,000 kW electric-generating capacity was installed, mainly by mining, industrial, and railway

corporations, In spite of the organisation of the DVC, there was a programme of expansion of the production of electrical energy by 327,000 kW for the Calcutta region. The DVC planned its power programme as a part of the unified development of the valley. First, it started to purchase power from the industries and eventually sold to the industries in 1952.

The DVC evaluated the water power resources of the valley region and estimated a capacity of 200,000 kW at the proposed 8 dams. These estimates were based upon the hydrological data maintained at the one gauging station at Rhondia near Burdwan. However, because of the seasonality of rainfall, 80% falling during 4 to 5 months of the monsoon season, the estimate was fixed at 65,000 kW.Fortunately, the main coal-fields of India were located in the upper and middle valley and hence hydropower production could be supplemented with thermal power. Voorduin had recommended construction of a 150/200 mW modern thermal station at Bokaro. It was eventually decided to install a total capacity of 350,000 kW, 200,000 kW of hydro and 150,000 kW of thermal, with a peak load demand of 300,000 kW.

The Damodar hydro-electric facilities - at the end of 1959-although they had progressed quite a bit-fell far short of earlier ambitious estimates because only four dams had been constructed for a total capacity of 104,000 kW. (Table 7).

Table 6. DVC's Power Generation in million kWh.)

Year	Thermal	Hydro	Total
1953-54	109	3	112
1954-55	186	5	191
1955-56	322	12	334
1956-57	471	1	472
1957-58	886	17	903
1958-59	1094	118	1212
1959-60	1142	315	1458
1960-61	1357	280	1637
1961-62	1780	302	2082
1962-63	2318	304	2622
1963-64	2469	234	2803
1964-65	2657	352	3009

Year	Thermal	Hydro	Total
1965-66	3464	250	3714
1966-67	4014	120	4134
1967-68	3980	203	4183
1972-73	4015	212	4227
1973-74	3427	353	3780
1974-75	4169	297	4466
1975-76	4686	321	5007
1976-77	5023	222	5245
1977-78	4904	259	5161
1978-79	3907	179	4086
Estimated - up to Feb. '79			5444

Source: The Statesman, DVC supplement, Calcutta March 31,1979 and I. J. of Power and River Valley Development, DVC. Special Number 1968.

Table 7

Project	Period of Construction	Capacity (MW)
Tilaiya	(1950-1953)	4
Konar	(1950-1955)	20*
Maithon	(1951-1958)	60
Panchet	(1952-1959)	40
		124

"never installed.

5.3.10 THERMAL

The Bokaro Thermal Power Plant was commenced in 1950, twelve miles down-stream of the Konar dam and was completed in 1953. Later it was expanded to have 4 units with a total-installed capacity of 225 MW and completed by 1960, producing about 1,142.80 mn. kWh. The power plant at Durgapur was started in 1956, and by 1961 two units were completed with an installed capacity of 150,000 kW and a total of 4 units of 400,000 kW. Chandrapura - the biggest thermal plant ever to be made in India with a total installed capacity of generating 500,000 kW in 4 units of

125,000 kW each-started in 1959 and by 1964, two units were ready for production of 409 million kWh. (1964-65).

Out of the total installed capacity of 1301 MW (1177 MW thermal and 124 MW hydro), it is producing only at the 40% to 50% level. At times production fell even to 350 MW without any specific reason. During the fifth plan period it was to increase its potential by about 760 MW at a cost of Rs. 208 crores: most of it will be thermal (200 MW at Durgapur, 200 MW at Bokaro, and 120 MW at Chandrapura, and 40 MW at Panchet Hydro). The DVC power system is interlinked with the West Bengal and South Bihar State electricity system and is now connected with the Rihand grid in U.P. and the Hirakud grid in Orissa. In spite of the tremendous growth of power generation in the DVC (Table 6) and the nearby systems, the demand could not be met—because of rapid industrialisation, urban development, railway electrification, and rural electrification in the eastern states (Table 8).

The DVC thermal capacity was to reach 1300 MW as per original rating and able to meet a firm load of 700 MW. The main DVC grid has so far been 132 kV but it has to be changed over to 220 KV with increasing load. Although hydro-power capacity has been planned to increase from 104 MW to 164 MW, because of annual variation in rainfall, its generation fluctuates to a great extent.

Table 8. Thermal Power Generating Capacity

No.	Thermal	Date of Commission	Installed Capacity	
1.	Bokaro	(1950-60)	225 MW	4 Units
2.	Chandrapura	(1959-65)	800 MW	(125/140 two units)
		3rd Plan -1968	140 MW	
		4th Plan -1974	120 MW	of two unit (4th, 5th unit)
3.	Durgapur	(3rd Plan) (1961-67)	140 MW	(2 units)
		1979	260 MW	(2 units)

Source: The Statesman, Calcutta, 31 March, 1979 brought out a supplement on the inauguration of the 6th Unit of 120 MW, the total capacity of Chandrapura increased to 800 MW.

5.3.11 REHABILITATION OF DISPLACED PEOPLE

In order to acquire land for the construction of dams and reservoirs, thermal power stations, and related project work, the DVC acquired about 86,253 acres of land displacing more than 20,000 families up to March 1967 (20 years of DVC) at a total expenditure of about Rs. 48 million (£3 million). Full-scale rehabilitation was undertaken at Tilaiya with the construction of five villages with roads, housing, community centre, wells for drinking water, irrigation tanks, schooling and health facilities. Except one, all of them failed as many people accepted the new land holdings but did not move into them. Then DVC reversed its settlement policy and offered cash compensation for the surrender of their ancestral homestead to build a house more to their liking. Many took cash which was soon dissipated.

> "Almost 92% people chose cash settlements in preference to accepting land for land and home for home. The remaining families took cash compensation to build homes for themselves and some even elected to do their own reclaiming. The large majority of the houses that were abondoned were eventually turned over to the Bihar Government. The total cost of acquiring project lands including the rehabilitation of the people as on March 1960 to talled Rs.6.44 crores or (US$13.5 million)".[5]

Thus, the DVC failed to shoulder the responsibility of rehabilitating the homeless people. Some of them however, could find jobs as daily workers in the construction projects and many of them found an easy escape to the streets of Calcutta.

5.3.12 CONCLUSION

The Damodar Valley Region was conceived as an economically viable and physically integrated inter-state planning unit for sustained economic development in India. The Damodar Valley Corporation was entrusted with the task of designing, planning, and executing - with multipurpose objectives-a prototype river basin development in the Damodar Valley, as an experimental laboratory in regional planning. During the last three decades, the experiment of river valley development which started in an economically-backward region with multiple problems of development

5 United Nations, A Case Study of the Damodar Valley Corporation and its Projects, Flood Control Serie No. 16, Bangkok, 1960.

had to pass through various stresses and strains. The Corporation, in spite of having wide power to execute the programme, had suffered from administrative, managerial, and financial problems and much public criticism, although it has been responsible in bringing about remarkable changes in the physical landscape and the socio-economic structure of the region. The utilisation and development of the vast resource potential of the region are far from optimal despite a relatively rapid industrial development in the plan period; but far from what it could and should have been, given an appropriate plan and its efficient implementation.

The life history of the Damodar Valley Corporation is full of partial successes and failure. Many schemes proposed could not get off the drawing boards; while the first phase was completed with lots of enthusiasm. Because of rapid urban-industrial development, in the valley region, many new planning responsibilities came up, which had to be diverted to the State Governments or new planning and implementing organisations which were created to tackle them.

By the end of the 1960s, the DVC as a public agency developed all the symptoms of an inefficient public sector undertaking, with internal squabbles with regard to personnel management coupled with frustrations and administrative failure. Resentments among the workers with regard to lay-off, transfer, and promotion took the shape of various types of commotion. The Corporation has also suffered from the conflicting interests of the participating state governments of Bihar and West Bengal, i.e. resettlement of displaced persons, procedure to be followed for land acquisition, irrigation benefits to be shared, industrial expansion to be made, etc.; and had to relinquish many of its responsibilities. The Corporation could not function efficiently in the face of an administrative impasse, nor could it expand its activity from its primary function of technological river valley development to keep pace with regional expansion as its financial power was very much limited.

Failure on the part of the three governments to support the flood control programme has had far reaching and devastating effects, particularly for the inhabitants of the lower valley.[6] Since its inception, the DVC could only complete four dams. However, the Government of Bihar has put up a dam at Tenughat on the Damodar as a project to supply industrial water to the Steel and Thermal power plants at

6. Ibid. p. 89.

Bokaro. The flood of 1978 was one such aspect which was effected by the failure of the DVC to complete its plan project.

The performance of the Corporation has never been reviewed during its lifetime and could not be given a good leadership from the third plan period. The overall development of the region needs to be reoriented and an integrated area approach needs to be adopted for valley-wide planning and development. Many of the regional planning problems which cropped up during the last three decades because of urban and industrial development need to be reviewed and resolved for unified but sustained development in the region.

It is true that the extent of the September 1978 flood in the lower valley region would have been much more devastating if there were no DVC-type project. Without the dams, the deluge could have washed away the industrial areas in its basin and threatened the life of Calcutta metropolis itself. Of course, the catastrophic flood of the 1978 has acted as an eye-opener to the need for construction of further dams with flood storage on the Damodar system. The DVC has constituted a committee to investigate the feasibility of a dam on the Barakar at Balpahari proposed by Voorduin in his preliminary report.

The suggestion of the DVC for a separate treatment for the lower valley of the Damodar has been given serious consideration by the Government of West Bengal - after the last year's flood. A flood-mitigating committee has been constituted to investigate the problems in the lower valley region particularly the reduced flood-water carrying capacity of the river channels. As a first step, an aerial photographic survey is being conducted to prepare a detail map of the lower valley region.

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5.4 REGIONAL PLANNING APPROACH TO CALCUTTA METROPOLITAN AREA

5.4.1. Introduction :

The regional development may be viewed as one of the end products of national planning effort, and regional planning as the process of translating national planning objectives into the reality of the local communities. Regional planning is, therefore, a component, albiet an essential component, of national planning process.

Regional planning process can also be explained as a process of synthesis of broad national objectives with the reality of local communities. It is thus, through this process of synthesis, regional planning aims at bridging the abstract consideration of the sectoral planning carried out the national level and investment decision, often taken locally, on a particular point in space, The regional frame of development, which is a spatial framework is therefore, an essential means of translating the national objectives in the language of concrete experiences of the local communities of a region. The formulation of spatial framework of regional development would, therefore, remain an important task of realizing the goals enumerated in the central planning at the national level.

This formulation, of course, will follow from various models of regional development based on different types of planning regions. Of all planning regions, probably, the metropolitan region posed the biggest problem in the past and continues to be so even to-day, in particularly the centralisation of all development in the metropolitan core and the near absence of development in its hinterland. We therefore, intend to deal with this particular area of regional planning in some detail. But before we take up this particular area of regional planning it may not be out of point to deal with some of the major considerations of regional planning in general.

These considerations will definitely help in our formulation. These considerations are (a) purpose, (b) process, and (c) scale of regional planning.

5.4.2. Purpose, Process and Scale of Regional Planning :

The broad objective of regional planning coincides to a large extent with that of central planning at the national level and it can be stated as the social advancement of the community through the process of economic development. While it is true that regional planning seeks to advance the national objectives within its sphere of influence, it has also a normative realm of its own, where due to its closeness to the incidence of investment the objectives can be described in a more concrete terms of physical reality.

In a developing economy, where India belongs to, regional planning aims at the maximization of resource utilization, primarily natural and human, according to the resource endowment of a particular region [1]. In other words, the prime objective of regional planning is first to determine the resource endowment of a given region and its level of exploitation at a given point in time and, then, to recommend courses

of action leading to the optimum use of the present under-used resources with the help of kin, knowledge, technology and material imputs, all of which may not be available locally. It is, thus essentialy a process of interaction between human and natural resources as well as between regions aided by technology within a given institutional set up. This process of interaction in turn produces new usable and productive resources for the benefit of the community. Regional planning is a conscious and intelligent method of organizing these activities in space in order to accelerate the process of interaction in an efficient manner.

Regional planning as a process can be viewed as the incremental changes in spatial structure of a regional system leading to the progressive integration of various isolated spaces, social, economic and political, within it [2]. In that regard, it can be claimed that regional planning process helps in nation building. Because, integration of political, social and economic factors within a given territory of a nation is essentially a nation building process. Of course, this integration takes place by establishing physical communication routes between every part of a region, and thus facilitating increased mobility and propagating exchange of ideas, thoughts and culture as well as various inputs required for optimal utilisation of resources in all regions.

This is the process of linking every community within a region to & total activity system, thereby providing an opportunity to weaker centres of a region to come in contact with strong centres and to thrive with economic activities. In this process, the barriers of political, social and economic isolation of weaker communities are broken away, and they are being integrated with the main body polity of the region.

With regard to the scale of regional planning it can be conceived of operating at following four distinct levels in a heirarchy of spatial system : (a) the world, (b) the multinational units, (c) the national units, and (d) the sub-national units. Although it is difficult to consider the world as a planning region across the national frontiers belonging to different, and often diverging political entity, yet its importance is being increasingly recognised in the world bodies like the UNO and its allied organisations like the FAO [3]. Regional planning at the multi-national level has experienced relative success and achievement. The EC APE region and its Trans-Asian railway net-work project can be cited as an attempt toward that direction [4]. Regional planning has hardly been used to embrace the whole national territory 0nt9 ft single

planning region. But there are many instances wbcre regional planning has been successfully applied, particularly in socialist countries, where the country has been divided into different planning regions, as has been done, for example, in Russia, Poland, and Yugoslavia [5], In other countries, the concern for regional planning at the national level has been expressed particularly for problematic areas and depressed regions within the country, as has been illustrated in the case of Appalachia and other big regions created by the Economic Development Act in the U. S. A. [6] There are of course a number of excellent regional planning studies prepared, taking into consideration the whole national territory as a planning region [7].

Regional planning has its widest application in practice within the tub-national areas. Illustrations may be drawn Irom various countries such as the TVA in the U. S. A., the DVC in India, the SUDENE in north east Brazil and the Gal Oya Project in the eastern Ceylon. Within these sub-national areas three types of regions based on general development problems have been identified as follows [8] in the U. N. Seminar on Regional Planning held in Tokyo in 1958 :

(1) Metropolitan regions which are experiencing problems of urbanization and industrialization ;

(2) Regions of resource development, such as hydroelectric watershed ;

(3) Rural regions in which village improvement programmes are being carried out.

Although these classifications have been made, it is in no way to suggest that these regions are mutually exclusive; rather, in fact, the approach to a set of problems of a particular type of region is very much related to the problems of other type of region [9]. They are intermingled and overlapped too. These classifications are only valid from the point of view of the emphasis laid on particular set of problems in a region.

With this brief overview of the regional planning in general, we can turn over to the particular planning aspects of metropolitan region, which deserves careful attention of the urban and regional planners of India, while her metropolitan cities are growing in size and population.

5.4.3. Role and Importance of Metropolitan Regional Planning :

'The metropolitan region' Professor Ginsburg obsersves, 'is a giant urban regional

system, different less in kind than in size from that of any urban region. Its typical structure is a large urban agglomeration functionally ceatral to a vast nodal region. To this great region the metropolis provides those specialized goods and services which the smaller centres cannot supply themselves—medical specialists, art museums, special tools, luxury food-staffs, and the like. It also acts as the great market for the surplus products of the region. The sinews of this regional system are the transportation facilities which converge upon the central city.'[10]

Professor Ginsburg, further, makes distinction between two conceptions of metropolitan region, often confused and used one for the other. While one referes to the "great hierarchy" observed above, the other referes to what he called, "inner metropolitan region" to cover "that area within the metropolitan region that is directly dependent upon the central agglomeration for most of its basic goods and services," and often extended from 30 to 40 miles from the central business district [11]. It now appears that in whatever manner the metropolitan region is defined, the central dominating feature of a metropolitan region is its strong metropolitan centre consisting of "a large urban agglomeration." Next, a zone around this metropolitan centre having a close association with the centre, which has been referred as "inner metropolitan region" may also be termed as the "core region" when viewed from the perspective of the "giant urban regional system," Finally, the remaining area of the region may be referred as the "periphery."

The main difference between the developed and the developing nations with regard to the pattern of urban hierarchy and the relation between the urban areas with the surrounding areas lies in the nature of economic relationship between dominant metropolis and other urban or rural areas surrounding it. In the developed nations, the relationship is a two-way one, in which not only the rural areas supply agricultural inputs and food to the urban areas, but the urban areas themselves supply industrial goods, particularly those which increase the productivity in the rural areas. Through such a relation the rural areas gradually approach the urban areas not only in terms of labour productivity but also in terms of social and physical infrastructure which can be supported by them. In the developing nation, rural-urban traffic is a one-way one, in which the urban areas use agricultural raw material and food produced by the countryside, bet do not supply any or much input for industrializing agriculture. And hence in such a relationship, the rural areas gradually become more rural, and relatively more backward. The absence or near absence of social or physical infrastructure

facilities in such areas, therefore, is a necessary concommitant of its increasing backwardness. The dualistic nature of economic and spatial structure consisting of a "centre" of intensive development and an undeveloped "periphery" which is poorly related—physically, socially and economically— to the centre is the resulting phenomenon. [12]

The developing countries are thus conformed with a major problem of economic dualism which is being embedded into spatial dualism [13]. The avowed objective of developing nations remains in this way to be the elimination of the characteristics of dual economy, which is one of the basic concern of regional planning too, and which can be accomplished by progressive integration of the economic spaces into the activity system of the centre, and thus relating the periphery to the centre not only more intimately but also in a new way.

The postulation of a general theory above may further be justified with the experience of India, the leading nation in the developigg world. In India, as it may be observed in Table I, where there were only two metropolises with 1,000,000 population in 1941, there were seven in 1961. This may be interpreted that during the colonial rule in India, that is upto 1947, there emerged too few metropolitan Centres. The two Centres Viz., Calcutta and Bombay, are again port based. A further analyses of table 2 reveal that these centres are strongly primate cities [14]. These factors together are suggestive to the fact that primate cities in India are also the result of pre-Independence colonial economy which is being characterised by one way process of exploitation of the country and its resources. The emergence of a strong centre in and around these primate cities in an overall backward setting of the country is further strengthened by the location—decisions of new industries which show particular preferenance for these centres to the remaining areas of the region making them locationally obsolete. This trend continues even after Independence.

Calcutta metropolitan region provides a good illustration in this regard, Calcutta metropolitan region, if it is defined on the basis of great regional sysiem as envisaged by Prof. Ginsburg. should embrace all eleven districts of the southern Bengal and then four districts viz. Calcutta. Howrah, Hooghly, 24-Parganas will constitute the "core region" or "inner metropolitan region" in a very broad manner. The remaining seven districts viz., Midnapore, Purulia, Bankura, Burdwan, Birbhum, Murshidabad and Nadia will naturally, constitute the outer ring around the centre or the

"periphery". This definition of Calcutta metropolitan region primarily based on spatial considerations is, of course, very preliminary and subject to further elaborate studies. Nevertheless, this definition can provide necessary frame of reference for this particular study.

If we now assume "core region" as the centre and the remaining areas as the periphery, it can be demostrated that dualistic centre-periphery (relationship exist here also). In a recent study, Bose [15] has actually worked out the development indices of different districts of West Bengal and grouped them into "developed" and "undeveloped" districts. Interestingly, all the districts occurring close to and around Calcutta, the primate city, have been found "developed" districts while all other districts of the metropolitan region with the exception of Burdwan have been found "undeveloped." One of the main reasons for the departure of Burdwan from the undeveloped ring of districts around Calcutta may be "due to the development of a new growth centre at Durgapur in Burdwan and this involved an investment of more than Rs. 6000 million [16]. It is further striking to note that the actual difference in development indices between two sets of districts belonging to the centre and the periphery respectively, has increased during the period of 1951 and 1965 [17]. It clearly shows that inspite of planned development during post-independence era. the gap between the centre and the periphery has increased, and this has been happening when our national objective was set or balanced regional development [18]. There are, of course, various measures suggested to achieve this important national objective of balanced regional development [19]. Our concern here will be on spatial integration measures necessary to achieve this objective.

In our judgement, a broad spatial framework of regional development integrating the centre with the periphery is an essential means to achieve toward that goal of balanced regional development. In the first place, it helps to maintain a balance in our investment decision so that it does not reflect any excessive bias toward any particular spatial unit. Because, spatial preference in resource allocation will certainly influence to a great extent the sectoral allocation and thus the sectoral interaction in the economy. For example, the relative amount of heavy investment in the metropolitan centre with little regard to the overall metropolitan region might shift the due emphasis from the agricultural sector causing sectoral imbalances. Secondly, a concentration of investment in the centre without appropriate and matching allocation in the periphery region will provide further impetus to exodus from the region to the centre

threatening the eventual seizure of the central city by the migrants rushing in search of economic opportunities. These are central points that wouW justify any serious concern about metropolitan regional planning in the perspective of developing economy.

In the case of Calcutta Metropolitan District (CMD), for example, while the concern over the alarming situation of the metropolis is very genuine and the threat posed to the overall urban infra-structure of the district is very real and serious, it is also to be kept in raind that for the survival of the metropolis the whole metropolitan region is to be rejuvenated [20]. Otherwise any improvement in the metropolitan district alone may invite disproportionate amount of influx of population from the region thereby making the improvement further inadequate. But how this process of rejuvenation may start ? One way is to strike a balance in investment decision spatially within a given regional development fame work in order to transform the broad judgement made at the national planning level on sectoral allocation of resources to the realities of the life of the region, with necessary modification in a given situation according to the resource endowment of a region, so that the mutual interaction between the sectors of a regional economy may actually take place releasing the total economic potential of a particular area. This is again the process leading to economic growth and social development. At this point it is to be recognized that the above approach stems from the implicit assumption that as sectorally, agriculture, industry and service sectors are mutually dependent interrelated phenomenon of economic growth, similarly in spatial structure the rural area, service and market centres, towns and cities are interrelated spatial entity of the same economic growth process and in that way economic planning and spatial planning are complements!. It is, therefore, imperative that a judgement is to be made on the regional spatial frame of development in every particular situation conducive to growth as it is being done on the sectoral model adoption at the central planning level.

It is particularly this very concern that motivated the present author to set himself in the task of conceptual formulation of a proposed strategy of regional development of Calcutta Metropolitan Region within the limited scope of this article. This attempt could, at least, hopefully stimulate further discussion ami studies in this direction so that eventually a wide acceptable approach may be evolved. We are further being convinced that what is needed in India's context is flexible experimental approach based on innovation rather than elaborate investigation, and carefully made judgement

rather than long drawn process of huge data analyses. Because, probably, India can ill afford the elaborate planning approach based on western model particularly at this stage of development when urge for action in various directions is immediate and means to respond to them are too meagre. But a conscious and intelligent effort to gnide the regional development pattern at this early stage of development would help the country in doing away the costly remedial measures that the west is presently busy doing [21].

It has also been observed that the unrestrained forces of market economy failed to work towards the convergence of the centre and the periphery regions. That is why the United States and Western Europe continue to be preoccupied with problems of depressed and backward regions within their national territories even after a century and a half of sustained industrialization [22]. This further points out the necessity of breaking this polarisation at a very early stage of development by the intervention of public actions so that the integration of economic spaces can take place along with the development of the economy.

Table 1
Growth Rates of Major Metropolitan Cities of India During 1931-61 :

Name of City	Population in Millions				Per Cent Variation			
	1931	1941	1951	1961	1931-41	1941-51	1951-61	1931-61
Calcutta	1.14	2.11	2.55	2.93	85	21	15	157
Calcutta Metro-politan District	2.49	4.05	5.25	6.58	63	30	25	164
Greater Bombay	1.30	1.70	2.85	4.15	31	67	46	219
Greater Delhi	0.45	0.70	1.44	2.34	56	106	63	420
Madras	0.65	0.78	1.46	1.73	20	87	18	166
Hyderabad	0.47	0.74	1.09	1.25	58	47	15	168
Ahmedabad	0.31	0.61	0.83	1.21	97	36	46	290
Bangalore	0.31	0.41	0.79	1.21	32	93	53	290
Kanpur	0.24	0.49	0.71	0.97	104	45	37	304
Poona	0.26	0.35	0.60	0.74	35	71	23	185
Nagpur	0.24	0.33	0.49	0.69	38	48	41	188
Lucknow	0.28	0.39	0.50	0.66	39	28	32	136

Source : Leo Jakobson and Ved Prakash, "Urbanization and Regional Planning in India," Urban Afftars Quarterly, Vol. 2, No. 3, March, 1967, Tab. 5, p. 44,

Table 2
Proportion of Urban to Rural Population in States Which Contain the Ten Largest Cities of India :

State Total / Remainder of State Excluding the Largest Cities	Population in Millions		Percentage
	Total	Urban	
WEST BENGAL	34.9	8.5	24
Less Calcutta Metropolitan District (1)*	28.4	2.0	7
MAHARASHTRA	39.6	11.2	28
Less Bombay (2), Poona (8), Nagpur (9)	34.0	5.6	7
MADRAS	33.7	9.0	27
Less Madras City (3)	32.0	7.3	23
ANDHRA PRADESH	36.0	6.3	17
Less Hyderabad (4)	34.7	5.0	14
MYSORE	23.6	5.3	22
Less Bangalore (5)	22.4	4.1	18
GUJARAT	20.6	5.3	26
Less Ahmedabad (6)	19.4	4.1	21
UTTAR PRADESH	73.7	9.5	13
Lesi Kanpur (7), Luckoow (10)	72.1	7.9	11

* Rank of the city according to population size.

Source : Leo Jakobson and Ved Prakash, - 'Urbanization and Regional Planning in India,' Urban Affairs Quarterly, Vol. 2, No. 3, March, 1967, Tab. 6, p. 45.

5.4.4. A Proposed Strategy for Metropolitan Regional Development :

In the foregoing paragraphs the broad objective of metropolitan regional planning has been set as to break the polarization of development between the centre and the periphery and to create a continuous activity system incorporating smallest village to biggest metropolitan centre. In dealing with the particular region the following general principles of regional planning have been applied :

1. Identification of existing and future growth nodes within the region and the provision of linkages—physical and economic— of these nodes to the metropolitan centre ;
2. Identification of zone of influence around each growth node.

In applying these basic principles, we are primarily concerned in identifying growth nodes or growth centres of second order only, the metroplitan centre itself

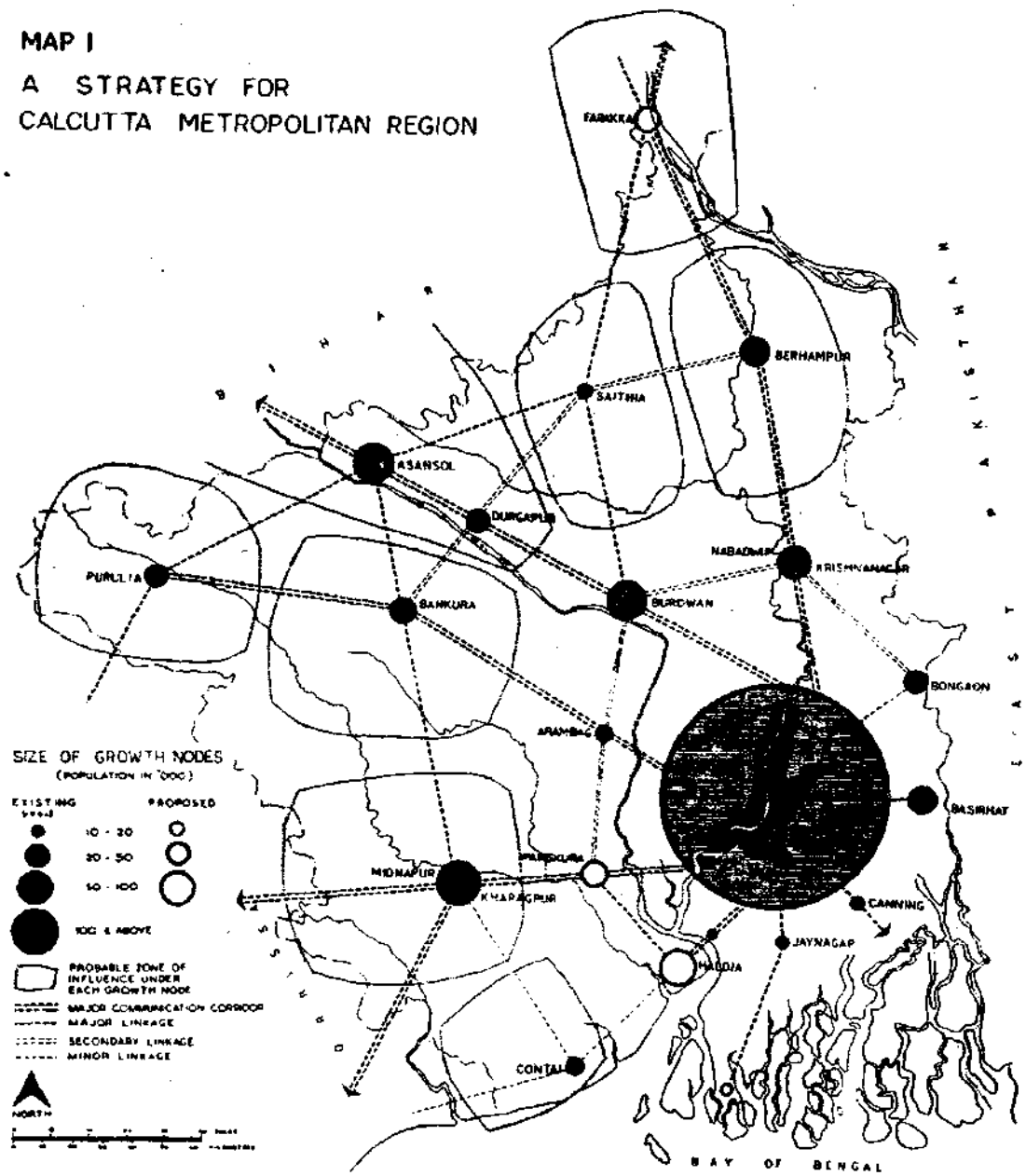
being first order centre [23]. It is because, these second order centres often being the district headquarters will be, in our judgement, prime growth poles absorbing growth impulses generated within the metropolitan centre and transmitting the same to its immediate zone of influence. In Map I these growth nodes have been identified and appropriate physical linkages have been shown. In selecting these growth nodes, the transportation nodality has been given prime consideration.

The strategy of metropolitan development suggested here is primarily based on radial corridor growth concept of the metropolis. In this concept, the metropolitan centre will continue to dominate the metropolitan region and its hinterland, and the transportation routes which are "the sinews of this regional system" converge upon the central city or group of cities. But each of these radial corridors will have number of growth nodes along its route and which will again be connected to the similar nodes of other corridors. In this manner various linkages are created to hold the overall regional system into balance and mutual interaction for development between the nodes are set into play. In doing so, there evolved two distinct rings of growth nodes around the metropolis, separated from one another and intercepted by the strong radial corridors. These two rings, one closer to the metropolis and the other away from it, may be called the "inner ring" and the "outer ring", respectively. The outer ring, in fact, embraces all the periphery districts and, thus, its development is very important to the integration of the periphery to the centre.

The inner ring is consisted of, as it appears in Map 1, Haldia, Parrskura, Arambag, Burdwan, Nabadwip, Krishnanagar, Bongaon, and while Barasat, Canning and Jaynagar do not complete the ring but its locations are within it. In this connection, a revealing feature to be noted that both the rings could probably approach to an ideal ring formation and thereby to a balance regional system around the metropolis had there been no political division of Bengal. The second ring or outer ring is composed of Contai, Kharagpur, Midnapore, Bankura, Durgapur, Saithia, Berhampur. Outside these centres, located along the outer ring, there will be two more growth centres namely, Purulia and Farakka. All these growth nodes or centres of the outer ring have been identified along with their probable zone of influence. Of course, the indication of these zones on the map is very much schematic without having any claim of precision. But the purpose of showing these zones is to indicate only the broad coverage of the periphery districts by the selected growth centres. It is to be realized that within these zones, there will be, again, lower order growth centres which will be connected to

MAP I

A STRATEGY FOR CALCUTTA METROPOLITAN REGION



the zonal growth nodes. The open-end zonal boundary of Asansol-Dnrgapsr complex has beea shown to indicate the possible emergence of the complex to a metropolitan character and, thus, extending its area of influence wide open to the adjacent territory of another state.

Although, two sets of growth centres inter-connected and. thus forming two separate rings (of-course, not complete) around the metropolis which are again intercepted by radial transportation corridors is the major concept behind this planning strategy, there are also some other important variations from this concept. For example, strong linear circuiation patterns bypassing the metropolitan centre have been suggested. One is coming from the south and meeting with the Haldia traffic at Kharagpur and going to north Bengal via Bankura-Asansol-Saithia-Farakka roete [24]. The other coming from Rourkela side and passing through Purulia, Asansol and Saithia is going to north via Farakka.

It is to be recognized at this point that the growth nodes suggested here are the proposed urban centres having an industrial base which would be able, with the help of other industries located outside, to initiate and support the increased productivity of the land and the people within its zone of influence. In the process of development the industrial base will be further broadened and diversified and in this way the urban centre would attain further economic maturity giving rise to import substitution and export specialization of the local economy [25].

It will not be appropriate here to recommend definite courses of action apart from general policy directions which can be derived from this brief study, nevertheless, the following study proposals including two railway links may be considered for further detail exploration :

1. Identification of the core region around Calcutta which will primarily be composed of the "Centre" as referred in the present study and which may later be defined as the metropolitan region. The development potential of this centre is very much related to that of the periphery.
2. In order to tackle the particular problem of the periphery, a separate study should be undertaken in order to assess and quantify the overall agricultural potential of this region, vis-a-vis, the industrial inputs necessary to realize that potential.

3. Industrial base appropriate to the need of the zone of influence of the proposed growth nodes particularly within the periphery is required to be studied in detail.

4. The exact nature and extent of the proposed physical linkages between the growth nodes and also with the metropolitan centre can only be ascertained after having an understanding of the economic ties between these centres. A study in this direction is also needed.

5. In particular, the proposal of linking of Puralia and Bankura by extending and strengthening the existing Tarakeswar line should be taken up for future study. This will give relative ease in accessibility to the two depressed districts of West Bengal and thus providing one of the basic physical precondition for its development. This rail link could also act as an effective bypass to the existing Burdwan-Asansol route by providing connection to the Grand Cord at Gomoh.

6. Also the extension of Jaynagar-Lakshmikantapur rail line by 50 k.m. upto sea-mouth [26], This will not only open up the vast recreation potential of the Sundarbans and the Bay of Bengal where the urbanites of the metropolis could enjoy even a day's retreat at the sea-shore but it could also provide altogether new boosting in deep sea fishing enterprises all along the shore away from the main river course of the Hooghly.

5.4.5. Summary :

In general, a strong dualistic economic and spatial structure is the characteristic feature of metropolitan regions in India. In the present paper also the author observes the same feature from a preliminary study of Calcutta metropolitan area. The structural dualism in Calcutta metropolitan area has given rise to a diverging centre-periphery relationship which has been manifested in the growing imbalances in development between the central and the peripherial districts. Of course, this development characteristic of a growing metropolitan centre very much unrelated to a static or even decaying national territory is a legacy of the past exploitation under colonial rule. But even in post-independence era the imbalance in development cannot be arrested to any significant level although national objective was set for the balanced regional development. In this paper an attempt has been made to provide one of the alternatives ol spatial integration as a means towards the goal of balanced metropolitan

regional development.

Notes and References :

1. This basic resource exploration leads to further industrialization, la this regard Fisher and Reveile stated tbac. "Improvement in agriculture and the other bask resource industries in nearly every instance will be necessary, if early stages of economic development, are to be followed by diversified industrial dcveicpfreat." Joseph L. Fisher & Roger Reveile, "Natural Resources, Policies and Planning for Developing Countries," in Stuart Mudd, (ed.j, The Population Crisis taut the Use of World Resources, (loJiana University Press, Bloomington), 1964. p. 409.
2. John Friedmann, "Regional Planning and Nation Building : An Agenda for International Research," Economic development and Cultural Change. Vol. 16. No. 1, p. 120.
3. See, for example. Report on the World Food Pcogramme by the Executive Director, FAO, Rome 1965.
4. "Transport and Communication in Asia and the Far East," EKISTICS. Vol. 29, No. 170, January '70, pp. 14f.
5. See Robert M. Bone, "Regional Planning and Economic Regionalization in the Soviet Union." Land Economics, Vol. XH1I, No. 3, August, 1967pp. 347-354.
6. See Melvin R. Levio, "The Big Regions," AlP Journal, March, 1968. pp. 66-80.
7. In this regard one of the recent and elaborate studies has been prepared by John Friedmann, Reg ional Development Policy: A Case Study of Venezuela, (M. I. T. Press, 1966). See also Vladimir Matousek, (ed). "The Development of an Environment for Life in the Towns and Villages of Czechoslovakia," EKISTICS, Vol. 25, No. 150, May, 1968 pp. 352-360.

Unit 6 ❐ Indicators of Regional Development

Structure :

6.1 Introduction

Concept of development is multi-dimansional. Economic, social, technological, and infrastructural. Human developments report (1990) has opened that a composite index could be used to measure the levels of development at national, regional and local levels. Index of per capita national income is widely used at national level to compare the economic status of the people. In otherwords, the GDP per capita is derived from the national income date.

Human Development apart from per capita income, refers to social wellbeing. Indicators such as life expectancy at birth, literacy and health determine the social development. The high life expectancy at birth is associated with nutritional & health status of the children. This indicator varies from country to country, region to region and also societal structure. It also includes the balance between birth rate and death rate (Natural increase). This process leads to population growth theory (Transition theory). Literacy including adult literacy is another measure of social development. It refers to the access to education and learning only in broad sense. But quality of education may be incorporated for manpower development.

Indicators related to health, sanitation and access to safe potable water sypply would directly determine the human development. There are many other indicators could be identified and measured by a composite index. Regional development is based on the level of technologies or information used in the development process. Primitive agrarian economy is having traditional mode of production with low productivity maintaining the economy at subsistence level. The use of modern technology in the process of production be it agriculture or industry or others leads to higher productivity, generate surplus and above all efficiency utilise the resources. The level of regional development is also need strong infrastructural base i.e., transport

and communications, trade and commerce and services. The variables such as road or rail length per unit area (100 sq. m.) or per population (1000), accessibility variables, etc are converted into indices by converting them into indicators with suitable statistical methods.

The variables are first made scale free by dividing them by standard deviation and then regionalise to identify the sub-regions of various levels of development into highly developed, developed, under-developed and very backward, etc. The regions or nations are classified into traditional primitive, transitional, urban industrial and regions of mass consumption societies. Scholars like Johnshon has classified the economics into first world of capitalistic economics socialistic second world and under-developed/developing countries as the third world. After the desolution of the socialistic economic, only two types of national economics are catagorised developed & developing countries. The latter ones include those countries which have undergone with colonial rules and recently in the post-second world war period have emerged independent economics. They may be politically independent but economically subserient to the developed economics. The developing world having long history of civilization and economic/political subjugation have emerged with lot of internal problems of poverty, regional imbalances and illiteracy, followed by high population growth. Socail and economics disparitives in them are reality and have been bogged down to achieve growth will equality or balaned regional development.

6.2 General

The theory of regional development that will be put forward in this chapter is closely related to the centre-periphery model that has already been introduced above. Whereas the centre-periphery model postulates the centre and thereby almost tautologically defines the periphery, the present effort tries to show how under the impact of the factor of distance as well as economies of scale and agglomeration centres of socio-economic and political-administrative power can emerge that act as innovation creating hot houses. In section 2.1 attention is paid especially to the economic and socio-political factors underlying the development of such centres.

Regional development theory cannot stop there, however. If regions are to be regarded as open sub-systems that form the parts of a larger system, it becomes necessary to enquire into the effects of the interrelations between them upon their development. It is for this reason that section 2.2 discusses some aspects of the

economic relations between regions and section 2.3 their socio-political interplay.

In section 2.3 we will try to show that the centre-periphery model is a special case of the domination model as elaborated and enlarged there. Whereas the centre-periphery model only allows for the working of so-called extractive forces in a spatial system, the domination model explicitly shows how distributive forces develop. It derives from our approach that the relationships that are assumed valid for one system level are also supposed to be at work at lower or higher system levels. This does not mean, however, that we assume their relative importance at various system levels to be equal.

Finally in section 2.4 a typology of regional structures is introduced which takes into account the constraints that can be imposed by physical factors.

6.3 Growth From Inside

In the previous chapter, we have identified regions as sub-systems of a larger system and in this section we will concentrate on a number of relations between elements forming part of such sub-systems, disregarding the interaction with the sub-system's environment. In doing so, we are especially interested in the processes that lead to (interrelated) structures of social, economic and politico-administrative nature inasfar as these are conducive to the region's adopted goal of growth to maturity.

It will be observed that a distinction can be made between the centre as a physical entity of the settlement system and the centre as a node of dependency relationships concerned with one or more specific sets of functions physically determined in the city. In this connection, it is important to show how such nodes have grown and how historically under the impact of undeveloped transport and communication technology they tend to coincide with specific settlements. In this respect it is unimportant to consider the cases in which functional specialisation has gone so far that decision-making proper has become severed from the execution of the related functions. In such cases the cost of overcoming distance has become negligible relative to the total cost of the operation and the question becomes whether the term centre as node of dependency relations should be associated with a concentration of decision-makers or with a concentration of top-executing activities. This question is answered when we consider that under these conditions we cannot speak of a concentration of decision-makers as the cost of moving these people to

where their top-executives are has become negligible. In other words, and with a better argument, nodes of dependency relations must be identified with concentrations of top-executing activities, as it is through these activities that the decisions become relevant.

Our first task will thus be to look into the process by which such concentrations of executive activities develop and that leads to the emergence of the centre of the sub-system region as defined above. This centre will be identified with the city, which may be defined as an interrelated set of human activities of non-agricultural nature that are separated from each other by relatively small perceived distances. As such, it requires for its existence the continuous production of an agricultural surplus elsewhere. In other words, if productivity in agriculture is not high enough to produce more food than required for maintaining the farmers and their families, specialisation in non-agricultural activities is impossible and cities cannot exist.

At low levels of development, there are two functional specialisations that are directly connected with the existence of an agricultural surplus: transport and commerce. The development process in Europe, Africa, Asia and the Middle East has led to the emergence of market places, whereto surpluses were transported for exchange. Market places, often being located at the intersection of (natural) transport routes, became much more than mere points for the exchange of commodities. They would also turn into points for the exchange of information. In addition, they would start to perform functions that stand in relation to transport and commerce, such as the production of leather goods, clothing, carts, repair shops etc.

While for many a city its transport and commercial functions have emerged first, this is not necessarily so. Other causes may also lie at its foundation, such as a sanctuary, a garrison, government administration, a mine etc.; but nevertheless the two first mentioned functions will always be performed. An important consequence of this is that until a high level of development has been achieved, cities will be distinctly different from the villages that surround them in that, whereas the latter are characterized by social homogeneity, the former have as their main feature social heterogeneity. The social homogeneity of the villages is largely explained by the fact that the villagers have a common interest: agricultural activities, while the social heterogeneity of the city is caused on the one hand by the diversity of functions performed by its inhabitants and on the other hand by the variety of backgrounds they come from.

As Lampard[1] and Friedmann[2] have put it, it is this social heterogeneity from which springs the city spirit, which is based on rationality rather than on religiosity and which reflects vitality and an urge to change rather than a strong sense for tradition. Innovation - of which technological change is only one aspect - will more easily occur in the city than in the rural areas, the relatively wide range of backgrounds and of functions causing the availability of a wide range of information. Innovation being largely based upon the combination of existing elements, the possibilities of using bits of information for bringing about new combinations are evidently greater in the city than in the rural area, as the city has more access to information as well as access to more information.

A major consequence of innovation is specialisation. This holds true for innovation that causes change in the economic structure as well as for innovation that leads to new social and political structures. Specialisation, in turn, causes a change in the dependency relations and can therefore bring about a higher degree of interdependency. While relations of dependency are characteristic of vertical integration, relations of inter-dependency are characteristic for horizontal integration. As will become more clear in section 2.3, the early phases of development of a region will be marked by the city's efforts to bring about dependency relations between itself and the (agricultural) area that surrounds it. Our conviction that it will be able to do so is partly based on the conclusion from general systems theory, that in the interaction between two sub-systems (in our case centre and periphery) there will be a flow of energy from the less organised to the more organised sub-systems[3]. It is also based on the observation of action as developed by change agents to which Friedmann[4] has drawn attention.

Friedmann has mentioned three specific kinds of agents that should be held responsible for the eventual integration of the activities in a contiguous area into a region, in which the social, political and economic spaces of the centre tend to coincide. This process of integration is principally based upon information that is

1. Eric E. Lampard, 'The History of Cities in the Economically Advanced Areas', Economic Development and Cultural Change, 1955.

2. John Friedmann, 'Cities in Social Transformation', Comparative Studies in Society and History, 1961.

3. Stafford Beer, Decision and Control, London 1966, pp. 345 ff.

4. Op. cit.

channeled to the periphery by intellectuals, administrators and entrepreneurs.

The fairly sharp distinction in the early phases of the development process between the social systems of the city and the rural area that has been mentioned above is normally maintained and enlarged by the behaviour of the city intellectual. The deep social gap will start to disappear with the emergence[5] of the disaffected, probably dissenting intellectual, who communicates existing values to the other group. The disaffected intellectual will in most cases be motivated by his belief in the necessity of establishing a new social order. He will eventually succeed in bringing about social integration by providing an ideology that is accepted by both peasantry and city intellectual.[6]

As the process of social integration goes on - or even before that -administrators will extend the influence of the city by establishing a certain administrative order, which will eventually result in legal order. In this way, a stabilising element is introduced and it becomes possible to speak of the political space of the central city, in which towns and villages are subordinated to the rule of the regional centre.

Both aspects of the process of organising the region are based upon establishing channels of communication and. therefore foster innovations in economic structure. The latter will be carried through especially by entrepreneurs, who have become aware of possibilities of economic specialisation in other places than the central city, that is to say, who will become aware of more investment opportunities. This will lead to further economic integration, which will be enhanced to a large extent, as much as social and political integration, by further development of a transport network.

Thus, the process of growth to maturity is seen here key terms of establishing channels of communication and transport networks and in bringing about a common code for all that use them, that is to say, to bring about a common set of values. This process receives its impetus from the actions of the agents, who as interdependent specialists in differing decision-making or top-executive units have high information input requirements and tend therefore to locate close to one another.

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5. See section 3.3.2.

6. Obviously, not any ideology will be successful. Friedmann lists a number of the beliefs that should be included and they range from the belief in progress as a summum bonum to the belief in the social and political equality of all persons.

In many cases, a region's natural resources are the economic basis for its emergence as such and for its further development. It is understood that what are natural resources basically is determined by the levels of technology and of economic development of those that exploit them. Leaving a discussion of the extra-regional forces affecting the exploitation of natural resources for section 2.2, it remains useful to review some of the economic factors leading to regional development by demonstrating the importance of natural resources for that process.

Although it should be recognised that a number of natural resources derive their importance for a region's development from the demand exerted by other regions, there are other types, such as the ecological conditions for agriculture and related activities, that by their primary effects should be identified as growth factors internal to the region. It is this kind of natural resources that allow a region's population to specialise and to come both to the production of surpluses and to the creation of urban settlements. However, not only the simple existence of such resources is of importance, but also their relative location. Should they occur in a concentrated manner, there is more chance of a strong urban settlement developing than in a case where they are widely dispersed. And as the growth of urban settlements can be identified with the emergence of better chances for innovation to take place, a con centration of natural resources can be evaluated as positive from the point of view of development. More favourable, however, is perhaps a situation in which natural resources are neither strongly concentrated nor widely dispersed, bearing in mind that 'concentration' and 'dispersion' are relative concepts in the sense that their content changes with transport technology. If such an intermediate relative location of natural resources is the case, the chances are not only that urban settlements will occur, but also that an intraregional transport network will come into being by which more territory is opened up than in the case of concentration. Such a network may never develop if the resources are too widely dispersed, or only discovered in the very late phases of the region's development process.

The urban centre developed through increasing productivity in the centre's hinterland as well as through that of the centre's secondary activities has been called the 'pole de croissance' or growth pole by perroux[7], who emphasises the effects of such centres upon the region's economic and spatial development. He argues that the emergence of such a pole leads to economies of scale that could not hitherto be attained by the region. These will not only be enjoyed by the so-called propulsive

units, but also by those units of economic activity that are directly or indirectly related to them. It is the expansion of this related set of activities which will cause two effects to take place: one set called agglomeration effects which occur when the propulsive units attract complementary activities which obtain cumulative opportunities for lower cost in one place; the other set called junction effects which arise as a consequence of the creation of new transport networks that serve primarily the propulsive units and the directly related activities but will also serve producers along these networks to obtain access to markets that were hitherto closed[7] to them.

Perroux's analysis has been refined by Siebert,[8] who discusses a number of growth factors - such as innovation, growth in the stocks of labour and of capital and the related increases in demand for consumer goods and capital goods - in terms of their locational origin and effect. Thus, he says that if the rate of return on capital is higher in the centre or pole, there will be a tendency for a flow of investable income from a great many points in the region toward the pole. The cause for differences in rates of return on capital, however, will never lie with capital accumulation itself, argues Siebert, so that this factor alone cannot be ascribed polarisation effects.[9] (Siebert seems to be overlooking here the importance of economies of scale). The main cause for these differences is innovation and, as innovation tends to occur mainly in poles, capital accumulation is seemingly therefore a polarising factor. Similarly, the new supply of labour will not have polarising effects. The polarising effects of other factors (such as innovation), however, are not hampered by labour, but can even — as with capital — be enhanced by the mobility of labour'.[10] The polarising effects of innovation are conditioned by the circumstance that innovation which is not related to transport is not immediately absorbed by the entire regional system, especially in 'capitalistic' societies, which tend to protect innovations by patents.

The spatial effects of increases in consumer demand will depend mainly upon the spatial distribution of an increase in income per capita and the average optimal size of the firm. If the average optimal size is small and increases in income per

7. Francois Perroux, 'La Notion de Pole de Croissance', Economie Appliquee (1955), Nos. 1 and 2.

8. Horst Siebert, Zur Theorie des regionalen Wirtschaftswachstums, Tubingen, 1967, pp. 30-52.

9. Op. tit., p. 35.

10. Op. tit., p. 38.

capita are evenly spread over the region, the effect of an increase in consumer demand will be evenly spread over the region. If however, the average optimal size of the firm is large, the effect of an increase in demand will be in the direction of polarisation and even of full polarisation, if all big firms are concentrated in the region's centre.

Given the fact that investment goods are normally produced in medium to large-scale firms, it must be concluded that an increase in demand for investment goods will have a tendency towards polarisation. While these economic processes take place - in which migration is of special economic importance - social and political processes go on, sometimes reinforcing the economic ones sometimes hampering them. By way of example, we can say that if the value system in the region is conducive to social mobility, economic specialisation will more easily come about. It may be hampered, however, if the social stratification is very rigid and especially so if the upper strata command most political power. The social structure of rural communities being in general more rigid than that of cities, the latter situation may constitute an important 'push' factor in the process of rural-urban migration.

Although we will come back to the political processes in section 2.3 it seems proper to admit that the present author does not feel competent to analyse these in detail, as is the case with the social processes.

Before concluding the present section and turning to theory concerned with growth factors that have their origin outside the region, it seems useful to mention a few loose ends that have to be taken up where an attempt is made to integrate the two approaches. One such loose end is the emergence of the disaffected intellectual, who can only appear in the regional scene due to information from outside. Another is that the present section can only have been concerned with activities of regional and local character,[11] as we have been considering the region as a closed system, and which is, in principle, the wrong way to look at regions.

6.4 Growth from Outside

The main factors for a region's economic development mentioned in the previous section are investment, innovation and natural resources. They constitute, together

11. See section 5.2.1.

with the growth of the labour force, the traditional growth factors of spatial economic theory, and should be considered as partially induced and partially autonomous factors. The seemingly most autonomous among these is natural resources. Especially in the early stages of a region's development, these are of overriding importance and their exploitation will often lead eventually to a scale of activities that is mainly determined by extra-regional demand. This will be especially the case with such natural resources as natural qesthetic beauty, mining deposits, favourable ecological conditions, natural harbour sites, etc. or combinations thereof. The exploitation of the resources may then become the economic basis for a region's development process. This will not be the case, however, unless a number of preconditions are fulfilled. These preconditions should lead to an absolute - and not a comparative[12] -advantage over other suppliers that sell similar products in one or more extra-regional markets. Such an advantage is based upon the structure of demand, the accessibility of the resources and the availability of the required amounts and qualities of factors of production. In other words, there should be a socio-economic structure (partly inside, partly outside the region) which permits the exploitation of the natural resource to lead to interregional trade.

Recognising that the exploitation of a region's natural resources is often based upon investments originating from other regions, the resulting increase in the region's exports has multiplier effects similar to those occurring for a nation's exports.[13] That is to say (although due to ownership of exploiting units by firms outside the region profits will often leave the area where they are earned and thus do not necessarily stimulate its further growth), the wages earned by the increase in export activities will be spent in the region, causing regional economic activity as well as imports to increase. Once demand for hitherto imported but potentially regional commodities has increased sufficiently to reach certain threshold values, it will become attractive for entrepreneurs to start production units within the region, thereby also enlarging the region's market for other activities. The creation of new industries will lead to

12. Classical international trade theory which requires the existence of comparative cost advantage as necessary and sufficient condition for the emergence of international trade, is, among others, based upon the essential assumptions of different monetary systems of two trade partners and immobility of factors of production, two assumptions which cannot be maintained in inter-regional trade theory.

13. See e.g. J. Vanek; The Foreign Trade Multiplier, in C. P. Kindleberger, International Economics, Homewood, 1963, p. 659 ff.

the emergence of external economies and may eventually cause the arrival of new industries that add to the region's export base.[14] In other words, the emergence of a 'national' or even 'international' economic activity, may (via the establishment of 'regional' and 'local' industry) lead to the diversification of the region's exports. And also, unless extra-regional demand is added to that from the region, the region's resources will not become fully employed. In this connection, it is quite possible that goods — such as wine, or wheat or sugar or wood — pass from being regional goods to the status of national goods.

Horst Siebert[15] criticises the export base theory for neglecting the effects of intra-regional demand upon a region's output (it only looks at exports), but especially for not explaining the reasons for an increase in extra-regional demand. The increase in total demand - he maintains -should have to be explained from the factors underlying the regional growth process, as extra-regional demand originates from another or other regions. In other words, Siebert feels that the export base theory loses much of its attractiveness once it has to explain growth in a system of regions. His criticism concerning intra-regional demand is justified, it seems (no autonomous changes in non-basic activities are accepted, as a result, for instance, of response to higher income demand) while that concerning the causes of growth in extra-regional demand is not quite tenable once a number of aspects of a system of regions are taken into account.

There is - first of all - the fact that the regions of a country are virtually always at different levels of income per head, and, equally important, of different size. The cumulative flow of innovations in the more developed sub-systems will bring about new products, the raw materials for which are not necessarily available in these sub-systems. (In this way, Siebert's first objection is also met). These raw materials may be available in other sub-systems, however, especially -in large countries. Thus, an increase in a region's export demand can be explained by the regional development process that goes on in other (more developed) regions. Another cause for an increase in demand for certain regional products that turn into national ones - such as touristic

14. The theory of the regional export base has been developed by Douglas North in 'Location and Regional Economic Growth', Journal of Political Economy, 1955, p. 243 ff., in analogy of Andrew's concept of 'urban economic base', cf. R. B. Andrews, 'Mechanics of the Urban Economic Base', Land Economics, 1953, 1954, 1955, 1956.

15. Horst Siebert, op.cit., pp. 89-91.

attractions, folkloric art, etc. - is found in their skillful promotion through national communication networks, the establishment of which is part of the development process.

A third possibility for extra-regional demand to emerge - although not implied in the export-base theory - is that certain natural resources become exhausted in other parts of the system, so that existing demand is diverted. A similar effect may be attained by sudden price differentials caused by imports restrictions, devaluation, etc.

Export-base theory, in order to work will, must assume that the partners in regional trade have attained a degree of-integration by which the mobility of labour and capital is not hampered. It is possible, however, that infra-structural conditions prevail that cause these flows to be negligible, so that Ohlin's[16] pure theory of international trade can be applied to the situation. The effect of trading will be a tendency for specialisation in the less developed of the trading regions. This specialisation - in the more favourable cases accompanied by economies of scale - will make for an increase hi productivity, by which additional resources become available for investment. In this way a process of development is set into motion.

Autonomous factors in this theory are the existence of scanty transport and communication networks on the one hand, and the relative scarcity of factors of production in both regions on the other. Unless the former exists and factor endowments in both regions differ, immobility of factors of production and comparative advantages can not exist. Authors supporting this theory normally leave it at this. It seems interesting, however, to try to pursue the road that might eventually lead to the poor region's development.

One might then observe that once trade between the two regions reaches a certain volume, another force starts to work, leading to the destruction of the conditions on which the growth of the poor region was based. This force is found in the improvement of the networks of transport and communication: once these are in better shape, the immobility of factors of production over the frontiers of the two regions starts to disappear and factor endowments in the two regions tend towards equalisation. The importance of the comparative advantage of the poor region starts to shrink and exporting will only be continued if the comparative advantage nears an

16. B. G. Ohlin, Interregional and International Trade, Cambridge, Mass., 1933.

absolute advantage. In this no-man's land between two clear theoretical situations it becomes difficult to foresee what will happen to the poor region.

Myrdal[17], Hirschman[18], and Perroux[19] have devoted serious attention to this no-man's land. Myrdal has devised two new terms for the purpose: the spread effects and the backwash effects, which coincide with the effects mentioned by Hirschman: the trickling-down effects and the polarisation effect. Trickling-down effects are favourable for the poor region and occur when the richer regions start buying from and investing in the poorer region.[20] This effect is very likely to occur if there exists between the two regions a certain degree of complementarity. By using the notion of complementarity Hirschman avoids the problem of comparative versus absolute advantage in competitive products, and takes up another extreme position by assuming that trade between the two regions will certainly lead to development of the poorer one if their products are complementary. However, what happens if there exists no complementarity? Then polarisation effects may be the stronger of the two.

The polarisation effects according to Hirschman - or, in Perroux's wording: the 'effects de stoppage' - take place when the activities in the poor region become depressed as a result of competition of the richer region. That is to say, a number of activities, that previously existed by the grace of a poor transport network are now no longer able to compete with the richer region's supply. In addition, when employment opportunities do not grow adequately, the best elements of the labour force of the poor region will tend to migrate towards the richer region.

It will now depend upon the strength of the two opposing forces whether the poor region will develop or enter into a period of stagnation. The positive trickling-down effects may in the end win from the polarisation effects, if the richer region has to rely upon the products of the poor region for further development. This possibility will come true if the poor region is able to supply these commodities. If, however, the supply-elasticity of the products of the poor region is too low, the resulting increase in price may lead the richer region to import from abroad rather than see its

17. Gunnar Myrdal, Economic Theory and Under-developed Regions, London, 1957.

18. Albert O. Hirschman, The Strategy of Development, New Haven, 1958.

19. Francois Perroux, L'Economie du XXeme Siecle, Paris, 1964.

20. Hirschman's trickling-down effects have been called 'effets d'entrainement' by Perroux; they occur when due to the richer region's demand new employment is created in the poor region, and productive capacity is increased.

production expansion hampered by shortages and its sales go down owing to price increases.

Thus we see that once the networks of transport and communication are improved, the poor region will enter into a period of economic uncertainty, unless a very clear advantage exists vis~a-vis the richer region.

6.5 A Theory of Regional Development

In this section an attempt is made to formulate a theory of regional development. It is a theory which is based on the one hand on some elements of Perroux's theory of domination and on the other, on recognition of the importance of access to information for effective decision making. This theory should not be seen as replacing the theories that were summarised in the previous section, but rather as one which makes possible the understanding of these two sets of theories as partial explanations of one and the same phenomenon that occurs simultaneously at different system levels. As such, the theory lends more substance to the concept of growth pole by giving it a political dimension and the same occurs with the economic concepts of trickling-down and polarisation effects which are paralleled by the concepts of distributive and extractive domination.

It seems useful to indicate at this point the relation of the present section with the previous ones, lest this be misunderstood. Such a misunderstanding could well arise from the fact that little reference is made to the economic mechanisms discussed nor that we made much reference to the relations we will elaborate here. The reason for not giving more cross references, however, should be found in the high degree of complexity of the phenomenon of regional development. It was, therefore, thought useful to separate, to some degree, the various kinds of factors influencing regional development and to discuss the phenomenon in successive approximations.

This iterative approach is not chosen without reason. It follows from the approach that is taken in this section, an approach in which it is assumed that the use of power — if not opposed by political or military means - can only be checked by either factors of physical nature and/or economic constraints. The relevance of the former

21. Cf. Spatial structure and decision making, Development and Change. 1-1, 1969; where an earlier version is presented.

kind of factors is a typology of regional structure. The importance of economic factors in the use of power among regions is hinted at continuously in the present section.

The use of power is a social policy in terms of the effectiveness of decision making and the importance of information. The relevance of information for development was effective while speaking of Friedmann's and Lampard's theories on the city. Here, their theories are expanded and used in relation to elements of Perroux's theory of domination, notwithstanding Blaug's criticism[22] of the latter.

While Blaug's criticism can be disregarded, we remain dissatisfied with Perroux's theory in as far as it does not properly explain how domination comes about; in his

22. Blaug's arguments (Mark Blaug: 'A Case of Emperor's Clothes: Perroux's Theories of Economic Domination'; Kyklos, 1964, pp. 551-563) against Perroux can be summarised in two quotes: i. 'The theory of economic domination is not a scientific proposition. It is not that the Domination Effect cannot be quantified, as Perroux himself put out. After all, many important ideas in economics are not capable of being expressed in numbers. It is rather that as a 'qualitative' proposition, it cannot, even in principle, be falsified. It makes no prediction that can be checked against facts. It is simply a slogan masquerading as a theory.' (Op. cit., p. 560), and 11. 'If economic activity is dominated by [economically] irrational macro-decisions which are not subject to market-corrections, what scope is left for economic theory as a separate discipline?' (Op. cit., p. 559. The addition is by the present author and is in accordance with Blaug's analysis; cf. p. 554.)

This first of both statements seems obviously the most serious one. The second is much less so: in the first place, economists ought not to be worried by the idea that economics as a separate discipline might no longer have a right of existence; in the second place, Blaug disregards the possibility that decisions which are second-best, and therefore not optimal and 'irrational' in an economic sense, can be economically feasible. This becomes clear for instance from case-studies concerning the choice of location by entrepreneurs (see e.g. Greenhut, M. L., Plant Location in Theory and Practice, the Economics of Space, Chapel Hill, 1965): this choice is often irrational from the economist's point of view but does not interfere with the possibilities of making a profit.

With his first statement, Blaug hits hard at especially the earlier versions of Perroux's theory, that is, before it was formulated in terms of 'poles de croissance' and interrelated with the various concepts of space. But even with regard to this last version, there is some justification in Blaug's assertion, that the theory of domination cannot be 'falsified'. This justification is not so much found in Blaug's arguments: Hansen (Niles Hansen, Development Pole Theory in a Regional Context, Kyklos, 1967, pp. 709-725) for instance, has given ample evidence that the theory can be 'falsified'. It is found in the basic assumptions that underlie the theory, namely, i. that domination exists and ii. that its effects promote development. It is the first assumption that cannot be 'falsified' and it is the second which Hansen found to be refutable. Hansen, therefore, justly quotes Paelinck 'who proposed that it be regarded as "a conditional theory of regional growth; it is valuable chiefly to the extent that it clearly indicates the conditions under which accelerated regional development can occur".' (Op. cit., p. 725), namely under the condition that domination exists.

view propulsive units are both cause and effect of domination processes, which leaves us with the unsatisfactory problem of the chicken and the egg. It is in an attempt to bypass the problem that we have started this chapter with a discussion of theories on the development of the city. The same attempt explains our preoccupation with flows of information and their relevance for decision making in the present section because the additional variable of 'availability of information' is taken here as among the causes for propulsive units to choose location at a certain site. In other words, we abandon the neo-classical assumptions of 'perfect foresight' and 'equal spread of information', two of the necessary assumptions for competitive equilibria to occur.

In his book related to regional development and planning in Venezuela, Friedmann summarises[23] the state of regional development theory in a set of eight propositions:

'1. Regional economies are open to the outside world and subject to external influence.

2. Regional economic growth is externally induced.

3. Successful translation of export sector growth into growth of the residentiary sector depends on the socio-political structure of the region and the local distribution of income and patterns of expenditure.

4. Local political leadership is decisive for successful adaptation to external change. Yet, the quality of leadership depends upon the past development experience of the region.

5. Regional economic growth may be regarded, in part, as a problem in the location of firms.

6. Economic growth tends to occur in the matrix of urban regions. It is through this matrix that the evolving space economy is organised.

7. Free flows of labour tend to exert an equilibrating force on the welfare effects of economic growth. But contradictory results may be obtained.

8. Where economic growth is sustained over long periods, its incidence works toward a progressive integration of the space economy.

The exchange of information which is more widely available in larger settlements than in smaller ones, *ceteris paribus,* tends to give the former an advantage over the

23. Regional Development Policy. A Case Study of Venezuela, Cambridge (Mass.), 1966, p. 29.

latter in terms of potential for development. The availability of information is important in a very specific way, namely in that it facilitates effective decision making. It is this element that will be elaborated upon in the present section, in order to arrive at hypothesis concerning the relation between a country's city-size distribution and the way in which its decision making processes have been organised.

City distributions by size are of two types and occur as such or as combinations thereof. The first type of distribution is the so-called primate distribution of cities by size, that is to say, distributions in which one or a few very big cities occur together with a large number of smaller towns and villages, while no intermediate-size cities are represented. These so-called primate distributions are not explained by theory (Jeferson), Rank-Size Rule, partly explains the so-called log normal distributions that seem to obey the law which is expressed in the following formula:

$P\alpha_r = P_1/r$
where P_1 = size of the highest ranked city
P_r = size of city rank r
and
α = a constant characteristic for the sample of cities.

Various attempts have been made to explain the different types of distributions. Among these attempts is that by berry [24], who tested the hypothesis that the type of distribution is a function of the relative degree of economic development. He made this test using data for 37 countries. Berry has to conclude that no such relation is apparent in his sample. He therefore points to factors of a politico-administrative and/or economic nature to account for the different types of city size distributions. Thus he says:

'Countries which have until recently been politically and/or economically dependent on some outside country tend to have primate cities, which are the national capitals, cultural and economic centres, often the chief port, and the focus of national consciousness and feeling. Small countries which once had extensive empires also have primate cities which are on the one hand 'empire capitals' (Vienna, Madrid, Lisbon, etc.) and on the other hand centres in which such economies of scale may be achieved that cities of intermediate size are not called for.' [25]

24. Brian Berry, 'City Size Distributions and Economic Development', Economic Development and Cultural Change, July 1961, pp. 573 ff.
25. Op. cit., p. 582.

Berry restates his argument in more general terms when he suggests that log normal distributions are the result of a 'stochastic' growth process, in other words, a process in which many forces act randomly. In other types of distributions, however, fewer but stronger forces act and the resulting distributions show a tendency for primacy.

It seems quite possible to argue that the forces Berry mentions are decision-based, the underlying aim of the decisions being the improvement of the welfare of the persons that make the decisions or of those they are made for. If these decisions are many and made randomly, they are not reflecting a general scheme of action that governs them. The evidence then seems to point to a high degree of freedom for making decisions, that is to say, it implies that they are made in a system of complete decentralisation. It also implies that the decisions carry little weight, therefore tie relatively few people, and therefore will, in general, have a relatively small area of influence. In other words, a system of complete decentralisation, if maintained over a relatively long period will tend to result in a city-size distribution that is oddly shaped: all centres will be of approximately the same (small) size.

If, on the other hand, all decisions are made in one centre, this will be the focus of all information and all decision-makers will need the greatest part of their decision-making apparatus in that centre. The resulting distribution of cities by size will be an extreme example of the primate distribution: one big centre will be accompanied by a great number of similarly sized small satellites.

In reality, these 'ideal types' do not occur of course. However, in a number of countries and during a relatively long period, the tendency towards «the centralisation of decision-making has been stronger than that towards the decentralisation of decision-making processes. The reverse holds for other countries. Whatever the case, the way in which the decision-making process is organised must be a reflection of the set of values and attitudes characteristic for the system - especially those concerning the use of power and the nature of authority - as well as of the use which has been made of production and communications technology. The more widespread is access to information, the more likely it will be that decision-making has a relatively high degree of independence. Recognising that the decisions that are essential for the behaviour of a system have, apart from political, also economic and social implications, it will be clear that institutions and organisations that have to some degree specialised

in the execution of functions in either of these fields, will tend to cluster in those places where such decisions are being made, bringing with them the greater part of their own decision-making apparatus. The implication of this reasoning appears to be that if the set of values and attitudes with which a spatial system has been organised, has led to a tendency to centralisation, decision-makers (i.e. top-executive units) will tend to cluster in a few cities of relatively large size, whereas if the reverse holds, the city size distribution will tend to have a log normal shape. Centralisation is defined here as the organisation of decision-making in which binding decisions regarding local and regional activities are made at the regional and national levels respectively.

Some support for this hypothesis is found when we arrange the data provided by Berry according to the type of politico-administrative principles applied in organising the decision-making process during a relatively long period in the history of the 37 countries he has studied (Table 5.1). As follows from the available data, 25 out of the 37 follow our hypothesis. Of the twelve remaining countries, two (Japan and Sweden) would probably have been in the proper box had their ecologically favourable areas been larg. Canada, Australia and New Zealand and Yugoslavia, which have not really had the time to establish themselves as countries, should perhaps not even have been in the selection.

Table 5.1 City Size Distribution and Government Organisations; 37 countries*

Types of City Size Distri-button	*Type of Government Organisation*			
	Historically Decentralised		*Historically Centralised*	
Rank-Size	Belgium Brazil China Finland W. Germany India	Italy Poland Switzerland U. of South Afr. U.S.A.		
Intermediate	Australia Canada Yugoslavia	England & Wales New Zealand Norway	Ecuador Nicaragua	Malaya Pakistan

Types of City Size Distri-button	*Type of Government Organisation*			
	Historically Decentralised		*Historically Centralised*	
	Japan		Austria	Mexico
		Ceylon	Netherlands	
Primate	Sweden	Denmark	Peru	
	Domin. Rep.	Portugal		
	Greece	Spain		
	Guatemala	Thailand		

* The data concerning the type of government organisation were most kindly provided by M. Faltas of the Institute of Social Studies.

Though our hypothesis has not been put to a very strong test, the evidence provided by the data allow the conclusion that a strong relation exists between the way in which a country's decision-making process has been organised and the country's distribution of cities by size. It is to be noted that these differences in the decision-making process refer to differences in power exercised at the various levels of the city hierarchy. The evidence thus seems to justify an attempt to add to the analysis provided by economic geographers and to follow Perroux when he discusses the relations between sub-systems at the international level in terms of domination, a concept which relates to the power for decision-making. In the following we will be concerned with the relations between the sub-systems of a system of regions, one of these performing the role of centre. Analogous reasoning is possible for the relations between the centre of a region and the other activities within its boundaries, although this analogy should not be pushed too far.

The concept of domination presupposes the existence of centre-periphery relations, which are reflected in the phenomenon of polarisation. By polarisation is understood the tendency for a number of activities in one or more areas (the periphery) to be geared to and led by decisions prepared in another area, called the pole or centre. In other words, the centre dominates the periphery. As is shown in the writings of authors such as Friedmann in a national system the centre should in the majority of cases be identified with the sub-system in which the nation's capital city is located. It is there that (within the limits set by the international system) decisions of direct or indirect allocative nature are made, these decisions influencing the entire system.

Perroux has made clear that domination of a sub-system B by a sub-system A occurs when the reactions of B are not sufficient to offset the actions of A with regard to B. This insufficiency is explained by one, or a combination of, the following factors: i A) may be considerably bigger than B; ii A) may have a superior structure or iii A) may have a greater bargaining power. The importance of each of these factors will be discussed in some length, starting with the last one.

Taking some basic conclusions from bargaining theory, it can be observed that a party's bargaining power increases with its ability to alter the opponent's preferences and/or to control the alternatives open to the opponent.[26] It seems useful to apply these conclusions to a centre-periphery situation, so that a number of characteristics of the centre-periphery relations can be pointed out more sharply. It may be added, that it is basic for the outcome of the bargaining process, how much information each of the parties in the process has available as to one another's preferences and alternatives.

In any deal occurring between A (the centre) and B (one of the peripheral sub-systems) A will be in an advantageous position, because it will be better able to know about B's preferences and alternatives than vice versa, as A is located with the system's communication centre and therefore has access to more information than has B. A's advantage is especially clear concerning information about alternatives. Whereas A has access to information from all other sub-systems as well as from the international system with which it is connected, the knowledge of B as to its own alternatives is most likely restricted to those related to the preferences of neighbouring sub-systems that also form part of the periphery. B's information concerning A's alternatives will be practically nil.

As A is better informed than B with regard to preferences as well as alternatives, it has a better position to start with. But also in the bargaining process A holds the winning cards: while it is in a good position to alter B's preferences, on the one hand through the use (or abuse) of the national communication network and on the other hand using the arguments which it knows are sufficient to make B change its mind, B will normally fail to alter A's preferences as A has access to superior information which it can use to its advantage.

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26. Df. e.g. A. Kuhn, The Study of Society, Homewood, 1963, p. 245 ff.

Also to A's advantage is the circumstances that national decision-makers have a tendency to over-estimate interests close at hand and to underestimate those far away: this psychological effect of distance will be easily exploited by A in its attempts to enforce control on B. The importance of this circumstance will diminish when in a later phase of the development process politicians from B are participating more forcefully in the decision-making process.

The two other factors that may underlie domination (differences in size and structure) are often interrelated, in the sense that a superior structure is often the consequence of larger size. Size is understood here in terms of population rather than in terms of area. If a sub-system has a larger population than any of the others in the national system it will be able to produce under conditions not available to the latter, that is, it will reap the fruits of economies of scale and of agglomeration as well as of a degree of specialisation that cannot be attained in the other sub-systems. The larger sub-system will, therefore, normally have a higher income per capita and in turn, a different demand structure. The differences in demand structure will tend to cause the existence of a production structure as well as of a level of technology that are ahead of developments in the other sub-systems. Hence, the dominant sub-system finds itself in a monopolic position with regard to technology. This is also the case with information: its central position allows for access to more information concerning the whole system and its position as the link with the international communications network enable it to take first choice of innovations transmitted through this network.

Thus, it was argued that differences in size among sub-systems may lead to differences in their structure, in the sense that the larger one will have a superior structure, that is to say, perform more functions. However, also sheer size differences may cause a situation of domination, even if the dominating sub-system performs fewer functions and has an inferior socio-economic structure. This case is especially relevant when domination is established through warfare between two otherwise equally well equipped sub-systems. The larger of the two opponents - who might even be slightly less well equipped than the smaller — will be able to acquire a dominating role.

Summarising we may say that a country's spatial system is defined by the existence

of a number of interrelated spatial sub-systems, one of which [29] acts as the dominant sub-system or centre, the other ones performing the role of the dominated. The emergence of these spatial sub-systems is explained in economic terms of factors such as transport cost and economies of scale and of agglomeration, whereas the emergence of relations of domination is explained by differences in power among the sub-systems. The latter factor is principally based upon differences in access to information. Both the way in which available information - especially concerning production and communication technology — is used and the prevailing value system determine to what degree decision-making is centralised and what part of the population is engaged in functions that are mainly characterised by their executive aspect. As will be elaborated, the value system of the dominant centre determines the character of the domination relationships. It thus seems that the sub-systems are organised into a hierarchical structure of three dimensional nature: the decision-making space in which the two first dimensions refer to area and which occur on a country's territory while the third dimension is decision-making power. This three dimensional space has a maximum power of the system's centre and relative maxima power of the centres of the sub-systems, the minima occurring between them and at the country's frontiers.

Domination appears to have two complementing components: extraction and distribution. It is extractive in-as-far as it enables the centre to gain a net profit from its relations with the dominated sub-systems. It is distributive inasfar as the latter are enabled to make use of the existing field of forces to promote its own development. The two components are complements in the geometric sense of the word: if the one increases, the other decreases and vice versa. Thus, it is assumed that political power can and will be used to the economic advantage of the most powerful. The hypothesis can be advanced that the extractive component in domination is of overriding importance when the dominated sub-systems are relatively underdeveloped, because it is especially in such a situation that the centre can more easily forge structures that allow relations of domination to work in an extractive manner. This is what we understand by a centre-periphery situation. In a situation in which the dominated sub-systems have become horizontally integrated parts of the system, the distributive

29. This is the general case. There are, however, a number of countries where competition exists between two such systems.

component is at its maximum and the forces that support it will see to it that the interests of the dominated are looked after.

In the early stages of a country's development, the centre will be especially interested in those structures by which relations between centre and periphery can be maintained, that enable the execution of decisions made at the centre as well as control over their execution. In this connection, three sets of processes designed to bring about such structures seem to be of particular importance: i) the formation of cadres at the peripheral sub-system level responsible for the execution of decisions made in the centre; ii) the formation of institutions and organisations that enable control of these cadres as well as of essential aspects of the periphery and iii) the formation of transport and communication networks that enable control over the flows of goods and information.

In the understanding that these structures never entirely respond to the centre's extractive objectives - not even in the earlier phases of domination - the first set of processes will in the case that the extractive component is of major importance lead to the establishment of economic and political administrations in the periphery that are at least partly manned by agents coming from the dominating sub-system. Their role is in the first instance made possible by means of investment, on the one hand in economic ventures, and on the other in a network of transport and communications that allow goods and information to be channeled to the centre. Of great importance to the then- success is the superior technology by which the activities of the agents are supported, as this will enable that control of the operations is in the hands of the agents. In addition, the agents may require the co-operation of the local population.

Whether this co-operation remains based upon the use of force or is obtained otherwise, it is essential for the spreading of the centre's technology and an important element in the transmission of the centre's values.

The integration process that is set in motion in this way will lead to an increase in the exchange of commodities between central and peripheral sub-systems. The increase in trade, however, will tend to be in the centre's extractive interest, as it is by the centre's technology that this exchange is made possible, and the networks of commodity distribution will tend to be under the direct control of the centre. Exchange of commodities that is not in the centre's interest can be ruled out or left at a

minimum level. The centre will not only decide about what goods are transported but also about where to. These decisions as well as all other ones will be made known through the communication network, established by the centre.

One of the major signals in the allocative process of commodities being price and the price that can be paid for something basically depending on the credit the prospective buyer can obtain, the establishment of complete control over distribution systems requires control over credit facilitating institutions. Thus, the second set of processes is essential, not only inasfar as they enable control over the periphery, but also inasfar as they serve for controlling the centre's agents, who might wish to enter into independent action on the basis of credit or control over distribution systems.

While the third set of processes was instrumental in enabling the cadres to perform their functions, it is also of importance for reinforcing the second set. It is obvious that the creation of centripetal networks of transport (by road and water and rail and otherwise in modern times) and of communication strongly influences the spatial structure of a system as a whole. The importance of the transport network can be clarified by the consideration that as long as a sub-system is of little importance for the centre's extractive purposes, or as long as a subsystem's relative isolation does not endanger the system as a whole, no resources from the centre will be spent on changing this situation. Development of natural resources in such sub-systems will, therefore, tend to stagnate and will instead tend to occur in those sub-systems in which the centre had already taken an interest and that have been more fully integrated into the system. Here, we have one of the reasons why regions can be late in developing.

Essential for the present attempt to add to Perroux's domination model is that in the analysis of the extractive component we encounter a number of factors that in the early phases of development make extraction more efficient, but later on cause and enable the distributive component to expand. These factors are principally the formation of cadres and the creation of networks of transport and communication.

Whereas the formation of cadres is designed to bring about the execution of decisions made at the centre, it also introduces into the dominated sub-system new technology as well as other information which is also put to uses other than the extraction envisaged by the centre. The need to employ people from the periphery

leads the centre to establish educational facilities by which the periphery acquires the means to adapt itself better to the new technology that comes from the centre. The information and technology - although introduced in support of the centre's agents — will eventually be integrated in the periphery and put to use to the periphery's advantage.

While on the one hand the centre's influence on the periphery increases as extractive activities increase, the extractive nature of the domination will be more and more recognised by second and following generation agents of the centre, who as time progresses will be inclined to identify themselves more and more with the interests of the dominated sub-systems.

In addition, however, it should be recognised that the distributive component in the domination process has normally been present independently from the beginning of its establishment. This recognition is based upon the consideration that in all societal systems, groups are found that consider it of high value to assume and carry responsibility for improving the welfare of others. It is characteristic of such groups that their members will accompany the cadres when these settle in the periphery. Such persons will often at an early stage recognise the extractive character of the centre's activities in the periphery and they will report accordingly to the centre, hoping that it will interfere with what is going on. They will also tend to bring about changes by means of direct action in the periphery itself.

Although the centre in response to such actions may change some of the aspects of extraction, it will basically attempt to maintain the extractive component at a maximum level. It will do so through the manipulation of the distribution network and the credit institutions. It will in general, however, not be able to prevent use of the transport and communication networks in favour of the dominated sub-systems. This use will be enabled by at least the following circumstances: a) conflicting interest groups at the centre that use relevant information from the periphery; b) the gradual involvement of persons with a periphery background in the national decision-making process; c) the emergence of banking institutions and commercial centres in the periphery. The polarisation effects are strong and the extractive component is probably most strongly perceived. Investments in the periphery and the multiplier effects of peripheral exports have become important enough to allow the emergence of secondary and tertiary enterprise owned by the dominated sub-systems. The

distributive forces start to take on organised forms. Trickling down effects have started to occur.

The extractive component in the centre-periphery relations will continue to be stronger than the distributive one until the periphery has created regional elites (often educated in the centre's educational system) that have sufficient power to replace the alien agents. Due to the contacts between the two groups, this replacement will eventually occur in administrative as well as in economic and political functions. Participation in these functions, especially when they concern international and national activities (as opposed to regional and local activities) by persons from the periphery will bring about a decrease in the extractive component of domination because these persons will tend to be more concerned with the periphery's welfare than with that of the centre. This tendency is explained by the pressure of social control.

The consequence of the access by the region's elites to the centre's technology and information systems and their participation in relevant decision-making processes will be a gradual overlap of the periphery's set of values and attitudes with that of the centre. The distributive forces will by now act through political parties and other pressure groups, in this way competing for public funds with the centre's extractive forces. Distributive forces need not necessarily be of similar ideological nature; the reason for calling them distributive is that they aim at using the domination process for interests other than those of the centre. It may, however, be expected that certain organisations (such as political parties that profess an ideology which is in favour of a more equal distribution of income and wider access to information in general) which find their origin in the centre or abroad will be the best means by which to make distributive forces effective. It is therefore that regional elites will — at least partly - tend to associate with such organisations. If they do so in general, the process of political integration of dominating centre and dominated sub-systems will be enhanced. The stage of political integration seems essential, as it permits the latter to bring about a new spatial pattern of government expenditure, which is crucial for further regional development. The chances for political integration - i.e. the factual recognition by the centre of the periphery's right to equal or even more than equal use of national revenue in the periphery's interest -will be the greater, the lesser the centre's need for high government expenditure. Only if the centre's infrastructure is well established will there (in most cases) be sizeable funds available for investment elsewhere.

Once political integration between the centre and (part of) the dominated sub-systems has been attained, also a further social integration on the basis of a better spread of educational facilities and other institutions becomes possible, at the same time enabling the periphery to acquire wider access to superior technology. The use of this technology by the periphery will eventually also cause economic integration to become horizontal in character. In other words, the full socio-economic development of the peripheral regions is constrained by their political integration. Without possibilities to make use of the domination process initiated by the centre, the periphery may only develop as a colony. As such, its chances will be largely determined by its natural resources and its location.

It might seem from the previous sub-sections that we are fairly optimistic about a region's chances, that is to say, any region's chances to develop. This is not the case, however. First of all, the theory that has been presented is one which considers long run development processes that take several generations. Secondly, as we have indicated, a peripheral region will in general remain under-developed, until the centre acquires an interest in it. This may only occur in the later phases of the centre's development process. A third reason can be the poor nature of the region in terms of its natural resources, a reason which may be underlying the one just mentioned. In such a situation, the region not only is without the positive influence of direct action by the centre, but also without a possibility of turning certain activities into national or international activities, which might have brought about export multiplier effects.

Similarly, a region may become depressed when its natural resources are physically or economically exhausted before the export multiplier has had a chance to create a broader export base. Not only economic reasons can be mentioned, however. The process of identification with peripheral interests of the centre's cadres need not proceed quickly, say, in five or six generations, but may take much longer. This is the case when a rigid social structure is developed as a result of the domination process and when regional elites are kept in a constant but highly rewarding dependency relation to the centre. Thus subtle means of repression can be used for prolonging a status quo, which, however, will never mean an absolute status quo. The periphery will, even under these conditions, develop but only at a minimum pace.

6.6 Regional Spatial Structure : A Typology

While discussing some of the issues that appear relevant to the formation of a system's decision making space, a number of factors have been left out that appear to have a good deal of importance when studying spatial structure at the level of the sub-system or region. These factors are: (i) the distribution over the area of the region of exploited natural resources other than those of importance for agriculture; (ii) the relative size of the ecologically most favourable area in exploitation within the region, and (iii) the number of resource-based functions the region performs within the national system. As a fourth factor of importance is taken the degree of centralisation in the region's decision making process. It may suffice to concentrate attention on the first three factors, especially inasfar as these affect decision making space in the first and second dimensions. Each of the factors will be discussed in relative isolation, that is to say, that while discussing variations in one factor the other factors will be held 'constant'.

The natural resources mentioned under (i) refer especially to those that may lead to mining and quarrying. The distribution of these resources (especially when they are being exploited) over the area of a region will strongly influence the distribution of population in that area. If the resources occur in concentration the people engaged in their exploitation will tend to live in one large mining town or in a cluster of mining towns. In case the resources occur in a dispersed way, there will exist a number of dispersed mining towns (probably tied together by some central place that has as its primary or secondary function the provision of services). If the scale of the operations in the exploitation of resources is determined by demand from outside, it will be obvious that the case of a relative degree of dispersion of natural resources is by far the more advantageous situation for the region, as the transport networks required to ship out the deposits will basically influence the region's potential to start other activities along these networks. In this connection the junction effects described by Perroux also play an important role. It should be added, however, that the same effects, though less strong, will occur even if the scale of operations is not based upon external demand.

It will be observed that whereas there will be a tendency for a primate city size distribution to emerge if the natural resources are concentrated. If they are fairly

dispersed the tendency will be towards the development of a log normal distribution. More importantly, however, a concentration of natural resources will tend to create a relatively large regional periphery while a dispersed distribution will cause the periphery to be relatively small. For explaining how we think the first factor to work, we have made the implicit assumption that the areas neighbouring on the location of the natural resources are ecologically fit for large human settlements. This assumption, however, does not always hold true. There are cases of petroleum wells in deserts as well as in oceans, but also, the cases of exploited mineral resources in mountainous inaccessible regions. In determining the effects of the first factor, we should, therefore, only take into account those natural resources which are surrounded by areas that can be accepted as ecologically favourable.

If we now look at the second factor, it seems necessary to define as the 'ecologically most favourable area' that area of a region's surface where natural conditions are such that they result in a higher productivity per hectare than anywhere else in the region, assuming that everywhere the same amounts of inputs per hectare are being used. Although the extent of this area is in principle subject to variation because of technological change, it may justifiably be assumed that such changes do not occur during the first phases of a region's development process. These either occur before a region becomes settled or in a rather advanced phase of its settled history. Whatever the case, it will be obvious that it will be in the ecologically most favourable area that settlers will tend to concentrate. It will also be clear that there will be a greater opportunity for a strong urban centre to emerge if the favourable area under exploitation is large. In addition, however, the larger the size of this area the more chance there will be for equality of such magnitude as productivity per man and per hectare as well as for the variables that are strongly correlated with these indicators. If, therefore, the extent of this area in relation to that of the region is large and considering that differences between centre and periphery can be directly measured in terms of the indicators already mentioned, it may be concluded that in such a case the region's periphery will be relatively small.

The third factor mentioned was the number of resource-based functions a region performs in the national system. If the region performs only one such function - such as the production of sugar or wheat or iron ore - there will be a strong tendency for development to be concentrated in the area that is most suitable for that activity. Due to the influence of the national centre, little attention is devoted to other activities,

or rather, the national centre will only pay attention to the development of that function which serves the rest of the country. Inversely, if more than one such function is performed, there will be various foci or poles of development in the region. In addition, the positive internal effects of the national transport networks that have been mentioned above will necessarily be felt in this case. From this follows, that the performance of a single 'national' resource-based function will tend to result in the emergence of a primate city size distribution, which in this case implies a system in which the periphery covers a relatively large part of the region's area. The performance of various such functions, however, will tend to result in a log normal distribution of cities by size, and in a situation in which the region's periphery is relatively small.

The fourth factor (degree of centralisation in the decision making process) is taken to have two effects. First of all, it is assumed that a high degree of centralisation finds physical expression in a city size distribution of the primate type and that a low degree of centralisation leads to a log normal distribution of cities by size. An argument in support of this hypothesis is that in systems with a high degree of centralisation fewer important centres of government administration are established, or, in other words, that the average territorial size of a country's second order administrative units is larger, given an equal distribution of population at the time when the boundaries of these units were established. In a decentralised system, the average extent of such units will be smaller, under the same assumption with regard to population density. In both kinds of systems, however, there is a tendency to have almost equal populations contained in a second-order administrative unit, excepting special cases. The effect of the differences between the two systems is that in a centralised one there will be fewer important administrative centres and therefore also less need for establishing networks of transport and communication between such centres, whereas the reverse holds for the case of decentralised decision making. This implies that the latter case will show clear physical evidence of a relatively small periphery, whereas the former will tend to be related with a relatively large periphery.

The typology is based upon the recognition of a three level hierarchy of forces: (i) those that act within the domination model; (ii) those that are of economic nature and concern transport cost minimisation as well as the effects of economies of scale

and of agglomeration; and (iii) those that emanate from data of a physical nature, by which is understood the relative location of resources in the broadest sense of the word. Thus, whereas the first level of forces is being understood as of prime importance for the functioning of a spatial socio-economic system, it is recognised that these forces are acting within the constraints of those working at the second and third levels. The four factors are assumed to have worked over a relatively long period, it is assumed that mew natural resources and the exploitation of them do not affect a region's structure immediately.

The four factors can be grouped according to their effects upon two classifying criteria: (i) the relative size of the territorial extent of the periphery and (ii) the type of city size distribution. Although it is understood that the four factors affect both and that both are to a large extent interrelated, it is felt that because of this interrelation it is more effective to identify a factor by its strongest effect rather than by its effect on both. An exception to this principle is made for the third factor, which concerns the number of resource-based functions of national importance that is performed by the region. For the other three factors, it is assumed that the distribution of natural resources as well as the relative size of the ecologically most favourable area have an effect mainly upon the relative size of the territorial extent of the periphery, while the degree of centralisation in government is supposed especially to influence the type of city size distribution.

Each of the four factors are considered by attaching to them alternatively more or less extreme values such as 'high' or 'low', 'various' or 'one' etc. The effects of each factor upon the two classifying criteria are entered in the column headed 'score', in order of the foregoing columns respectively. The score? can be: 'L', meaning that the effect of the value attached to the factor is a tendency towards a relatively large territorial extent of the periphery; 'S', meaning that the effect of the value attached to the factor is a tendency towards a relatively small territorial extent of the periphery; 'R', meaning that the effect of the value attached to the factor is a tendency towards the formation of a rank size distribution of cities; T', meaning that the effect of the value attached to the factor is a tendency towards the formation of a primate distribution of city sizes, or - for the factor concerning the number of national functions - a combination of two of these scores.

The spatial structure resulting from the various activities is very tightly knit. All

centres - even the fourth rank ones - are well-served by infrastructure and at a short distance from major centres. The region has reached a stage in its development in which certain sub-systems become discernable. One such sub-system contains the northeastern department plus parts of the adjacent departments. Another one has developed in the southwestern department and is moving into the eighth department, the capital of which is as yet in the influence of another regional centre. A third sub-system has come into being in the department east of the region's centre. As it is, the region's spatial structure has become 'shock-resistant', even to such shocks as the disappearance of demand of one of its export products such as minerals. If this were the case, both the western part of the system and its centre would face difficulties, especially the former. But the degree of dynamism in the rest of the area would seem to guarantee the possibility of expansion in various directions, while more industrial development can also be expected in the cattle raising plain between the northern and the central valleys, especially in the city along the railroad.

The region's centre, however, has never seen fit to stimulate more than intra-regional demand for its cattle raising and mining products, the only export items deriving from agriculture and processing industries. In addition, far less decision-making is done outside the region's centre: only three other administrative centres have emerged.

The most important conclusion from this discussion of the four types seems to be that a region's economic shock resistance is much greater in the cases where its spatial structure is more closely knit. In these cases, many regional functions have emerged, forming a substantial part of the region's total activities. As communications are better than in the opposite cases, much more information pertinent to what is likely to happen in the future reaches the lower echelons of the decision-making hierarchy and as the degree of freedom at the various levels is greater, there is also more freedom to start countervailing measures when the region is threatened by extra regional activities. Although some of these measures will be in the field of interregional activities, most will be in regional and local activities, these being tightly intertwined by the input-output relations existing between them.

Unit 7 ❐ Integrated Regional Development

Structure :

7.1 Introduction

Regional Planning for development has be a comprehensive and integrated one. Comprehensiveness refers to the development of all factors of eonomy spatial and non-spatial. Sectional plans are implemented with in the spatial framework and could be achieved through safety sectional linkages and the all characteristics of regional units are taken together. Spatial planning has to be integrated with two types integration spatial of functional in a finer time frame. Becaue the development of function is spatially linked with the other functions/activities. The spatial organisation of economic and sociocultural developments to achieve/promote the long term economic goals, viz. Agricultural sector could not be developed without the industrial output or demand from indsutry for agriculturer foods. Both the sectors are inter dependent with each other. Integrator has be achieved not only spatially with the location of economic activities, time dimension is also important. It has to be a perspective one. The economic structure has to be supported by the required infrastructure i.e. transport and communication, energy supply, financial and banking institutions. The development to be achieved has to have environmental sustainability. If the developmentis directly flowded by the regional development policy of the government it is imperative planning but if the implementation of such developed is delegated to the private sector it is an indicative planning. The planners prepared the plan defining the objectives, goals to be achieved phasing the plan & directed to implement at every stage of implementation, integreting sectorel and functional elements and identity the location of each activity in space taking a national decision is integrated normative planning. Refer to the accompanging literature on integraded rural due approach by the author enclosed. In the context of multi level planning, there has to integration among micro, meso and macro level planing as they are interdependent with each other. While we conceived development from open ended micro regional planning whose goals of functionality are determined by the decision taken in next higher level, the

macro plans are also integrated with the lower level plans. So spatial integration from bottom up to top-down approaches with synthesis at different spatial levels is mandetory. Such integration at various spatial levels are essential elements of integrated development. (Ref. A. Roychaudhury, p. 13)

Dickinson's concept of city region is the study of human ecology. He defined city region as an area of interrelated activities, kinded interests are common organisations brought into existence through medium of the routes which biod them to the urban centres. The importance of regions and its use in planning, economic development come to be accepted by the planners. When surface transport was not developed Dickinson extended the area of city region up to 20 miles from the City centre in case of U.K.

Edward Ullman's concept of 'umland' is daily commenting of one of the city is also about 20 miles or 32 km from the city centre. The structure of the metropolis is disaggregated into (a) the city core or CBD, (b) the central city with in the jurisdiction of the city jout in providing basic social and economic infrastructure, (c) the peri urban area/urban fringe area which forms the planning area of the city region and the (d) Metropolitan area including all the inter-dependent settlement units : rural or urban within which a common system of local/regional transport & communication system bind them together.

In modern days the concept of city region has been extended to metropolitan region. The region's economy and society are coordinated by the authority organised for the purpose i.e. hinterland region.

We have already analysed the structure of the Calcutta Metropolitan region (Ref. Monideep Chatterjee). The Calcutta Metropolitan region include the Calcutta Conurbation with independent urban economics but interlinked with that of Calcutta. Similarly the metropolitan structure being primate cities in their hinterland need analysis of mega cities Mumbai, Chennai, Delhi, NCR, Bangalore & Hyderabad.

7.2 Planning Process and Development Plans

Renewal, Redevelopment & Mangement

The national State-Regional-District and local level of planning involves the examination of various aspects of developmental problems in different perspectives and with varying importance to different aspects. As earlier explained the economic aspects. As earlier explained the economic aspects are most important at National-

State-Regional and District levels though physical aspects should not be overlooked particularly because of the need for environmental management. However, the physical aspects are more important in increasing order from Regional, District to Local level. Besides, the integrated approach in planning both from physical and economic as also urban and rural development is most important if the aims of balanced development and creation of most suitable environment for man are to be achieved.

The Comprehensive Urban Development Plan : Objectives and Scope

The need for a plan :

A human settlement is a living organism. It has an origin growth, decay and regrowth. It is a dynamic entity, rather than a static phenomenon. A settlement is subject to various types of forces, physical, economic, social and administrative, which influence its form and structure. It is necessary to channelise these forces in a planned manner to create the total environment, which is healthy, efficient and satisfying for working, living, recreating and worshiping. A comprehensive plan is an instrument to achieve these objectives.

The city is a corporate entity. The local government of the city has a great deal of influence on the nature, extent and manner of development of the city. The various utilities, services and facilities provided by the local, state and federal governments affect the urban environment. The local government has to co-ordinate the various decisions. It will require a legal and technical instrument which establishes long-range as well as short-term policies, programmes and strategies, for the orderly development of the community in a co-ordinated and unified manner, and which can be continually referred to in deciding upon the development issues, which come up from time to time. The Comprehensive Development Plan provides such as instrument.

Definition of Plan

'A Development Plan'— is defined as a Plan for the development or redevelopment of the city. The word 'development' has been defined in the Planning Acts as carrying out of any building, engineering, mining or other operations or over or the under the land or making up any material change in its use or in the use of any building standing on it. Thus the change of use is also covered by development.

Goals and Objectives of a Plan :

The Master Plan or Development Plan or General Land use Plan or Urban

Development Plan is a means to an end and not an end in itself. It is essentially a policy instrument. It should provide the basis for a programme to accomplish certain aims and objectives and to satisfy the aspirations of the community. More specifically ; the plan should aim at :

(i) To create a totally functional environment efficient, healthful and aethetically satisfying as a setting for human activities ;
(ii) To promote the larger interest of the urban community as a whole ;
(iii) To serve as a policy framework to fulfill the needs and aspirations of the community ;
(iv) To effect co-ordination between physical, economic, socio-cultural and political forces that govern the structure of the community and the technical means to regulate it ; and
(v) To formulate long-range and short-range action programmes with a view to injecting long-term considerations into short-term actions.

Basic Elements :

The basic elements of a Development or Master Plan are :—

(a) Land use Plan : The Plan should indicate areas designated for residential, commercial, industrial, socio-cultural, recreational, administrative and other uses.
(b) Circulation Plan : The net works of roads and streets, railways, water-ways and air-ways, terminal facilities, transil systems, etc. for the movement of people, goods and services.
(c) Planning for Utilities, Services and Facilities : The Plan indicates the desirable location, size and other particulars regarding public utilities (water supply, sewarage, electricity), municipal services (transport, fire fighting and community facilities (education, health, recreation).
(d) To prepare Civic Design : The Plan should depict the design of important elements in the city such as the civic centre, the central basiness district, shopping centres, and cultural areas. The civic design proposals which determine the aesthetic quality of the townscape and the urban space should necessarily be included.
(e) To maintain the Open spaces : The Plan indicates the location and extent of desirable open spaces for parks, play-grounds, stadium, gardens, cemeteries, crematoria. They are breathing places of urban people in concrete jungle.

(f) Special Problems : Cities differ from each other and have different planning problems. Cities do not have identical problems. By virtue of its location, size, structure and form each community has some special problems and unique characteristics ofits own. The Master Plan should highlight the distinctive features and also need solutions to the special problems.

Characteristics of a Plan :

The Plan must possess the following characteristics :-

i) It must be a well-balanced design best suited to the present and the probable future needs.

ii) It must be in scale with the present and the prospective financial resources of the community.

iii) It must be in keeping with the ideals and aspirations of the community.

iv) It should be comprehensive, comprehensible, long-range and general. It should be comprehensive because it encompasses all the significant elements of urban environment, whether physical, economic, social or administrative. The plan should be comprehensible, as otherwise, the public will not be able to appreciate its significance and importance. The plan should be long-range (15 to 20 years), because it sets down at once the best thinking of the planning staff, local administrative authority and the citizenery, as to the most desirable direction of development of the community. The Master Plan should be general, because generally gives the plan flexibility. The plan should not be rigid ; nor should it involve questions in detail. It should attempt to define the main outlines of desirable future development. The plan summaries policies and proposals. The general plan should be flexible enough to respond to changes in requirements and at the same time, firm enough to guide and direct urban growth.

The Process of Planning

The process of planning should include the regional (district is also a region in a way) and local level plans. Though the process may vary according to the problems and prospects involved and the statutory framework in which the plan works. The general stages are as follows :

1) Declaration of intention to prepare a plan.
2) Consultation and eliciting public suggestions for planning approach.
3) Surveys to find out physical, social and economic problems and potential for development.

4) Formulation of draft proposals and discussions with authorities concerned on the basis of accepted goals.
5) Eliciting public suggestions and comments.
6) Finalisation taking into consideration the suggestions including republication if major changes involved.
7) Submission to Government Authorities concerned for approval.
8) Scrutiny and approval, making changes if necessary.
9) Implementation.
10) Periodical Evaluation and Review.

It will thus be seen that the process of planning is such that it satisfies legal requirements and involves public and authorities concerned in the decision making process so that it is really plan for the people and of the people, for whose benefit the development efforts have been undertaken. In the decision making process the conflict of private interests versus community's interests (taking into consideration the socio-technical aspects) has to be resolved satisfactorily.

Surveys for Planning :

Survey is collection, interpretation, arrangement, combination and presentation of all the data and information needed and included in the plan proposals. It will involve stages like study, Analysis, Diagnosis and Synthesis. The need of surveys is felt for (i) collection of basic information for identification of problems and solutions to the same (ii) Providing to the sanctioning authority with information needed and convinsing the property owners. The next stages is to prepare a physical plan identifying the location of various elements.

(This portion has been taken from G.R. Division, H.D. Koperdekan, Urban & Regional Planning : Principle & Practise.)

7.3 Urban and Rural Planning : Techiniques*

Planning includes village planning, town planning, city planning, metropolitan planning, regional planning and national physical planning. Many a time, this broad concept of planning is overlooked and the town planner is thought of as one who plans streets, houses and a few civic buildings. Town planning to be effective and creative, has to start from the village and cover the entire country.

* This portion is taken from Urban and Regional Planning by K. S. Gowda (1971) p 25 to 33.

While at the village level, town planning pays detailed attention to such matters as location of houses, providing schools, shops, rural industrial estates, as also the distance of the farms from the village, at the city level the town planner comes across more complex problems, such as industrial development, movement of people from their houses to work place, transport of goods, residential accommodation, utilities and services, zoning of land and others.

At the metropolitan level, the town planner seeks to serve the interests of not only one community or one town but several communities, individually as well as in telation to one another, and utilise the resources of the metropolitan area to the best advantage of and optimum utilisation by all the communities of that area.

At the regional level, the planner is concerned with an assessment of the resources for optimum utilisation, transport and communication network that is necessary to move men, goods and services intra-regionally and inter-regionally, urban development in the context of regional population distribution pattern, infra-structure development and other factors.

These regional plans would take into account capabilities over a long period of time and will help in the formulation of national physical plan which will be a factual translation of the economic development targets into their physical counterparts, such as industries, roads, railways, agriculture, forests and a host of other factors which go to make the national economy.

In its actual practice, for example, town planning may seem to take away the land of somebody, deprive someone of building a cinema house or place restriction on the number of storeys. In all these cases, the deprivations or restrictions are intenced to help the community as a whole, and, where an individual is being genuinely deprived of a property, a good town plan or scheme will always provide for alternative sites and adequate compensation for resettlement. In fact, the person who is deprived will find himself placed in a better environment and with more facilities than he would have had in his original location. If the construction of a cinema theatre is refused, it is because the cinema in that location is considered unsuitable from the point of view of traffic congestion, noise and other problems.

Unless people fully appreciate the fact that town planning is primarily meant to look after the community's interest, it will be difficult to carry through any scheme and people may as well be misled by individual complaints of deprivation of property, refusal of licence, and other similar objections. Thus it is essential for the public to understand the aim of planning for the benefit of the community.

7.3.1 Urban Planning Technique

Town planning is considered both as an art and a science. It is a technique of physical planning for the 'convenience', 'safety' and 'pleasure' of the people. Convenience means provision and proper arrangement of various facilities, such as housing, offices, educational institutions, industries, commercial areas, hospitals, parks, playgrounds and other entertainment centres. Safety means the movement of people without fear of being exposed to dangers and their living without the ill-effects of slums, congestion, fire, air and water pollution, traffic hazards and unhealthy surroundings. Pleasure is the joy and happiness that would be derived by the people out of the clean, healthy and visually attractive environment of the town in which they live.

All these require careful study, analysis and synthesis, followed by sound proposals. Many town planners have tried to achieve these objectives from the beginning of our civilisation.

History of town planning tells us that four distinct types of growth are encouraged for the development of human settlements. The following are the patterns evolved (Figs. 14 to 18).

(a) Linear pattern
(b) Radial pattern
(c) Grid-iron pattern
(d) Concentric pattern

Fig : 14

A number of combinations of these patterns are also possible. If the development is not planned, it leads to organic growth where the settlements grow in any manner depending upon the situation. This will create very difficult problems requiring wholesale clearance and improvements on a later date, involving heavy expenditure.

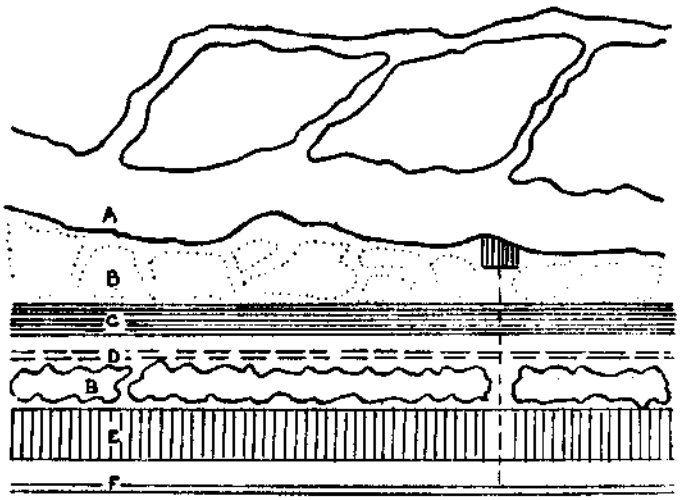


Fig. 15. Linear type of city plan for Stalingrad-1930.

A. Volga River
B. Green belt
C. Residential
D. Highway
E. Industrial
F. Rail road

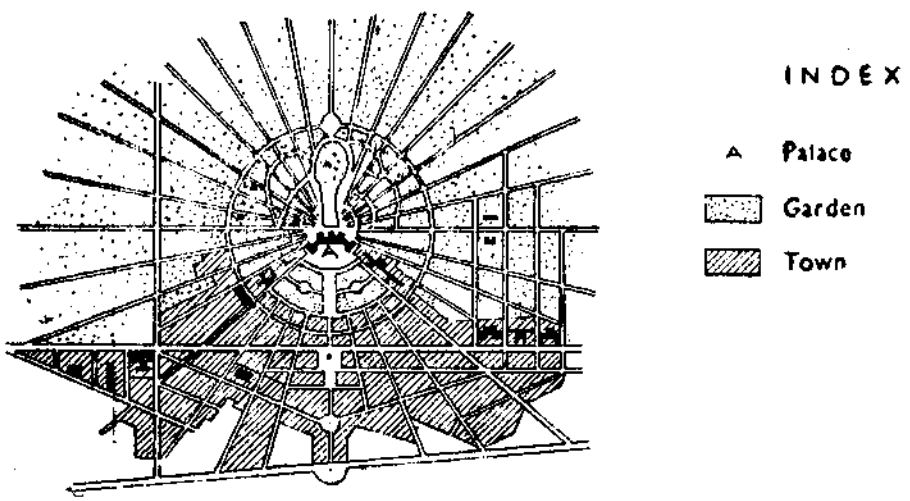


Fig : 16

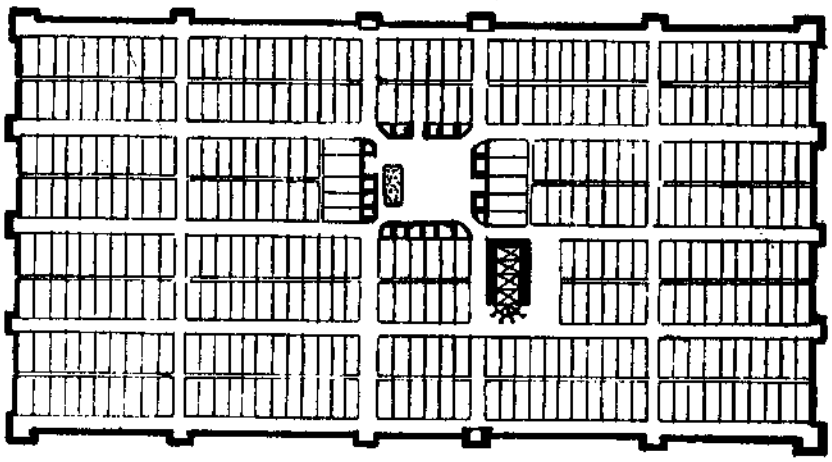


Fig : 17

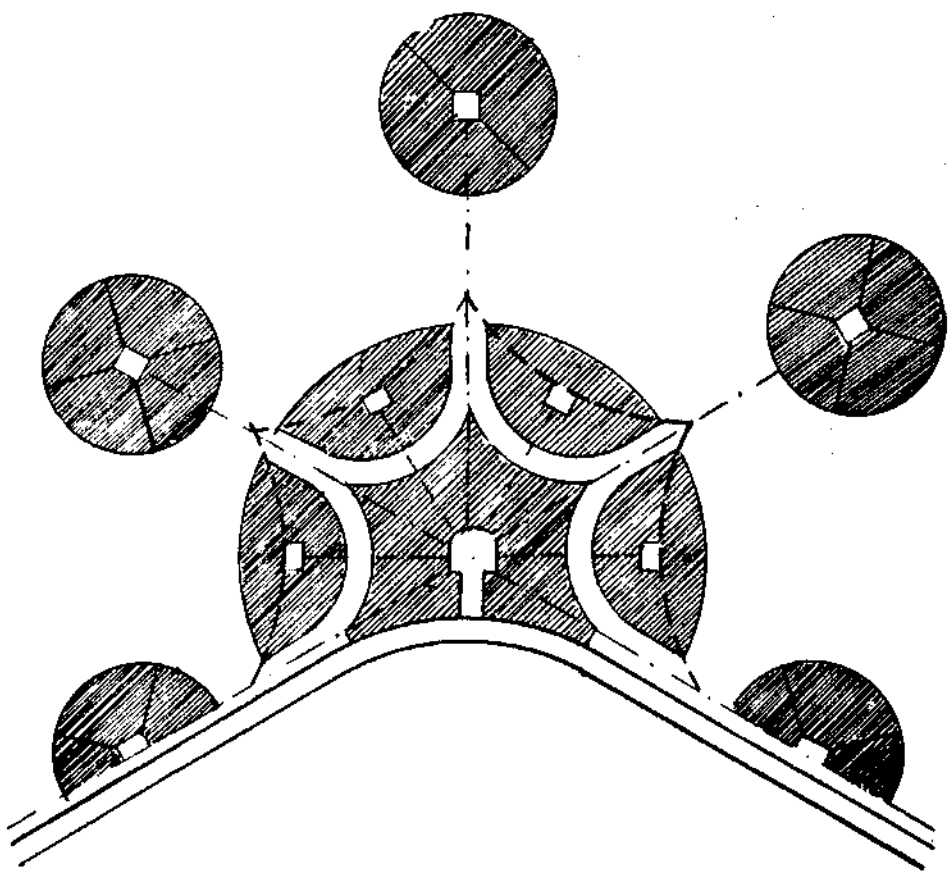


Fig : 18

Methodology

Neighbourhood concept : Town planning is approached on a scientific basis generally by the three-tier system of planning, namely 'neighbourhood, community (district) and city'. A neighbourhood generally consists of a population of about 10,000 to 20,000. Three or four neighbourhoods constitute a community or a district with a population range of 50,000 to 75,000. The city comprises of a number of communities. Each neighbourhood has to be designed as a self-contained residential unit, with necessary community facilities and civic amenities.

Surveys : Before planning, a number of surveys are required to be conducted by the planner to have a clear idea of the town to understand the problems to be solved. Generally, perspective plans for any town or region are made for the development of the area over the next 20 to 30 years. Therefore, the most important item of a perspective plan is the forecast of the future population. One could easily assume the natural increase of population, that is, births over deaths. But, it is very difficult to forecast the migration trends in any area. As migration depends on various factors, such as facilities for work, convenience for stay and safety for movement, one has to find out the probable number of persons migrating to any urban centre, by following different formulae evolved by demographers. After finding out the probable population target, we have to find out the space target, that is, the area required to accommodate this population. It depends on the type of development, density of population, land value, topography of the area and the mode of transportation. The development plan, which is commonly known as master plan, has to contain proposals for various items of work with necessary technical background to substantiate the proposals.

In addition to the demographic surveys explained above, the following are the important surveys to be conducted before preparing the development plan.

1. Reconnaissance survey
2. Topographical survey
3. Existing land uses
4. Structural condition
5. Density of population
6. Socio-economic conditions
7. Traffic and transporation
8. Community facilities
9. Utilities and services
10. Housing conditions
11. Recreational facilities
12. Trade and commerce
13. Industrial survey
14. Public and semi-public uses

Analysis and proposals: After conducting the surveys, necessary plans showing the existing conditions under each category are prepared with the required charts and tables to highlight the problems. The data is synthesised and future projections worked out regarding the requirements of various uses at the three levels, namely, the neighbourhood, the community and the city. A plan for a neighbourhood generally provides space for amenities, such as neighbour hood shopping, elementary schools, dispensaries, neighbourhood centre, children's playground, post office and similar uses. The community (district) should at least provide for high schools and colleges, post and telegraph offices, police station, divisional offices, service stations, service industries, community park, theatres, banks, competitive shopping area and other cultural centres. Major facilities required for the entire city, such as civic centre, major parks, central business district, large industrial areas, stadia, university campus government offices and others, are to be provided at the city level.

The plan also contains proposals for various land uses, like residential, commercial, industrial, recreational and public and semi-public. The zoning regulations containing proposals for the enforcement of proposed land uses are to be enclosed with the plan. Details regarding the building line, height of the buildings, floor area ratio, architectural controls and yard space have to be specified under the regulations. A number of plans are to be prepared for showing the proposals and they may vary from town to town depending upon the size and the complexity of the problems. In a small town all the proposals could be shown in one or two plans. But in a metropolitan city, large number of plans have to be prepared for each item of use and in some cases like the land use, a number of plans have to be worked out, both at the neighbourhood level and the city level.

A report, explaining the surveys carried out before the preparation of the plan and detailing the proposals made in the plan under various items of work listed earlier, has to be prepared. The report generally contains the stages by which the plan has to be implemented and the responsibilities of various implementing agencies. A city development programme containing the financial implications of the proposals made in the plan, has also to be prepared.

7.3.2 Rural Planning

The technique and methodology discussed so far, apply in a more or less degree,

to urban areas. Techniques with lesser emphasis on details, avoiding sophisticated methods of approach, are required for planning rural areas. The problems are simple as the population in each village will be less than 5,000 and the requirements are very small. Therefore, the following are some of the steps recommended to be followed while planning a village.

■ Surveys

For reconstructing or expanding a village and providing the villagers with better houses, roads, environmental hygiene and other facilities, the knowledge of socio-economic conditions, population structure, living habits, available land space and existing situation, is necessary The surveys to be conducted for collecting the information are : —

(i) **Reconnaissance survey:** This study is to find out the suitability of the village for redevelopment and the willingness of the villagers for improvement.

(ii) **Engineering survey** : This survey is to prepare a base plan of the village and the surroundings with details of streets, structures, contours and other existing features.

(iii) **Household survey**: This gives the complete picture of the village regarding socio-economic conditions of people and the housing situation.

(iv) **Observational studies**: By actually visiting the village, a study of environmental hygiene, roads, water and other facilities can be made by observation.

(v) **Group discussions**: Mutual exchange of views on planning with the villagers enables better planning.

With the complete analysis of these particulars, the physical planning can be made based on the results so obtained and supplemented by other surveys, like land use, structural condition of buildings and occupational pattern.

■ Master plan for a village

(i) **Road pattern** : The road pattern has to be worked out without radically changing the existing pattern and minimising demolition of houses. The width of village roads may be such that two carts can pass easily and ihat sufficient margin is left for parking carts without obstructing traffic.

(ii) **Land for public use** : In the plan, sufficient land has to be earmarked for village community centre, which will accommodate buildings, like village office, co-operative store, dispensary, school and playground.

The location of the community centre should be such that it becomes beneficial to all the villagers. Religious buildings and the village tank require improvement with good approaches.

(iii) **Commercial use:** Depending on the population and the number of existing shops, suitable site is to be earmarked for shops. The location has to be such that shops can be approached easily from all sectors of the village.

(iv) **Residential use**: This can be approached in two ways.

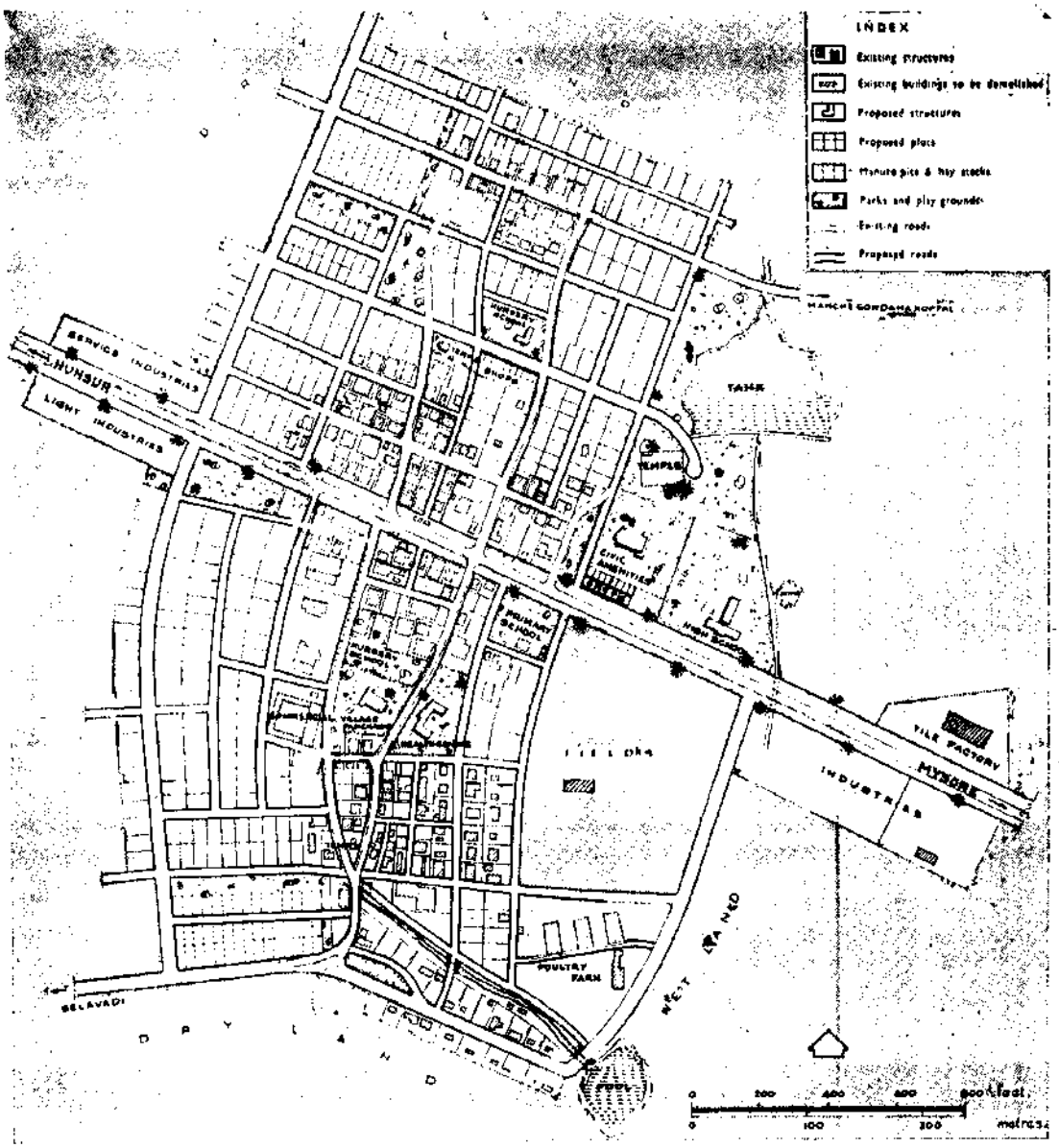
(a) Redevelopment: In the case of redevelopment of housing area, the permanent and semi-permanent houses have to be retained as far as possible. The number of families that are to be displaced from this area can be worked out and accommodated in new residential areas.

(b) Development : Development of new housing area depends on the number of families to be housed and the growth of population, which helps in working out the area required for new houses. A detailed layout is then prepared showing plots, roads, location of wells and community facilities (Fig. 19).

(v) Village sanitation :

(a) **Water supply** : The source of water supply may be ground wafer or surface water. Ground water supplies may include wells and springs. Surface water is generally contaminated requiring treatment and may work out costly. Hence ground water is recommended for village water supply. The location of wells should be away, by at least 10 metres, from sources of contamination, such as latrines, septic tanks, cess pools, soak pits and manure pits. The distance may vary depending upon the texture of soil in which the well is dug. The top ot the platform has to be high enough to prevent flood water, as well as water splashing from bathing and washing. Installation of pumps operated by hand or power can be encouraged. When higher yields are required in dry areas borewells are preferable instead of open wells.

(b) **Latrines**: Most of the villages do not have proper sanitary arrangements. For better sanitary conditions, the sanitary excrete has to be disposed of in such a way and in such locations that it will not pollute water and air.


INDEX
Existing structures
Existing buildings to be demolished
Proposed structures
Proposed plots
Manure pits & hay stacks
Parks and play grounds
Existing roads
Proposed roads
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SERVICE INDUSTRIES
LIGHT INDUSTRIES
TANK
TEMPLE
TILE FACTORY
MYSORE
INDUSTRIES
POULTRY FARM
BELAVADI
D R Y L A N D
feet
metres

Fig : 19

(c) **Cattle sheds and manure pits**: The location of cattle sheds on a plot should be such that it is away from living rooms, but provides facilities for the members to take care of the cattle. The locution should also satisfy the sanitary needs.

Regarding manure pits and hay slacks, they are to be located outside the village and on the leeward side of Ihe wind direction.

(d) **External and internal drainage**: Roads are to be provided with side gutters, to permit the flow of storm water and waste water from houses, so designed that the water flows away without stagnating.

(vi) **Housing**: Housing programme may be divided into two parts :—

(a) Construction of new houses.

(b) Improvement to existing houses.

The house design should be evolved by taking into consideration the physical needs and the cultural and economic aspects of the family. Regarding the housing material and the method of construction, indigenous materials and local ways of construction may be adopted. For economic housing, aided 'self-help technique', which is the best way of tackling rural housing problem, is to be encouraged.

■ Public co-operation

The success of the implementation of the plan depends on the villagers' co-operation. The villagers have to be convinced of the plan and the importance of self-help and mutual co-operation. Following are the means suggested to achieve the objective :

1. Audio-visual presentation and publication of problems and proposals
2. Practical demonstration of the advantages of planning.
3. Social contact with the villagers.
4. Staging of dramas.
5. Organisation of youth clubs.
6. People's participation and involvement in plan-making and plan-implementation process.

These techniques are useful in encouraging public participation not only in village planning but also in urban and regional planning.

7.4 Problems of Micro-Level Planning for Integrated Area Development

This note is based upon the report on Planning Rural Growth Centres for Integrated Area Development—a study of Miryalguda Taluka of Nalgonda District, Andhra Pradesh and the author's contribution to the seminar discussion which took place on this report[1] at the National Institute of Community Development (NIDC) during October 11/12/1971 and on problems of Micro-level planning for development. The report and the seminar are the first phase outcome of the five-year project on Integrated Area Development and Rural Growth Centres in Nalgonda District, Andhra Pradesh undertaken by the NIDC. A short summary of the seminar discussion as a whole is at first presented as a background information for this note.The issues for seminar discussion are based upon the comments made by the participants on the NICD's report on the Miryalguda study, and were grouped as follows : (1) Need for Growth Centres, (2) Concept of Integrated Area Development, (3) Central Place Theory and Central Place Concepts, (4) Complementary Regions, (5) Population Thresholds, (6) Statistical Analysis, (7) Plan Implementation, (8) Phasing and Time Perspective, and (9) Area of further Research

The issues are of course, not all comprehensive but are very much pertinent in evolving a method of micro-level planning based on the concept of growth centres for Integrated Area Development (rural)[2].

In a developing economy like that of India where the developmental activities are financed mainly by governmental investments, micro-level planning for a self-generating growth is often neglected. The governmental investments should be treated as only initial subsidies for creating necessary infrastructure for integrated development. The fruits of capital projects which draw maximum share of national investments must trickle down to generate economic growth into the lowest level—(say—village

1 Sen, L. K. and el al : Planning Rural Growth Centres Tor Integrated Area Development—A study in Miryalguda Taluka, NICD, Hyderabad, 1971.
This book was sent to the Association fcr review in the journal. *As* the book reviews are not yet included for publication in this journal we decided to publish a note with the permission of the authors of the took. Hovever, the comments are my own and does not anyway inclusive of the authors of the book or that of the NICD. The author is grateful to Dr. L. K. Sen and the NICD for their kind permission.

2 A detail report of discussion on the above issues are available on request from Dr. L. K.. Sen, Director, NICD, Hyderabad-38, A. P. The report is also to be published in the March issue of the Journal—Behavioural Sciences and Community Development, 1972.

or rural community) ; then only we could expect a self-generating cycle of economic growth. The Nagarjuna Sagar multipurpose river valley project is an example of such capital projects ; the command area of the project rests on the threshold of development and waits for the growth impulses to be exerted from this economic magnent.

To realize fully and most efficiently the fruits of our national community development programmes we should take into account the consequences both direct and indirect, wanted and/or unwanted, of the development programmes in regional or national level, translate them in the context of local area development, and also induce the "spread effect" of such programme in bringing the whole community and space into the fold of planned growth.

■ Need for Growth Centres :

The growth centres are basically the economic growth foci through which growth impulses could be injected for area development. They may also be service centres bnt not necessarily vice-versa. The rationale of extending the 'growth centre' strategy to a micro-level planning especially in an agricultural tract lies in the locational decision of innovative and propulsive non-agricultural activities. They are centres of production, consumption and also exchange of the commodities produced in the centres and their catchment areas.

■ Concept of Integrated Area Development and the Central Place Theory:

It involves the simultaneous integration of various socio-economic functions as well as their locations in space. Thus, an integrated area development approach will have to be conceived as a part of the regional framework of which it is a spatial component. Naturally question arises regarding the spatial unit of study for integrated area development. Starting from the smallest village to growth centres, which are the spatial elements of area development, a spatial framework is to be worked out for coordinating and integrating the growth processes.

Micro-level planning can hardly stand on its own feet unless it is integrated with .over-all planning at the regional level. Although this Taluka (Miryalguda) has just been opened up for area development because of availability of irrigable water from the Nagarjuna Sagar Dam (Project), still its regional framework should be defined and then studied in greater depth for plan formulation. The central place theory as such does not provide us with a regional spatial framework for an exercise in integrated

area development—without incorporating the studies of anticipated changes in land use pattern and locational decisions[3]. As a matter of fact, the testing of the central place theory in a micro-level planning fails to guide further growth unless it is applied in a broader context. Unless very much differentiated internally in physical and socio-economic character, the district should be the smallest unit of area development in case of India. The theoritical framework of the central place model could be applied also to non-urban settlement since central places are not conceived a priori to be urban places, but in the scale of hierarchy they are identified to be urban (with set definitions). The model by definition is required to cover the whole gamut of settlements of various size and functions. The framework is applicable to any community entirely rural, or urban or combination of them (various level) and would differ only in fitness depending upon the varying character of the regions concerned. The spatial laws which govern the central place model are applicable when the whole system of settlements (which are in a system of hierarchical network though imperfect in most cases) is considered.

Selection of central villages or service centres and locating growth generating activities in them should be a rational process of any plan formulation. This would lead to further widening the gap in wealth distribution among the people ; initially, there would be a tendency for the discriminated settlements to have the feeling of being left out and the favoured centres would be further differentiated from the dependent settlements in income, wealth, etc. Although discrimination is a necessary precondition because of inherent limitation in investable resources in creating growth generating centres, this should not lead to the differentiation of "haves and have-nots". Spreading butter too thin is as undesirable as distributing the scarce piece of butter among the fortunate few. This is in fact a problem of resource allocation in regional development. Economic concentration of growth generating activities, with least possible discrimination may be considered as an alternative, but it is not an easy task.

■ Central Function, and Centrality and Hierarchy of Central Places

The selection of central function types is as important as the identification of growth centres for area development. The central functions are those inclusive of the

3. Bhat. L. S. The note for the seminar.

governmental and other specialized services which involve "movement" of people for such services.[4] Centrality of a place is determined by the intensity of such 'movement' pattern. Intensity again relates to not only number of such functions for which people move but also magnitude of inch movement and the degree of interaction that takes place between settlements on the basis of group behaviour and also on the basis of movement of goods and services. So identification of existing and/or future hierarchy of services or of service centres or of hinterlands should be based upon the consideration of both existing and/or projected travel pattern of consumers[5] and consumer goods and services.

■ Regional Plan Formulation and Implementation

The objective of integrated area development a to set a self-generating growth process. A detailed analysis of employment potentiality within the area and also realistic estimate of financial commitments for undertaking the development programme are part of such plan. It is not possible for any government to go on subsidising and financing the projects indefinitely. The regional economy should be geared to self-financing development projects end with this end in view capital generating projects should be identified and recommended.

When any exogenous capital flows to any area for financing development projects and if it operates in the form of free market economy, priority projects are very difficult to choose because of existing and emerging socio-political pressures. The group pressures linked with vested interests may often be exerted and these may not have positive relevance for regional development. And there may also be genuine popular demands often expressed through political pressure. The plan must be flexible enough to accomodate genuine pressure with due caution. This factor should be treated as an anticipated consequence of bringing social change through regional development. Where agriculture is the mainstay, future development of industries will have to be in the nature of agro-based processing industries. So agriculture should be developed first in a planned way with the help of its irrigable water as in the command area of the Nagarjuna Sagar Project. Without proper assessment of land capability, land tenure system, and future demand for types of crops, planning for

4. Prakasa Rao, V. L. S. : His comments in the seminar.
5. Seminar proceedings on Problem* of Micro-level PUnntai for Development October. 11/12, 1971. NICD.

agricultural development will be fruitless. In a traditional society it is almost impossible to bring any change in agriculture without corresponding changes in the land tenure system and in agricultural technology. This finding will lead us to think afresh about the prospect of agricultural development in the study area in the light of social attitude toward planned development.

Land-use model for central village planning has been adopted to predict the location of a non-final market resource based industry in the area.[6] So industries having locational advantages in terms of raw material availability have been suggested, but factors like market demand for finished products, cost of production, transport cost, consumers, market etc., which are more vital in industrial development should be fully explored. These exogenous factors may attract the industries outside the study area. Measures could also be suggested to induce industrial development in the area along with land-use planning model.

Plan implementation is a vital part of any planning, which are often affected by diverging socio-political interests. However, political pressures in plan implementation could be mitigated only when there is a scientific plan. The objectives of the plan and also the process of implementation should be acceptable to the people provided they are in their own interest and they are helped to realise this in actual practice. Priority should be determined on the basis of critical functions which are the preconditions for initiating development.

The lesson learned from the Miryalguda study and the seminar on problems of micro-level planning is a big step forward in tackling the problems, of area development. The necessity of taking district as a spatial unit for integrated area development has been reiterated. This is in no way to replace the development blocks within the districts under, community development scheme but to complement them and coordinate the development at the block level as well.[7]

Thus the problems of micro-level planning for integrated development could be summarised as follows :

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6. Op. Cit.

7 Much have been said and discussed in various occation regarding the success and failure of our Community Development Programme which is as old as the period of planned economy of India. We have no intention to discuss here further the Community Development Programme but just to mention we may refer that the growth centre strategy is a breakthrough for initiating growth in the rural areas.

1) How could the micro-level planning be integrated with the regional framework ?

2) How best an analysis be made of the employment potentiality and of the public and private investment that is likely to come, in the regional economy to make it a self-sufficient, generative and viable unit ?

3) Should we not explore fully the factors like market demand for finished products, cost of production, cost of transport to consumer market, scale economies and multiplier effect before the location of a particular industry is suggested only on the basis of availability of raw material in future ? In other words is it justified to suggest a sectoral development without planning for inter-sectoral development in an area ?

4) When we plan for integrated development does it mean also a social change ? If so how to integrate 'man' in the process of such development ?

Unit 8 ❐ Concept of Regional disparity & imbalances

Structure :

8.1 Introduction

The concept of balanced regional development has its counterpart as unbalanced development. The conccept of balanced development could be viewed in two angles i.e. interregional balanced development and in the context of national development refers to intersectional balanced development. The National economic development plan aims at intersectoral balance among the section of the economy whereby development growth of one sector has to be weighed with respect to growth of other sectors as all the sectors are interdependent on each other otherwise there will be sectional polarisitation. If priority is given to industrialization its growth shall be thwerted by the needed inputs from agriculture, mining, power generation. Besides integrated economic development is derived from the infrastructural & functional linkages. There is a consistent and symbiotic relationship among the components of the national economy. Imbalanced development items from regional characteristics. Resource based economy would prefer location in the resource rich regions. Efficient utilisation of resources and their contribution to regional economic growth would like a tendency to create disparity in development. The concept of comparative advantage if turns into absolute advantage for location of the productive factors of economy would result in regional imbalances in development.

The problem regional disparity has been discussed in detail by the theories of G. Myrdal on polarisation and backwash effects or Hischmenn's Interregional transmission of economic growth leading to agglomeration versus trickledown effect. According to him concertration of investment in certain sectors/regions would pride incentive to growth while other sectors/regions lag behind.

The agglomeration of economics with favourable backward and forward linkages would to be spatial polarization of regional economics. Such agglomeration or polarized growth will result in regional in-equality. A time series analysis of American, Italian, Bragillion and French economics have proved increasing regional inequality for growth

& devlopment at least in the initial stages of development. This problem of regional disperity has been studied thoroughly by I.G. Willamson (put in the added literature) and dealt with in detail stating that disparity would increase at the initial stages of development ultimately would achieve regional converence and achieve balanced development by enacting clear regional policies to develop the backward areas.

Regional disparity both in economic and social development has been major problem in India. Such condition was there in the pre independence period because of colonial exploitative mercantile economic policy, but it has continued in worst form in the post. Independent India because the priorities were put on national economic growth rather than interregional equity in development. Regional disparity has been the outcome of weak regional development policies. Disparity has been observed in the functional and spatial linkages with the growing urban areas exploiting the rural resources— labour, capital & migration. The problem of regional disparity got attention of the government since 1970's after identifying the leading and logging regions or identifying industrially backward areas. The stated objectives of the Govt. aim at balanced regional development by various policy planning measures. (to be followed by Willamson's article on regional inequality.)

8.2 Regional Inequity and the Process of National Development : A Description of the Patterns

■ Introduction

Economists have long recognized the existence and stubborn persistence of regional dualism at all levels of national development and throughout the historical experience of almost all presently developed countries. Increasingly active theoretical discussions, empirical research, and especially political concern with this aspect of economic growth has given the phenomena of regional imbalance and inequity a popular new term - the 'North-South problem'. In spite of the recent attention which this problem has attracted, very little progress has been made in formulating and testing a general explanation for the occurrence of inequality in the spatial distribution of national income. One only needs to observe that Frenchmen, Italians, Brazilians, and Americans still tend to treat their North-South problems[1] as unique to their own

1. Throughout this paper we use such terms as North-South problem' and 'regional dualism' interchangeably with regional income differentials. They are not to be interpreted literally, since in comparing regions there is a whole spectrum or range of regional differentials - not just a dichotomy. Furthermore, it must be obvious to the reader that North is not equivalent to developed for all nations. These arc purely literary simplifications.

national experience with economic growth. This may be explained by the fact that only a small amount of research effort has been devoted to comparative studies of regional inequality as related to the process of national development.[2] This empirical investigation into the nature of spatial inequality within national borders and over the development spectrum is an attempt to fill that void. Unfortunately, only a description of the aggregate patterns is presented here. It must be frankly admitted that, to a large extent, the more difficult task of disaggregation and identification of causation is left untouched.

■ Expectations

There is an abundant accumulation of theoretical writings in which hypotheses about the nature of regional inequality during the development process are implied. Given that significant economic growth first appears in one region of a national state, it should occasion no surprise that the *absolute differential* between rich and poor regions (North and South) should persist or even increase. Even if both regions should grow at the same percentage rate after the fortuitous 'random shock' in the North, the absolute regional differential will not only persist but increase. Regional income differentials are measured in this paper, however, in terms of relatives, not absolutes: the income per capita of each region is taken as a percentage of the average national income per capita. For example, the Brazilian Northeast in 1959 contained 25 per cent of Brazil's population but only 10 per cent of her income. The Southern states, on the other hand, contained 35 per cent of the population but 50 per cent of the income. In a less awkward fashion, the degree of inequality may be better summarized by indicating that most of the Northeastern states had per capita incomes of less than 50 per cent of the Brazilian national average.

An inequality measure of this sort implies a comparison of regional growth rates and is much more informative for our purposes than one which considers absolute differentials.[3] Using this measure as the most appropriate index, what a priori notions

2. There are, of course, significant exceptions. Besides the increasing empirical evidence relating to well-known North-South problems in Italy and Brazil, there has been an active interest in regional inequality in American historical development. See, for instance, Easterlin (1960) and Hanna (1959) Furthermore (the Economic survey of Europe in 1954 (Geneva, I955), ch. 6, pp. 136-71, devoted a good part of that issue to an examination of regional imbalance and inequality within the European nations. For the most recent examples of studies of llm sort see Baer (1962), Lasuen (1962) and Tachi (1964).

3. The problem of choice of indices is clearly an important one; we discuss this point at length below.

might we have about the behavior of regional income differentials as national development proceeds? Does our 'historic and current system of social and economic organization [perpetuate] in-terregional growth and income differentials once they come into existence?' (Hughes, 1961). The answer may be as easy, or as difficult, as explaining why growth tends to be high and self-sustaining in nations which have already experienced it and so difficult to generate in currently underdeveloped Asian and African nations. The increasing divergence in international income per capita levels, at least prior to World War II, is well known, and a similar theoretical apparatus may be used to predict increasing divergence among geographic units within national borders and perpetuation of 'poles de croissance'.[4]

But presumably economic interdependence among regional units within nations should be much stronger than between countries themselves. Retaining the most restrictive classical assumptions, internal factor mobility should tend to eliminate interregional income per capita differentials, geographic dualism, or spatial polarization. Under conditions of free factor mobility, and abstracting from transportation costs, spatial inequality can persist only via lags in dynamic adjustment. That spatial inequality, depressed areas, and backward regions appear to persist may simply suggest to some that internal factor flows (tending to reduce interregional inequality) do not occur with sufficient speed and quantity to offset the dynamic indigenous conditions which cause relatively faster resource augmentation and technological change in the rich developing regions (tending to increase inequality).

In fact, one could reasonably appeal to the high degree of sectionalism, fragmentation, and general national disintegration in the youthful stage of national development to predict increasing regional inequality during those early decades. Given that young nations historically, as well as those currently, embarking on modern economic development have been typically devoid of national labor, capital, and trade markets approaching even rudimentary degrees of efficiency, this seems the only reasonable prediction. Regions within nations do not typically possess equal capacity for growth, and when development begins in some of these islands, regional barriers may be too great to communicate the growth stimulus to other less fortunate

4. This is a term used often in French literature to describe regional growth differentials. See Perroux (1955) and the use of the derivative 'polarization' in Hirschman (1958). It should be pointed out that the efforts of Perroux and his students have not added much to our knowledge of the process of interregional communication of growth. See Kindleberger (1964).

regions. As long as the barriers to trade and factor flows (as well as communication of technological change) persist, regional inequality will clearly increase.

The problem is hardly that simple, however. Myrdal's theorizing about backwash effects, Hirschman's concern with dualism and polarization, and Kuznets' more cautious 'empirical' guesses suggest that even internal factor flows may not always be equilibrating in the classical fashion. On the contrary, in the initial stages of national development regional inequality is likely to increase all the more sharply due to a number of disequilibrating effects.[5]

■ Labor migration

Interregional labor migration is likely to be extremely selective because of either the prohibitive money costs of migration at low levels of income or traditional inertia in the non-urbanized, non-industrialized poor Southern regions. The migrants may be characterized as the vigorous and entrepreneurial, the educated and skilled, and of productive age. (We are not describing the dominant characteristic of emigrants from the backward South, but suggesting that these characteristics will be more prevalent among the migrants than among the average population of the Southern regions.) Selective migration of this type obviously accentuates the tendency towards regional income divergence: labor participation rates, *ceterisparibns*, will tend to rise in the rich and fall in the poor regions; furthermore, precious human capital will tend to flow out of the South and into the North, making regional resource endowment *per capita* all the more lopsided and geographic imbalances all the more severe.

What has been said above about migration patterns in early development stages is hardly original to this study. It appears as one important theoretical buttress for the operation of both backwash effects (Myrdal, 1957) and Hirschmnn's polarization Effects.

Instead of absorbing the disguised unemployed, Northern progress may denude the South of its key technicians and managers as well as well at of the more enterprising young men. . . . Thus actual pay differentials between North and South are likely to overstate considerably the real productivity differentials in the most productive and skilled grades. In addition, of course, mobility is highest in these same lines so that it becomes almost a certainty that the South will lose to the North first and foremost its more highly qualified people.[6]

5. Disequilibrium here describes an internal factor flow which tends to increase regional inequality. We are not necessarily using it to describe factor movements which do not respond correctly to interregional factor price differentials. The two concepts may or may not coincide.

6. The Canadian province of Nova Scotia was for a long time noted for its major exports of 'brains and fish. Hirschman (1958).

To illustrate the potential disequilibrating effects of interregional labor migration, Eckaus has characterized migration patterns during the early stages of Italian industrial development as being precisely of this type, although his contention is not defended empirically :

The nineteenth century was a time of extraordinary emigration, generally heavier in the South, where at some times and places it exceeded the natural increase in population. The concentration of immigrants in the younger, productive ages left the South with a working force of deteriorating quality (Eckaus, 1961).

Dziewonski presents us with a contemporary example of the perverse effects of interregional migration at low levels of national development. He has noted that the Polish government has deliberately minimized interregional labor migration, since central planners are concerned with the past effects it has had in further contributing to regional inequality and dualism via effects upon relative participation rates and labor force quality (Dziewonski, 1962). This, too, appears to be consistent with the notion that in early stages of growth interregional labor flows may generate further spatial inequalities rather than reduce them. This would appear to follow from the fact that Poland has not reached a mature stage of growth.

■ Capital migration

The interregional flow of private capital may tend to be perverse as well. External economics and general benefits derived from agglomeration of capital projects in the relatively rich Northern regions may cause capital to emigrate from the South to the North, tending to accelerate interregional inequality and to widen the North-South schism. High apparent risk premiums, lack of entrepreneurial ability, and immature capital markets may further depress investment activity and capital accumulation in the South. The latter, immature development of financial institutions, may prove to be not only important but also the most easily measurable of these factors in explaining perverse capital flows. Spain may serve as our example here:

Capital migrates mainly through the banking system. Spanish banks are of a highly mixed thuracter, being commercial and industrial, and are highly oligopolistic. Seven banks handle more than seventy per cent of the total credit. The result is that the deposits of the backward regions are transformed into credits for the industries in the north, particularly for those industries in which the banks participate. But capital migrates also via the capital market, for benefits are more certain and higher

in the developed industrial sectors of the country. Most of the direct investment by entrepreneurs of Southern origin is also made in developed regions. Better infrastructure! setting, superior transport and communications facilities, and larger markets all play a role. (Lasuen, 1962, pp. 179-80).

Nor is the evidence of perverse interregional flows of private capital isolated to the underdeveloped nations of Europe. The same pattern appears to exist in Pakistan, with heavy capital flows from East to West Pakistan, and in Indonesia, with similar flows from the outer to the central islands. And, of course, given Our accumulated evidence that capital flows are heavily influenced by growth rates (demands for capital), capital 'scarcity' in the South does not always imply high marginal productivity and high price.

■ Central government policy

The national or federal government's overt or unconscious intention to maximize national development may tend to increase still further the degree of regional inequality if active political expression in the South is lacking (as in the American post-Civil War Reconstruction period) or even in spite of such expression. In an overt fashion, the central government may allocate investment to the North, where 'urgent demands for several types of capital intensive public investments appear' (Hirschman, 1958, p. 192), which favors the fast-growing industrial regions and helps generate even more rapid growth there, only to create large social overhead capital requirements in the future. This is a common argument in the historical arsenal of Southern apologists in both Italy and the United States to explain relative lags in Southern industrial development.

In a less overt but equally important fashion, the central government may manipulate the external terms of trade in favor of the industrial North. A national tarill policy implemented with the intention of fostering and protecting industrial development, common to most underdeveloped nations past and present, clearly involves a geographic transfer to the rich Northern regions.[7] Southern senators and representatives in the United States were certainly aware of this and attached great importance to its effect during the three or four decades prior to the Civil War when their voice was important in American policy making.

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7. Eckaus questions the significance of u protective tariff policy in contributing to nineteenth- and early twentieth-century Kaliun North-South differentials. Eckaus (1961). pp. 313-14.

■ Interregional linkages

More generally, there may be a lack of interregional linkages in the early stages of national growth, so that the spread effects of technological change, social change, and income multipliers are minimized. Part of the national growth process is simply economic unification of regional markets. To the extent that such interregional linkages are slow in developing, national development is all the more likely to be regionalized in the earliest stages of growth. Furthermore, if the North possesses a large and productive agricultural area, 'the South will be largely cut off from beneficial contact with Northern development, while remaining exposed to the adverse polarization effects' (Hirschman, 1958, p. 189; Friedman, 1959, pp. 167-79). This factor should help explain the relatively severe problems of North South dualism which have persisted, for example, in the histories of Brazil's Nordeste, Colombia's Oriente, Italy's Mezzogiorno, and the U.S. South.

The working hypothesis of this study, however, is not that inter-regional divergence of income *per capita* levels will persist indefinitely into the mature stages of national growth. On the contrary, there are a number of reasons why we should expect the elements which tend to cause divergence to diminish over time, allowing the more classical equilibrating effects to make themselves felt.[8]

■ Labor migration

Migration is likely to become less selective as economic development proceeds. There are a number of justifications for this expectation. Growth will have been occurring in the poor regions, although at a slower rate, and the prohibitive costs of migration may disappear, eliminating the bias against the unskilled and low-income groups in the Southern regions. Traditional rural inhibitions to interregional migration should have been significantly weakened by whatever economic progress has occurred in the South. Occupational wage differentials between the skilled and the unskilled are likely to diminish in the North relative to the South, further causing a change in

8. Myrdal's analysis strikes me as excessively dismal. In the first place, he fails to recognize that the emergence of growing points and therefore of differences in development between regions ... is inevitable and is a condition of further growth anywhere. Secondly, his preoccupation with the mechanism of cumulative causation hides from him the emergence of the strong forces making for a turning point once the movement toward North-South polarization within a country has proceeded for some time.' Hirschman (1958), p. 187.

9. What little evidence we do have suggest that this is certainly the case of the American South in the post-word War II period. Just how far back in American economic history this pattern can be traced is uncertain.

the composition of internal migration. The South may not only retain its educated and skilled, while" losing its unskilled, but may even attract the former type of migrant from the North[9] At any rate, it certainly seems likely that the rate of internal labor mobility should increase as the integration of regional markets into a truly national economy proceeds. This has been the case historically for most developing nations: even after the Turnerian frontiers were filled in the United States in the 1890s, population mobility refused to decline and even increased in recent decades (Lebergott, 1964); the same appears to have been the case in France, since the degree of population mobility has increased throughout the late nineteenth and early twentieth centuries (Goreux, 1956).

■ Capital migration and interregional linkage

Not only should the economy tend to develop a national labor market after experiencing continued secular growth, but more efficient national capital markets should evolve apace. If indeed perverse interregional capital flows had been typical of early growth stages, the development of more sophisticated capital markets in the Southern regions themselves should help deter the net outflow of capital. External economics and benefits accruing from agglomeration of capital projects may eventually become exhausted at the margin in the North while they begin to assert themselves in the poorer Southern regions as industrialization proceeds there (albeit, perhaps, at a slower rate). Finally, if growth becomes relatively rapid in the South due to any other factors, the capital flow will most likely undergo a natural reversal.[10] In Myrdal's terminology, the spread effects may begin to assert themselves from those islands of industrial growth as the economy fully integrates itself and commodity and factor markets become more efficient.

■ Central government policy

Perhaps most important, central governments may allow themselves the luxury of equality in the geographic distribution of income and pursue an active policy of income transfer to the poor regions. This may take the more dramatic form of TVA's, or regional concern may be implemented through highly-publicized institutions like the *Casa per it Mezzogiorono,* or it simply may result from a more general national commitment, not necessarily spatial, to welfare and equity. In the latter case, the

10. We certainly know very little about interregional capital (lows, but Professor Lance Davis of I'urduc is currently adding u grcul deal to cur knowledge. In his study of American history. he thus far has found significant evidence of sharp reductions in interregional intcrcit rate differentials from 1870 to 1914.

appearance of a progressive income tax structure and concomitant welfare payments may be suflicient to create large regional transfers to the South without the emphasis on federal social overhead investment in the backward regions.

Finally, with regard to the central government's pattern of regional investment, it should be clear that after development has proceeded for some time, the need for public investment relative to private may tend to diminish, and in any case a larger portion of public investment may lie financed from earnings of previous investments. This, of course, provides an excellent opportunity to alter the geographic composition of public investment in favor of the less developed areas (Hirschman, 1958, p. 1954).

Any one of these factors, or any combination of them, may be enough localise regional inequality to diminish. Once the process of regional convergence or depolarization begins, however, it is likely to become cumulative, with the forces tending towards regional equality mutually strengthening each other contributing to a more rapid speed of adjustment.

The initial hypothesis of this study is, therefore, that the early stages of national development generate increasingly large North South income differentials. Somewhere during the course of development, some or all of the disequilibrating tendencies diminish, causing a reversal in the pattern of interregional inequality. Instead of divergence in interregional levels of development, convergence becomes the rule, with the backward regions closing the development gap between themselves and the already industrialized areas. The expected result is that a statistic describing regional inequality will trace out an inverted 'U' over the national growth path: the historical timing of the peak level of spatial income differentials is left somewhat vague and may vary considerably with the resource endowment and institutional environment of each developing nation.

11. If it has not been made so already, we should make it clear that this study does not concern itself with patterns of regional concentration of income and population over the national development spectrum. Our concern will be with the regional dispersion *of per capita* income and labor force productivity. It should be noted that the two concepts *of* regional concen tration and regional income per capita differentials need not converge. For example, in the case of twentieth-century France, it appears that concentration or industry, income, and population around Metropolitan Paris and surrounding areas has been consistent with convergence in regional income per capita levels. On the other hand, with the United Slates, 'it is interesting to observe that the lower rale of spatial redistribution of various countrywide aggregates toward the second half of the period (1900/10-1960) is accompanied by greater reduction in inequality of income per capita among regions'. Sec Kuznets (I960). It would be extremely fruitful to examine this aspect of the problem more intensively.

The rest of this paper summarizes the empirical evidence concerning the relation between levels of development and regional inequality.[11] To achieve this end and to utilize such data as exist, we have used alternative techniques. First, an international cross-section analysis is pursued for twenty-four countries during the decade of the 1950s. Second, the cross-section approach is applied to the United States census data (1950 and 1960) where counties are treated as the regional unit and the states as nations. Third, national time series analysis is applied to those few countries for which data is available.

Finally, we shall also attempt to shed light on three other related questions: (1) What is the relative importance of income growth versus population redistribution in contributing to the time patterns of regional inequality ? (2) What role does the labor participation rate play in producing differences in income *per capita* levels? (3) Does regional inequality differ sharply between industrial sectors?

■ International Cross-Section Analysis

The ideal measure of regional development in a study of this sort would be real income *per capita* (including income in kind) by geographic units which have maximum regional homogeneity. This ideal statistic is rarely available. First, the regional units are more or less given by the nature of decentralized political administrative units: for the United States the units are states; for Puerto Rico, *municipios*; for Canada, provinces; for Colombia, departments; for Spain, *provincias*. The regional units are not necessarily those which would be chosen by an economist or an economic geographer. Second, proper regional cost of living indices do not exist, and therefore any differential in regional price levels could possibly bias our results, since the data are usually given in the form of income in prices prevailing for the national unit. The nature of the regional units is unlikely to impart a systematic bias into the study, but regional price level differentials may be a serious problem, since the cost of living is usually lower in (he poor agricultural regions. Furthermore, the divergence between regional price levels is likely to diminish as the nation develops.[12] Third, those regions which are primarily agricultural and which have less developed money economies will absorb a systematic downward bias, since their estimates of income rarely accurately record income in kind. The nature of the bias may vary with the level of national development as the Southern regions also become

12. It is interesting to note that for one country where allegedly adequate regional cost of living indices are available, Finland (1950), the use of those price indices produced little effect upon our estimates of regional inequality.

fully monetized and market oriented. Finally, the income accounting concept (not to mention serious reservations about the reliability of the data themselves!) varies considerably from country to country.[13] Puerto Rican regional development evels are measured by median income per family, Norwegian by assessed income *per capita,* Canadian by personal income *per capita,* German by net national product *per capita,* and so on. It can only be hoped that none of these limitations is serious enough to negate the striking patterns discovered in the data.

Table 1 presents the results of the international cross-section study. Statistics for these twenty-four nations were available to us, and they are grouped according to Kuznets' seven level-of-development classifications. These twenty-four include thirteen European, four 'empty' overseas European, four Latin American, and three Asian nations. Regression analysis was not attempted for this portion of the study because of the difficulty of cardinal ranking of these countries by levels of development or income *per capita.* Column 2 indicates the years from which the measures of inequality were computed. The period covered overall ranges from 1949 to 1961. Where data for a number of years were available (as in the case of Italy, Norway, and the United States, for example), they were utilized to more closely approximate an average decade estimate of regional inequality.

Columns 3 and 4 give a measure of the extent of the 'North-South problem' within these nations at widely differing levels of development. Column 3, Vw, is a

13. This criticism does not hold lor the United Suites county-stale study or for the time series studies which follow this section. In the case of the time series studies, however, the number and nature of the regional units sometimes vary over time.

14. More precisely

$$V_w = \frac{\sqrt{\sum_1 (y_i - \bar{y})^2 \frac{f_i}{n}}}{\bar{y}}$$

where f_i - population of the ith region,
n - national population,
y_i - 'income *per capita*' of the ith region,
y - national income *per capita*,

and $V_{uw} = \frac{\sqrt{\frac{\sum_1 (y_i - \bar{y})^2}{N}}}{\bar{y}}$, Where n = Number of regions

As a brief reading of the footnotes to Table 1 will suggest, this study utilizes a more detailed regional breakdown than usually appears in the literature. For example, we computed V_w, from nineteen Italian regions rather thur unnecessarily limit ourselves to the conventional separation into Norm, Central, and South.

weighted coefficient of variation which measures the dispersion of the regional income *per capita* levels relative to the national average while each regional deviation is weighted by its share in the national population;[14] the higher the V_w the greater the size of geographic income differentials. Column 4, V_{uw} is much less useful for our purposes since it is unweighted and will be determined in part by the somewhat arbitrary political definition of regional units (the number of which varies considerably between countries: see footnote to Table 1). As a final word of caution preparatory to an examination of the results themselves, it should be noted that twenty of the twenty-four observations fall within groups I and IV or between 'middle' and 'high' income levels. This is indeed unfortunate, since it will not allow us to test significantly the hypothesis that V_w should rise, or in other words, that regional inequality should increase, during early stages of development. Furthermore, the sample does not include any of the Communist East European nations, other than Yugoslavia, and this is a lamentable exclusion.

The results are quite striking. Our measure of regional inequality, V_w, range widely between a maximum of 0.700 for south.

■ Summary

This concludes our investigation into the nature of regional dualism. What we have done thus far is to simply describe the nature of the so-called 'North- South problem', giving particular attention to the relationship between regional dualism and national economic development. There is a consistent relationship between the two: rising regional income disparities and increasing North-South dualism is typical of early development stages, while regional convergence and a disappearance of severe North-South problems is typical of the more mature stages of national growth and development.

More specifically, both our cross-section approaches and our time series analysis suggest that there is a systematic relation between national development levels and regional inequality or geographic dispersion. In the international cross-section, the degree of regional inequality is very high in Kuznets' middle income class, but consistently lower as we move to higher levels of development. Although our evidence is much less extensive, it also appears from this sample that those nations below the middle income class have not yet generated the high levels of regional inequality associated with Spain, Italy, Colombia, and Brazil. The U.S. cross-section lends support to the international cross-section, in that the states with lowest income *per capita* are also typically those with the greatest inter-county inequality. The historical

evidence on regional productivity or income *per capita* differentials is much more difficult to collect, but what little information we have on nineteenth-and twentieth-century Italian, Brazilian, U.S., Canadian, German, Swedish, and French experience suggests that increasing regional inequality is generated during the early development stages, while mature growth lias produced regional convergence or a reduction in differentials. Finally, we have seen that regional dualism or inequality is much more extensive within the agricultural than within the industrial sector, and that labor participation rates in part contribute to regional income *per capita* differentials.

This leaves us with a number of interesting related questions which are left unanswered in this study. The most pressing question is, of course, why docs this pattern of regional inequality persist? What is the mechanism by which regional income differentials increase in early development stages, then stabilize, and then diminish in mature periods of growth? Have economic institutions in the past been of such a nature to cause capital to first flow in an interregional fashion, so as to increase the income gap between North and South, and then to cause this flow to reverse? Are presently developing nations sufficiently aware of the conflicts between national growth optimization and regional equality ? If they are, are they aware of the costs necessary to reduce such inequities in early development stages? What historical role have central governments played in contributing to these patterns of regional inequality, and can contemporary developing nations derive benefit from that knowledge ? What role do changing patterns in regional income distribution play in contributing to changes in national size distribution?[15]

But the most important question, one which is related to those enumerated above, has not yet been posed. If, indeed, contemporary underdeveloped nations are attempting to achieve industrialization on a weaker and more unstable socio-political scaffolding, 'can ... the underdeveloped societies withstand the strain which further widening of income inequality is likely to generate?' (Kuznets, 1955, p. 26).

These questions seem extremely important. Hopefully, economists will continue to find them interesting enough so that some answers will appear in future research.

15. Sec Smoleniky (1961) Some historians have even suggested the use of regional income inequality indices to approximate the historical patterns of national size distribution!

Kuznets, of course. has emphasized the importance of intersectoral distribution as a contributor to size distribution trends. Given the information here contained on regional inequality, is it possible that *changes* in national size distribution are dominated by a combination of changing regional differences within sectors and changes between sectors ?

8.3 Regional Planning and Development in India

After India got Independence, the Damodar river vally project was launched in 1948 in the light of Tennessee Valley Authority. This is considered as the first land mark in thehistory of economic planning and development in the country. The Damodar Valley Region was conceived as an economically viable and physically integrated inter-state planning unit for sustained economic development in India. The Damodar Valley Corporation was entrusted with the task of designing, planning and executing with multipurpose objectives - a propotype river basin development in the Damodar Valley as an experimental laboratory in regional planning. The utilization and development of the vast resource potential of the region are far from optimal despite a relatively rapid industrial development in the plan period; but far from what it could and should have been, given an appropriate plan and its efficient implementation. The life history of the Damodar Valley Corporation is full of partial success and failures.

In 1957, Dandakaranya Project was implemented to rehabilitate displaced persons from the then East Pakistan (now Bangaladesh) and to promote integrated development of the area with special reference to the tribal and resettled population. This was sponsored as a joint venture of the Central and three State Governments (M.P., Orissa and A.P.), focussed one of the most backward pockets of the country- territorially comprised of the peripheral areas of the three partner states. The Dandakaranya Development Authority has taken up many area development programmes like construction of road and transport networks in the inaccessible tracts, development of community facilities of all types, construction of minor and medium irrigation projects and preparing bases for economic development. So far as the rural sector is concerned, the Dandakaranya Project with its planned villages is considered as one of the most successful rural development projects of India and should be viewed as a model of rural planning.

In fact the consciousness for regional development planning and emergence of regional development policy was reflected in the Third Five Year Plan period. The awareness of regional disparity within the country led to the identification of industrially backward areas in the fourth plan period (1969-74). The growth pole strategy was emphasised under industrial decentralization policy during this period. However there were no specific programmes following the policy and development strategy. The

picture of regional planning and rural development in successive plan periods are presented here.

The major policy of the Fourth Plan was aimed at the reduction of inter regional (inter - state) income differentials. The attention was on weaker sections (small and marginal farmers and agricultural labourers) , special area planning for drought - prone area, command area (irrigated tract), desert area and tribal area development. This is the starting point of the implementation of a number of programme in favour of rural areas.

In Fifth Five Year Plan the emphasis was given for alleviating rural poverty, fulfilling basic/minimum needs in terms of primary education, health, transport and safe drinking water. The integrated rural development strategy got operationalised through micro level planning at the Block Level. The industrially backward areas were simultaneously focussed with a number of programmes like concessional finance and investment subsidy, industrial infrastructure establishment of public sector industrial undertakings and preference to backward areas in the licensing of industries.

The comprehensive area development (sub-plan) approach was introduced to take care of the problems of hill and tribal areas. Finally family/household was accepted as the unit of planning under the integrated rural development programmes. Towards the end of this plan period the industrial development was strengthened and extended to all the districts of the country under the district industrial centre programme. In true sense, this plan period is considered to be the most important in initiating a number of diversified and integrated programmes to combat against rural poverty.

The focus of alleviating rural poverty remained unchanged during the Sixth Plan, got further consolidated with employment generation policy. The area of concentration was on economic rehabilitation of the rural poor through a number employment programmes (NREP) and rural landless employment guarantee programmes (RLEGP). These programmes were strongly supported and complemented by the continuance of the IRDP.

The Seventh Plan has adopted the policy for balanced regional development, alleviating rural poverty and the decentralized district planning. The rural development programmes already implemented in the previous plan periods were given further importance and continued as such in favour of the rural poor. To make the planning operations more effective, the long felt desire for decentralized district planning took

shape in almost all the districts of the country to strengthen the developmental activities at the bottom level and simultaneously to bring spatial balance successively at higher levels. The expansion of computerised data transmission network from the lowest level (district) to the state, regional and national levels have been provided through National Information Centre (NIC) . The development of integrated data bases with the cooperation of data producers and managers, NIC and planning bodies at different levels is definite to strengthen and fulfill

Regional Development Policy and Programmes

Plan Period	Regional Development Policy/Strategy	Focus	Programmes
Third Five Year Plan (1961-66)	Industrial decentralization through the creation of industrial growth poles	Awareness of regional disparity	No specific programmes
Fourth Five Year Plan (1969-74)	Reduction of Inter-regional (inter-state) Income differential	Identification of industrially backward states and districts. Target group and area development (resource/ problem areas) approach	SFDA and MEAL (1971) ICDS (1972) DPAP (1974), CADP (1974), DADP (1974), TDA (1974)
Fifth Five Year Plan (1974-78)	Alleviation of rural poverty, Basic/minimum needs programmes Integrated rural development strategy. Micro (Block) level planning	Backward area development Comprehensive area development (sub-plan for hill and tribal areas) Family/Household oriented beneficiary programmes under IRDP	Concessional finance and investment subsidy Industrial infrastructure (industrial estates) Establishment of public sector industrial undertakings Preference to backward areas in the Licensing of industries ITDP (1975) HADP (1971) DIC (1978) IRDP (1979, ISB/ TRYSEM of IRDP (1979)

Plan Period	Regional Development Policy/Strategy	Focus	Programmes
Sixth Five Year Plan (1980-85)	Alleviation of Rural Poverty Employment generation	Economic rehabilitation of the rural poor, through gainful employment, creating durable community assets, improving the overall quality of life in rural areas	ERRP (1980) NREP (1980) RLEGP (1983) Continuation of IRDP
Seventh Five Year Plan (1985-90)	Balanced regional development Allevaition of Rural Poverty Decentralized District Planning		Continuation of ERRP, NREP, RLEGP and IRDP

● *Ref. J. K. Routray*

decentralized planning requirements. The decentralised planning process in the context of multi-level planning would strengthen rather weakens the democratic setup of the nation and achieve national integration.

It is obeserved from the previous discussion that the planning process has undergone several changes during last 20 years and becoming complex day by day because of the multiplicity of the problems. In aggregate terms, it is difficult to assess the impact of the development programmes on the rural poor. The rural poverty situation is in a downward trend if not fully controlled and the quality of life in rural areas is also not improved as envisaged. From a number of evaluation studies and impact assessments, it has been realised that the rural poor get limited benifits. The subsidy oriented rural development programmes dominated the last four plan periods could not motivate much with subsidy incentives rather made people more dependent on the government for everything. The unwillingness to repay the capital loans, lack of enthusiasm in recycling the programmes to reach the sustainable level in many cases, underutilised capicity and potential, and finally the high level of misappropriation of development funds at all levels diluted the impact very much. However, without these attempts, the problems would have been more intense. There is a great scope and ample opportunity to improve the situation if the programmes are properly

designed, implemented, monitored and evaluated. The challenges are many and linked to sectors of economy, spatial balance, rural poverty, rural infrastructure and social services, meaningful employment oppertunities and a number of environmental issues. The current thrust is on agro-ecological planning and identification of agro-ecological regions to support and strengthen the rural and regional development practices. There is a great need for formulating detail and elaborate regional development policies.

CONCLUSION

Finally the following recommendations are put forth in favour of balanced urban and regional development (J. K. Routray)

1. The national urbanization and urban development policy should be complementary and integrated to regional development policy.

2. The decentralization of planning approach in the multilevel planning framework for urban and rural areas need to be strengthened and operationalised with a much faster rate than what it is now.

3. The urban and rural-regional development programme are to reassessed and framed afresh in favour of rural and urban poor.

4. The focus should be on spatial balance simultaneously giving due emphasis on sectoral economic growth.

5. The concern for creating healthy living environment both in urban and rural areas should be considered as one of the important output of planning operations.

8.4 Economic Disparity and Social Inequality—an Enquiry

Economic growth does not take place at a particular time in all the regions, as the factor endowments are dissimilar over space. The location in space of growth processes being regional specific, the phenomena of regional unbalance and inequality occur in geographic space. The emerging regional disparity is being resulted in the development process of national economic growth, popularly termed as the 'North-South' problem in the spatial pattern. As national income grows, the inequality in spatial distribution of income is warranted. This phenomenon could be explained by comparative studies of regional inequalities as related to the process of national development.

Economic growth first appears in one region of a nation state, there would persist absolute differential between the rich and poor regions (North-South) or even increase. The income percapita of each region as percentage of average national income percapita would differ or even widen. The increasing divergence in inter-regional income per capita levelscould be used to predict the increasing divergence among geographical units withing the national border and would perpetuate on * 'Poles de Croissance'. In the initial stages of development at least where factor mobility is limited, inequality or geographical dualism would persist. Under the conditions of free factor mobility and abstracting transportations costs spatial inequality could persist only via lags in dynamic adjustment. The spatial inequality among the depressed areas or backward regions with free factor flow may increase or persists at the initial stages of economic development. Trade barriers or factor flows persist regional inequality due to a number of dis-equilibrating effects.

Myrdal's (1957) Backwash Effects or Hirschman's Polarization Effects have contributed to the Theory of Divergence. Labour and Capital migration may accentuate the disparity. Examples are Brazils's Nordeste, Colombia's Oriente, Italy's Mezzogiorno and the US' South.

There is consistent relationship between Regional Dualism and National Economic Development rising income disparities and increase North-South dualism is typical in the early development stages; while Regional Convergence or a disappearance of severe North- South problems is typical of the more matured stages of national growth and development. Increasing regional inequality is generated during early development stages while mature growth has produced regional convergence or a reduction in differentials. Regional dualism or inequality is more extensive within the agriculture than in industrial sector and the labor participation rates in part contribute to the regional income per capita differential.

Could the under developed economies shall be able to do away with the regional disparity having embarked upon economic development with weak economic base ?

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