DKN22 - ECONOMICS GROWTH AND DEVELOPMENT

UNIT — I: Growth Models

Economic growth and Development — Factors affecting economic growth — Role of Capital, Labour and Technology in development — Technological progress —Embodied and Disembodied progress — Hicks Harrod & Kaldor Models — Models of Tobin, Patinkin and Johnson. Indigeneous growth model.

UNIT — II: Theories of Development

Classical theories of development — contribution of Adamsmith, Ricardo, Malthus, J,S.Mill and Karlmarx — Lewis theory of unlimited supply of labour — schumpeter's theory Innovation, Role of cuedit, profit and structural analysis of development.

UNIT — III: Approaches to Development

Partial theories of growth and development vicious circle of poverty, circular causation, Theory of big push, Balanced growth, Unbalanced growth - Critical Minimum effort thesis, Nelson's Low Income equilibrium trap — Dualism — Ranis and Fei Model — Dixit and Marglin model.

UNIT — IV: Sectoral Aspects of Development

Role of agriculture in economic development — Efficiency and productivity in agriculture — New Technology and Sustainable agriculture — Globalization and agriculture growth — Rationale and pattern of industrialization in developing countries — the choice of Techniques and approximate Technology and employment, small scale Vs Large scale production — Infrastructure and its importance — Information Technology.

UNIT — V: Development Planning

Need for Investment criteria in developing countries — Linear Programming —Investment Criteria — Cost benefit analysis, Shadow prices, Project Evaluation and UNIDO guidelines.

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UNIT – I

Growth Models

Economic Growth

A country's general economic health can be measured by looking at that country's economic growth and development. Let's take a separate look at what indicators comprise economic growth versus economic development.

Let's first examine economic growth. A country's economic growth is usually indicated by an increase in that country's gross domestic product, or GDP. Generally speaking, gross domestic product is an economic model that reflects the value of a country's output. In other words, a country's GDP is the total monetary value of the goods and services produced by that country over a specific period of time.

Definition of Economic Growth

Economic Growth is defined as the rise in the money value of goods and services produced by all the sectors of the economy per head during a particular period. It is a quantitative measure that shows the increase in the number of commercial transactions in an economy.
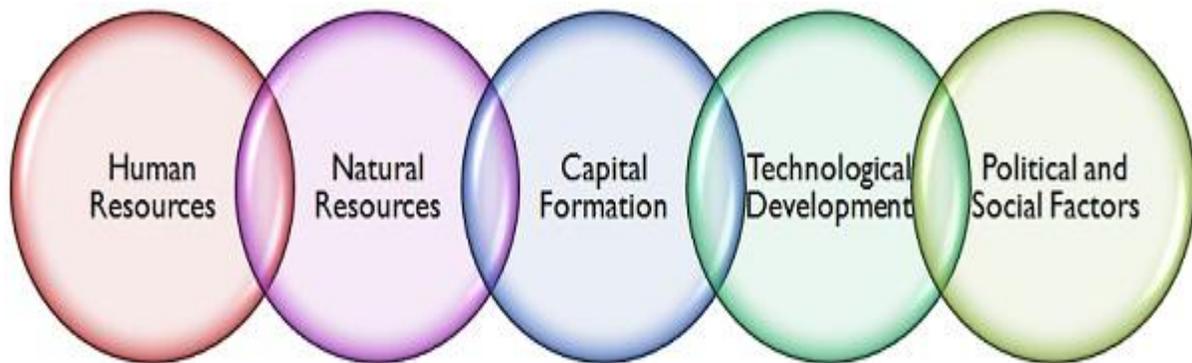
Determinants of Economic Growth

Economic growth can be expressed in terms of gross domestic product (GDP) and gross national product (GNP) that helps in measuring the size of the economy. It lets us compare in absolute and percentage change, i.e. how much an economy has progressed since last year. It is an outcome of the increase in the quality and quantity of resources and advancement of technology.

Definition of Economic Development

Economic Development is defined as the process of increase volume of production along with the improvement in technology, a rise in the level of living, institutional changes, etc. In short, it is the progress in the socio-economic structure of the economy.

Human Development Index (HDI) is the appropriate tool to gauge the development in the economy. Based on the development, the HDI statistics rank countries. It considers the overall development in an economy regarding the standard of living, GDP, living conditions, technological advancement, improvement in self-esteem needs, the creation of opportunities, per capita income, infrastructural and industrial development and much more.

A country's economic health can usually be measured by looking at that country's economic growth and development. This lesson defines and explains economic growth and economic development, including the role of U.S. foreign aid.

Economic Development

Now let's take a look at economic development. A country's economic development is usually indicated by an increase in citizens' quality of life. 'Quality of life' is often measured using the Human Development Index, which is an economic model that considers intrinsic personal factors not considered in economic growth, such as literacy rates, life expectancy and poverty rates.

While economic growth often leads to economic development, it's important to note that a country's GDP doesn't include intrinsic development factors, such as leisure time, environmental quality or freedom from oppression. Using the Human Development Index, factors like literacy rates and life expectancy generally imply a higher per capita income and therefore indicate economic development.

1.1 Economic Growth Vs Economic Development

Economic Growth is a narrower concept than economic development. It is an increase in a country's real level of national output which can be caused by an increase in the quality of resources (by education etc.), increase in the quantity of resources & improvements in technology or in another way an increase in the value of goods and services produced by every sector of the economy. Economic Growth can be measured by an increase in a country's GDP (gross domestic product).

Economic development is a normative concept i.e. it applies in the context of people's sense of morality (right and wrong, good and bad). The definition of economic development given by Michael Todaro is an increase in living standards, improvement in self-esteem needs and freedom from oppression as well as a greater choice. The most

accurate method of measuring development is the Human Development Index which takes into account the literacy rates & life expectancy which affects productivity and could lead to Economic Growth. It also leads to the creation of more opportunities in the sectors of education, healthcare, employment and the conservation of the environment. It implies an increase in the per capita income of every citizen.

Economic Growth does not take into account the size of the informal economy. The informal economy is also known as the black economy which is unrecorded economic activity. Development alleviates people from low standards of living into proper employment with suitable shelter. Economic Growth does not take into account the depletion of natural resources which might lead to pollution, congestion & disease. Development however is concerned with sustainability which means meeting the needs of the present without compromising future needs. These environmental effects are becoming more of a problem for Governments now that the pressure has increased on them due to Global warming.

Economic growth is a necessary but not sufficient condition of economic development.

Comparison of Growth and Development

	Economic Development	**Economic Growth**
Implicarions	Economic development implies an upward movement of the entire social system in terms of income, savings and investment along with progressive changes in socioeconomic structure of country (institutional and technological changes)	Economic growth refers to an increase over time in a country`s real output of goods and services (GNP) or real output per capita income.
Factors	Development relates to growth of human capital indexes, a decrease in inequality figures, and structural changes that improve the general population's quality of life.	Growth relates to a gradual increase in one of the components of Gross Domestic Product: consumption, government spending, investment, net exports.
Measurements	Qualitative.HDI (Human Development Index), gender- related index (GDI), Human poverty index	Quantitative. Increases in real GDP.

	(HPI), infant mortality, literacy rate etc.	
Effect	Brings qualitative and quantitative changes in the economy	Brings quantitative changes in the economy
Relevance	Economic development is more relevant to measure progress and quality of life in developing nations.	Economic growth is a more relevant metric for progress in developed countries. But it's widely used in all countries because growth is a necessary condition for development.
Scope	Concerned with structural changes in the economy	Growth is concerned with increase in the economy's output

Key Differences between Economic Growth and Economic Development

The fundamental differences between economic growth and development are explained in the points given below

1. Economic growth is the positive change in the real output of the country in a particular span of time economy. Economic Development involves a rise in the level of production in an economy along with the advancement of technology, improvement in living standards and so on.
2. Economic growth is one of the features of economic development.
3. Economic growth is an automatic process. Unlike economic development, which is the outcome of planned and result-oriented activities?
4. Economic growth enables an increase in the indicators like GDP, per capita income, etc. On the other hand, economic development enables improvement in the life expectancy rate, infant mortality rate, literacy rate and poverty rates.
5. Economic growth can be measured when there is a positive change in the national income, whereas economic development can be seen when there is an increase in real national income.
6. Economic growth is a short-term process which takes into account yearly growth of the economy. But if we talk about economic development it is a long term process.
7. Economic Growth applies to developed economies to gauge the quality of life, but as it is an essential condition for the development, it applies to developing countries also. In contrast to, economic development applies to developing countries to measure progress.
8. Economic Growth results in quantitative changes, but economic development bring both quantitative and qualitative changes.

1.2 Factors Affecting Economic Growth in Developing Countries

- ❖ Levels of infrastructure – e.g. transport and communication
- ❖ Levels of corruption, e.g what percentage of tax rates are actually collected and spent on public services.
- ❖ Educational standards and labour productivity. Basic levels of literacy and education can determine productivity of workforce.
- ❖ Levels of inward investment. For example, China has invested in many African countries to help export raw materials, that its economy needs.
- ❖ Labour mobility. Is labour able to move from relatively unproductive agriculture to more productive manufacturing.
- ❖ Flow of foreign aid and investment. Targeted aid, can help improve infrastructure and living standards.
- ❖ Level of savings and investment. Higher savings can fund more investment, helping economic growth.

1.3 Capital Formation

Capital formation is a term used to describe the net capital accumulation during an accounting period for a particular country, and the term refers to additions of capital stock, such as equipment, tools, transportation assets and electricity.

Meaning of Capital

Capital has been defined as that part of a person's wealth, other than land, which yields an income or which aids in the production of further wealth. Obviously, if wealth is left unused or is hoarded, it cannot be considered capital. Capital serves as an instrument of production anything which is used in production is capital.

Is Money Capital?

In the ordinary language, capital is used in the sense of money. But when we talk of capital as a factor of production, it is quite wrong to confuse capital with money. There is no doubt that money is a form of wealth and it yields income, when it is lent out. But it cannot be called capital. Capital is a factor of production, but money as such does not serve as a factor of production. It is another thing that with money we can buy machinery and raw materials which then serve as factors of production.

Securities and Shares Capital

There is no doubt that securities, bonds, stocks, shares, etc., possessed by a man yield income to him. But they cannot be called capital, because they represent only titles of ownership rather than factors of production. Capital has also been defined as "produced means of production". This definition distinguishes capital from land and labour, because both land and

labour are not produced factors. Land and labour are often considered as primary or original factors of production. But capital is not a primary or original factor it is a 'produced' factor of production.

Capital has been produced by man working with nature. Hence, capital may also be defined as man-made instrument of production. Capital, thus, consists of those physical goods which are produced for use in future production. Machines, tools and instruments, factories, canals, dams, transport equipment, stocks of raw materials, etc., are some of the examples of capital. All of them are produced by man to help in the production of further goods.

Characteristics of Capital

The following are the main characteristics of capital
    a. Capital is man-made. It is, therefore, possible to increase its supply when the situation requires.
    b. It involves the element of time, as it renders its service over a period of time. That is why payment for capital is calculated in terms of so much per cent per annum.
    c. The use of capital makes roundabout methods of production possible. Its application increases efficiency and the productive power of all the factors with which it is combined and used.

Fixed Capital and Working Capital

Capital may be divided into fixed capital and working capital. Fixed capitals are the durable-use producer goods which are used in production again and again till they wear out. Machinery, tools, railways, tractors, factories, etc., are all fixed capital. Fixed capital does not mean fixed in location.

Capital like plant, tractors and factories are called "fixed" because if money is spent upon these durable-use goods it becomes "fixed" for a long period in contrast with the money spent in purchasing raw materials which is released as soon as the goods made with them are sold out.

Working capital, on the other hand, includes the single-use producer goods like raw materials, goods in process, and fuel. They are used up in a single act of consumption. Moreover, money spent on them is fully recovered when goods made with them are sold in the market.

Wealth and Capital

From the definition of capital, it is clear that capital consists of valuable economic goods which are scarce. Such goods are called wealth in Economics. All capital, therefore, is wealth. But all wealth is not capital. Only that part of wealth, which is used productively, is called capital. The car which is used for personal enjoyment is wealth but not capital. Wealth and capital are, therefore, not synonymous.

Capital and Income

Capital and income should be distinguished from each other. The factory that a man owns is his capital, but the profit that he gets out of it every year is his income. Capital is a fund (or stock) and income a flow. Income flows in at regular intervals. It is calculated per week, per month or even per year.

Land Capital

Land is nature's free gift to man; it is limited in area, and is of infinite variety. On the other hand, capital is man-made, and can be increased at will Land lacks mobility, whereas capital is fairly mobile. Land has no supply price, i.e., its supply does not depend on the price for its use (i.e., rent). If, therefore, rent falls, its supply cannot be withdrawn. But the supply of capital varies with its price. For all these reasons, land can be distinguished from capital and is not regarded as capital.

Functions of Capital

Capital is valued for the very useful functions it performs in the production of wealth. In fact, production would almost come to a stand-still without adequate and suitable supply of capital.

The Following are its Main Functions

Supply of Raw Materials

Capital supplies raw materials. Every businessman must have on hand a sufficient supply of raw-materials of a good quality. A cotton mill must have cotton ready in its go down; a paper mill must keep straw or bamboo cuttings; a sugar mill must buy large quantities of sugarcane, and so on.

Supply of Appliances and Machinery

Another equally necessary function that capital performs is the supply of tools, implements and appliances. It is clear that these things are essential for production. Without their aid large-scale production is impossible. Tools are needed even in the most primitive stage of economic development. But they are all the more necessary today when production has become capitalistic. Modern industry is highly mechanized. Even agriculture employs all sorts of machines like tractors, threshers, harvester-combines, etc., All these are obtained with capital.

Provision of Subsistence

Capital provides subsistence to the labourers while they are engaged in production. They must have food, clothes and lodging. Production today is a long-drawn-out affair, and has to pass through many stages. It may be after years that the goods reach the market and bring income to the manufacturer. Means must be found in the mean time to bridge this gap, and this is the

function which capital performs. It provides means of subsistence for the workers when they are engaged in the work of production.

Provision of Means of Transport

Goods have not only to be produced, they have also to be transported to the markets and put into customers' hands. For this purpose, means of transport, like railways and motor-trucks, are essential. A part of the capital must be devoted to the supply of this need.

Provision of Employment

In modern times, capital is performing another very important function, viz., to provide employment. This function is of special importance to under-developed or developing economies. Among the determinants of employment in a country, probably the most important is the saving and its investment in the form of capital. Application of capital to agriculture, trade, transport and industry creates work on the farms, in the factories, in commercial houses and on roads, railways, ships, etc. It is the lack of capital which is responsible for unemployment, or under-employment in backward countries. A sure way to tackle the problem is to create more and more capital.

Importance of Capital

Capital plays a vital role in the modern productive system

(i) Essential for Production

Production without capital is hard for us even to imagine. Nature cannot furnish goods and materials to man unless he has the tools and machinery for mining, farming, foresting, Ashing, etc. If man had to work with his bare hands on barren soil, productivity would be very low indeed. Even in the primitive stage, man used some tools and implements to assist him in the work of production. Primitive man made use of elementary tools like bow and arrow for hunting and fishing-net for catching fish. But elaborate and sophisticated tools and machines are required for modern production.

(ii) Increases Productivity

With the growth of technology and specialization, capital has become still more important. More goods can be produced with the aid of capital. In fact, greater productivity of the modern economy likes that of the U.S.A. is mainly due to the extensive use of capital, i.e., machinery, tools or implements in the productive process. Capital adds greatly to the productivity of worker and hence of the economy as a whole.

(iii) Importance in Economic Development

Because of its strategic role in raising productivity, capital occupies a central position in the process of economic development. In fact, capital accumulation is the very core of economic

development. It may be free enterprise economy like the American or a socialist economy like that of Soviet Russia or a planned and mixed economy of India, economic development cannot take place without capital formation. Much economic development is not possible without the making and using of machinery, construction of irrigation works, the production of agricultural tools and implements, building of dams, bridges and factories, roads, railways, airports, ships and harbors which are all capital. Broadening and deepening of capital are mainly responsible for economic development.

(iv) Creating Employment Opportunities

Another important economic role of capital is the creation of employment opportunities in the country. Capital creates employment in two stages. First, when the capital is produced. Some workers have to be employed to make capital goods like machinery, factories, dams and irrigation works. Secondly, more men have to be employed when capital has to be used for producing further goods. In other words, many workers have to be engaged to produce goods with the help of machines, factories, etc.

Thus, we see that employment will increase as capital formation is stepped up in the economy. Now if the population grows faster than the increase in the stock of capital, the entire addition to the labour force cannot be absorbed in productive employment, because not enough instruments of production are there to employ them. This results in unemployment. The rate of capital formation must be kept sufficiently high so that employment opportunities are enlarged to absorb the additions to working force of the country as a result of population growth. In India, the stock of capital has not been growing at a fast enough rates so as to keep pace with the growth of population.

That is why there is huge unemployment and under-employment in both urban and rural areas. The fundamental solution to this problem of unemployment and under-employment is to step up the rate of capital formation so as to enlarge employment opportunities.

Role of Technology in Economic Development

The technology can be regarded as primary source in economic development and the various technological changes contribute significantly in the development of underdeveloped countries. Technological advancement and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. Schumpeter observed that innovation or technological progress is the only determinant of economic progress. But if the level of technology becomes constant the process of growth stops. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries.

The growth of net national income in developed countries cannot be claimed to have been due to capital alone. Kindle burger observed that major part of this increased productivity is due to technological changes. Robert Solow estimated that technological change accounted for about 2/3 of growth of the U.S. economy; after allowing for growth in the labor force and capital stock. In fact, the technology can be regarded as primary source in economic development and the various technological changes contribute significantly in the development of underdeveloped countries. The impact of technological change on production functions can be illustrated with the help of following diagrams.

Fig. 1.   Fig. 2.   Fig. 3.
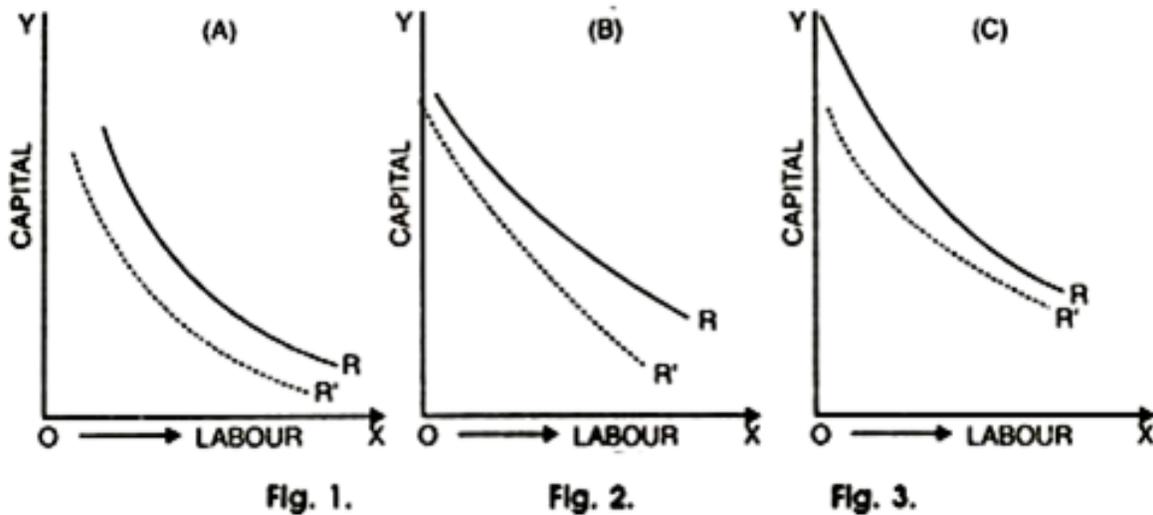
In the above figures 1 to 3 R' is an isoquant of production function before technological change and R' represents the same quantities output after the innovation in the first figure. The innovation is neutral with respect to labour and capital. The new production function R shows that the same output can be produced with less labour and less capital after technological advancement.

The second figure shows that innovation is labour saving and R' shows that same output can be produced with lesser inputs but the saving of labour is greater than that of capital. The third figure shows that the innovation is capital saving and R' shows that the same output can be produced by less inputs after technological change but saving of capital is greater than that of labour.

It is generally assumed that the technological advancement is even more important than capital formation. But the capital formation alone can bring out economic development to a limited extent and the progress stops if there is no technological change. A country cannot remain dependent on the import of technology. A nation that spends more on science and

technical research will tend to grow faster than another country accumulating more capital but spending less on technological.
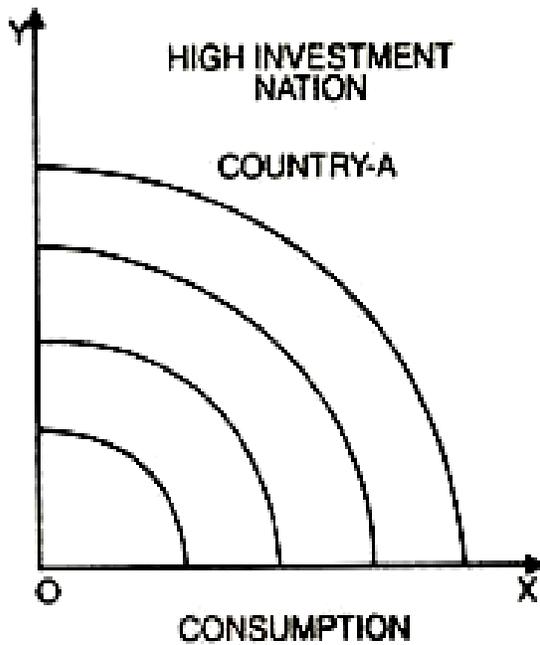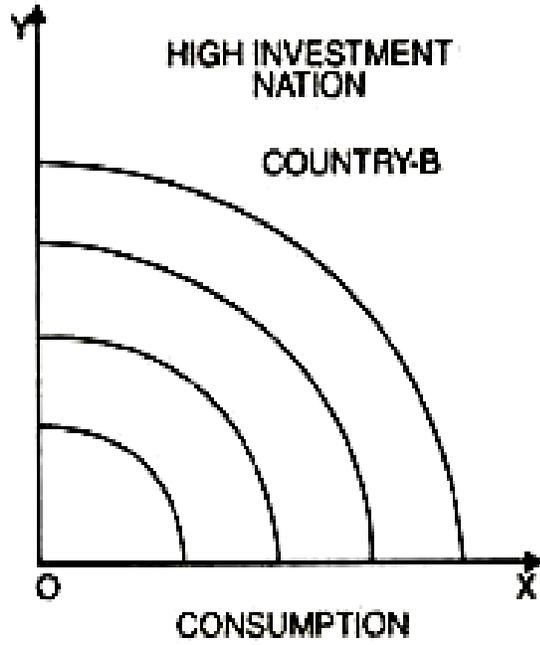

Fig. 4

Fig. 5

In the first figure (4) the country A concentrates on accumulation of more capital resources while in second figure 5, country B focuses attention on technological aspects but does not regulate the accumulation of capital. It is clear that the progress of country B is faster than that of country A due to the high rates of technological development. The concept that technological progress is more important than capital formation is illustrated with the help of production function in the diagram 6.
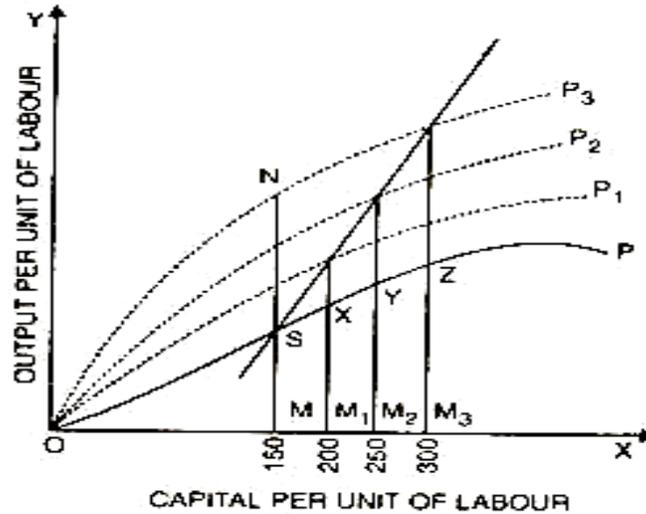
CAPITAL PER UNIT OF LABOUR
Fig. 6

In the figure 6, OP represents the production function which rises to OP,, OP_2 and OP., with technological progress. On the production function OP if amount of capital per worker raised from Rs. 150 to Rs. 200, the output per worker of labour is raised from SM to XM^1, when capital per unit of labour is Rs. 300 the output per labour is. ZM,. The main objective of technological progress is to make a better utilization of labour and other resources and hence the production function shifts upward which means that more output per labour can be obtained by the same amount of capital per worker.

The quantity of capital per worker remains at Rs. 150, the production per worker goes on increasing from SM to NM. This is due to the upward shifting of the production function. In the same fashion, more production can be produced at other levels of capital intensity. Thus, technological progress results in shifting the production function upward which enables more output per labourer with same amount of capital per worker.

Role of Labour

A man is both a consumer and a producer. Labour is an important factor not only in production, but in all other economic activities. Classical economists like Ricardo and Karl Marx gave prime place to labour as the main source of production.

The Rule of Labour Is Highlighted By the Following Factors

1. Basis of Consumption

Labour is a human factor and the main source of consumption. Utility is created (Production) for the satisfaction of his needs. Lord Keynes was of the view that a stimuli to investment comes via increase in consumption. When investment increases, income increases which leads to increase in consumption. The basis of this consumption is labour.

2. Basis of Production

Producers produce the commodities when they are assured by consumers that their products would be consumed. Labour is the basis or the compulsory factor of production. It is a mobile factor and brings in use the other factors of production like land and capital.

3. Basis of Exchange

Labour is a basis of not only consumption and production, but also it serves as a basis of exchange. A man needs so many commodities to fulfill his daily needs. He cannot produce all of them. He has to satisfy his needs by exchanging his surplus production with others. So labour serves as a basis of exchange.

4. Basis of Distribution

National income is the result of the contribution of all the factors of production. So labour becomes the basis of this distribution of national income among all factors. The contribution of each factor depends on its marginal productivity. If labour is efficient, its share in national income would go up.

5. Basis of Economic Growth

Technically sound and intelligent labour serves as a spinal cord of the nation. Efficient labour force makes proper use of the scarce natural resources of the country. Sincere, dedicated, devoted, hardworking and intelligent labour force helps the country to march on the path of development.

1.4 Technical Progress and Economic Development

Technological advancement and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. Schumpeter observed that innovation or technological progress is the only determinant of economic progress. But if the level of technology becomes constant the process of growth stops. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries.

The growth of net national income in developed countries cannot be claimed to have been due to capital alone. Kindleberger observed that major part of this increased productivity is due to technological changes. Robert Solow estimated that technological change accounted for about 2/3 of growth of the U.S. economy; after allowing for growth in the labour force and capital stock.

Similarly, Karl Marx and Schumpeter have emphasized the significance if technical progress in their growth model formulations. In the words of Mansfield "Technological change is one of the most important determinants of the shape and evolution of the economy. Technological change has improved working conditions, permitted the reduction of working hours and provided the increased flow of products." In fact, the technology can be regarded as primary source in economic development and the various technological changes contribute significantly in the development of underdeveloped countries.

The contribution of technical progress to economic development has been summarized below

(1) Intensive Utilization of Resources

Technical progress helps intensive utilization of the available resources. It leads to diversification of resource utilization. Increased and diversified output contributes to the growth of national income and economic development.

(2) Use of Potential Resources

Technical advancement facilitates the discovery and utilization of potential resources of the country. Thus, technological progress helps the growth of substitute resources for imports. As a result, domestic production is increased with domestic resources themselves. For example, in India, oil could be exploited due to technical progress.

(3) Helpful for Export Promotion

Technical advancement is very much helpful for export promotion. It facilitates diversification of output in under developed countries. As a result, these countries become capable of exporting non- conventional goods, such as engineering products and various other finished products. New technology helps to increase the level of output and therefore the capacity to export. Because of diversified output, dependence upon the developed ones is considerably reduced. Accordingly, terms of trade start improving in favour of the developing countries and these countries start getting fair compensation for their exports.

(4) Contribution to Import Substitution

An underdeveloped country utilizes technological progress in the field of import substitution. As a result, lot of foreign exchange is saved for the import of essential raw materials and capital goods. Thus, the process of technological progress continues hand in hand with the process of capital formation within the country.

(5) Growth of Infra-structure

Technological advancement helps the growth of infra-structure of the economy. They include the basic facilities like transport, Communication, power and irrigation. They play pioneer role for the development. Thus technical progress contributes to the growth of the economy by way of developing its infra-structure.

(6) Increase in the Efficiency of Human Resources

Technical advancement helps to increase the efficiency of human resources. Labour is given training for the use of techniques of production. It improves their efficiency. Increase in the efficiency of workers, in turn, facilitates more innovative ideas of production. Cost of production and prices are reduced which are very much useful for developing countries.

(7) Helpful Industrialisation

The growth of industrialisation depends upon the growth and application of new technology. Technological progress has been the chief determinant of industrial revolution in the European nations. In less developed countries, establishment of basic industries requires modern-technology. Technological progress has the direct bearing upon the process of industrialization. It helps the progress of all such parameters which are vital to the growth of industrialisation. Germany and Japan are good examples of technological progress in the world.

(8) Change in Social and Economic Structure

It has been observed that technological progress has made remarkable change in the social and economic structure of underdeveloped countries. Man becomes curious to acquire new ideas so as to raise his income level and the level of living. The outlook of the man becomes more progressive. Contacts with the developed countries generates 'Demonstration Effect' which in turn help shedding conventions and rituals. A new social order is established. More of efficient labour and capital are needed for the application of new technology. For its arrangement new economic institutions are established. All this brings about structural changes in the economy.

(9) Increase in Capital Formation

Technical progress leads to the growth of output and productivity. As a result, per capita income is increased. On the one hand, consumption of the household rises, while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases.

(10) Availability of Foreign Capital

Generally underdeveloped countries face the problem of capital and domestic capital is already scarce. Thus, foreign-capital is invested in such developing countries generally on the

condition that technological changes "are introduced in the process of production. In such a situation technology and external investment become the cause and effect for each other. New technology is also used in the new enterprises established with foreign collaboration. In this way, foreign capital is available with the underdeveloped countries which can be used for domestic technological advancement.

(11) Agricultural Development

With the advancement of technology, agricultural sector is also developed. New agricultural strategies which include new high yielding varieties of seeds, fertilizer and other methods of production are sine qua non to technical advancement. As a result, there is tremendous increase in agricultural production. In India, green revolution in a good example of technological progress.

An economic relation which seeks to explain changes in the level of economic output in terms of the level of technical progress. Rather than looking at economic growth as a form of efficiently allocating inputs, the technical progress function explains economic growth in terms of investment in technological progress

Hicks-neutral technical change is change in the production function of a business or industry which satisfies certain economic neutrality conditions.

Technical progress can be classified into two parts: Embodied Technical Progress: improved technology which is exploited by investing in new equipment. Disembodied Technical Progress improved technology which allows increase in the output produced from given inputs without investing in new equipment.

Models of Technical Change in Economic Growth

Technical progress plays an imperative role in influencing the pace of economic growth. It is the technical change which results in an increased output per unit labour. It signifies a comprehensive phenomenon and, therefore, denote different things in different contexts.

Technical change refers to change in the production function embodying all techniques. Thus, technical change in the context of economic development must result in more output for the same resources or the same amount of output. It could occur following a change in any of the production variables. Thus, it may result due to a change in kinds of physical capital, in the quality of labour or even in the organisation of these resources.

Harrod-Dommar model is based on the assumption of fixed coefficients of production and gives rise to the knife edge problem. Kendrick, Kaldor and Solow and others have been the most consistent critics of this approach who have tried to demonstrate the role of technological changes in the growth of an economy.

In this way, the nature of the technical progress is most important determinant of the individual factor productivities. It brings a proportionate increase in the productivities of all the factors. Therefore, the model of technical change is based on the controversy over neutral and non-neutral technical change.

Neutral and Non-Neutral Technical Changes

A technical change is said to be neutral if it is neither capital saving nor labour saving i.e. it is neutral in its effect in the sense that neither of the two factors become more or less important at the margin. There are two definitions of neutrality. One is given by Prof. Hicks and the other by Prof. Harrod.

A. Hicks views on Neutrality. According to Prof. Hicks, neutrality is **"An invention which raises the marginal productivity of labour and capital in same proportion"**. Thus, a technical change is neutral if the ratio of marginal product of capital to that of labour remains unchanged at constant capital labour ratio.

A technical change is termed as labour saving if it raises the marginal product of capital relative to that of labour at a constant capital labour ratio.
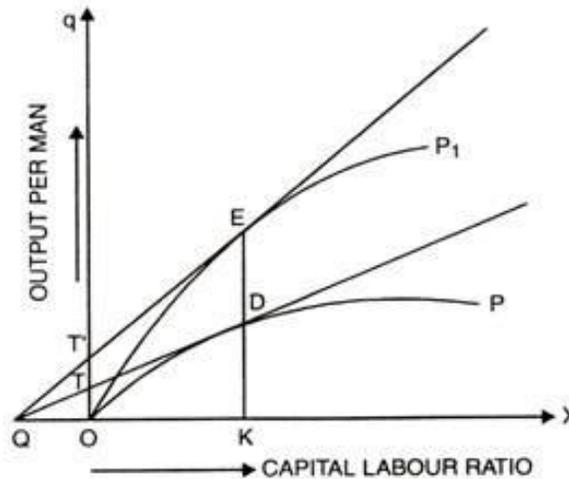

Fig. 1

Hick's neutral technical change is explained in the figure 1 by comparing points on two different; production functions

The output per man q is represented along with vertical axis and capital labour ratio is represented along with horizontal axis. OQ measures the marginal product of labour and capital. OP is the production function before technical change and OP_1 is the production function after

technical change. Taking, production function OP, the slope of tangent QTD measures the marginal product of capital and OT measures the marginal product of labour.

Since slope QT shows the marginal product of capital, say u, we can express it as

$$u = OT/ OT \text{ or } OQ = OT/u$$

Hence OQ measures the ratio between marginal product of labour OT and marginal product of capital 'u', Hicks neutral technical progress requires that if technical change shifts the production function upwards from OP to OP_1, the ratios of two marginal products must be same on vertical line from X-axis like KE where it passes through the production functions at points D and E, respectively.

Hicks Neutral Technical Progress

The condition is that the tangent QE on the higher production function OP, must originate from the point Q to left of O, like the tangent before the technical change. In the figure, the tangent QE on the production function OP_1 originates from Q.

When both the tangents QE and QD on production functions OP and OP_1 originate from Q, only then the ratios between marginal product of labour and capital will be equal i.e. the ratio between the marginal product of labour and capital after the technical progress (OW_1/u_1) must be equal to the ratio between the marginal products of labour and capital before technical progress (OW/u)Therefore, the ratio between the marginal product of labour and capital is equal at points D and E on the vertical line KE.

This situation can be expressed as under
Q = Q (t) f (K, L)
Where Q — Total output
K — Inputs of capital
L — Inputs of labour
A (t) — Index of Technical Progress.

It measures accumulated effects of shift overtime and is an increasing function of t.
On the basis of the definition of Hicks neutrality, we can define labour saving and capital saving technical changes, which Mrs. Joan Robinson's terms biased technical progress.

Capital- Saving Technical Change

A technical change is capital saving if it raises the marginal product of labour relatively to capital, at constant capital labour ratio. The given output will require less capital relative to labour.

This is illustrated with the help of a diagram 2 given below

This shows that a shift in production function resulting from the capital saving technique would be one where, for a given K
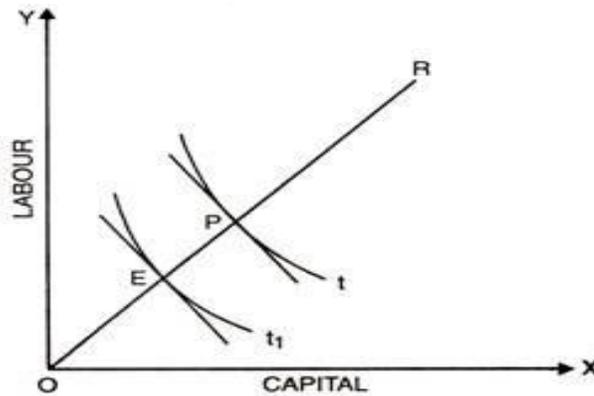

Fig. 2

$$\frac{\delta Y}{dK} \Big/ \frac{\delta Y}{dL} \text{ declines}$$

i.e. $\dfrac{\text{marginal productivity of capital}}{\text{marginal productivity of labour}}$

This type of technical change is capital saving, i.e. it would be possible to produce a given level of output with less capital relative to labour than before the introduction of technique.

If the amount of capital used is reduced absolutely and that of labour rises, the technical change is absolutely capital saving and labour using. On the other hand, if the technique leads to a fall in the amounts of both the inputs, but the fall in the input of labour is less compared to that of capital, the technique is said to be relatively capital saving.

Labour-Saving Technical Change
A technical change is labour saving if it raises the marginal product of capital relative to labour at constant capital labour ratio. The given output would require less labour relatively to capital i.e. for a given K

$$\frac{\delta Y}{dK} \bigg/ \frac{\delta Y}{dL} \text{ increases}$$

i.e. $\dfrac{\text{marginal productivity of capital}}{\text{marginal productivity of labour}}$ increases

and it would be possible when the technical progress causes a rise in the productivity of capital proportionately more than that y of labour i.e. it is possible to produce a given level of output with less labour relative to capital. The figure 3 given below shows the case of labour saving technique.
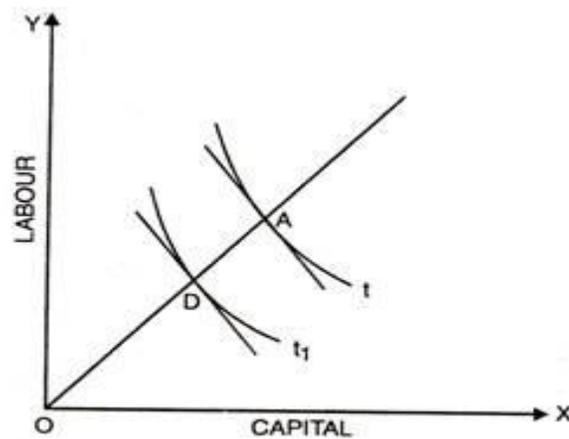

Fig. 3

Where t is the isoquant before the technical progress and t_1 after the technical progress. If the amount of labour used is reduced absolutely and that of capital rises than the technical change will be absolutely labour saving and capital using. On the other side, if the technique leads to a fall in both factors but the fall in amount of labour is proportionately more than that of capital, the technique is said to be relatively labour saving.

The precise manner in which relative and absolute amounts of labour and capital used will change as a result of technical change will depend upon the factor elasticities of substitution and product elasticities of demand.

Therefore, it will depend upon the elasticities of substitution between capital and labour in the economy, for these will help to determine what effects the technical change has on the prices of the two factors. It will also depend upon the elasticities of demand for the product of various industries that make up the economy.

In Hicks Neutral Technical progress, the factor shares remain constant if factor proportions and relative remunerators of labour and capital are constant. If he consider figure 1, it implies that between D and E if the slope of the production function OP_1 at E is greater than the slope of production function OP at D in the same proportion as the output KE is greater than KD, then the technical progress is Hicks Neutral.

This means that when the amount of capital is changed, the marginal product of capital increases in the same proportion as total output. In other words, between D and E, the proportion of total output which is paid out of profits and wages remains constant. Again, it is also as when the elasticity of substitution between labour and capital is equal to unity.

1.5 Embodied and Disembodied progress Technical Change

Solow modified the residual approach himself based on disembodied technical change where in capital stock is regarded as homogeneous and technical change floats down from the outside.

According to F.H. Hahn and R.C.O. Mathews, "In this model, new capital accumulation is regarded as the vehicle of technical progress. Technical progress increases the productivity of machines built in any period compared with machines built in previous period, but it does not increase productivity of machines already in existence. Technical progress is embodied in new machines. Machines alterably embody the technology of their date of construction. Machines built at different dates are therefore, qualitatively dissimilar and cannot in the general case be aggregated into single measure of capital. A separate production function is needed for each vintage. Total output is the sum of output of all the vintages in use".

Assumptions

This model is based on the following assumptions

1. Capital stock consists of machines of different vintages or built at different dates.
2. New machines are more productive than old ones.
3. Technical change proceeds at some given proportional rate.
4. Machines embody all the latest knowledge at the time of construction but do not share in any subsequent improvements in technology.
5. Technical change effects only new machines.
6. Only gross investment in new machines is considered in the model and the production function is linear homogeneous.
7. Technical change proceeds at some given proportional rate.
8. The production function is linear homogeneous of the Cobb- Douglas type.

The total output Qv (t) at times t from the machines of each vintage v is given by Cobb-Douglas production function

"The picture is one of the continuum of capital goods of various vintage and corresponding productivity, subject to an exponential life table", according to Solow. At each moment of time the labour force is reshuffled over the existing capital goods. This total output is determined by integrating over all layers of capital stock".

Solow states that if we assume competition in the labour market, all homogeneous labour must receive the same wage regardless of the age of capital on which it operates.

$$W_t = \frac{dQ_v(t)}{dL_v(t)} = \alpha B e^{\lambda v} \, Lv(t)^{\alpha-1} \, Kv(t)^{1-\alpha} \qquad \qquad ...(3)$$

$$L_v(t)^{\alpha-1} = \frac{W_t}{\alpha \, B e^{\lambda v} \, K_v(t)^{1-\alpha}}$$

$$L_v(t)^{\alpha-1} = \frac{W_t}{\alpha \beta e^{\lambda v} \, [I(v) \, e^{-\delta(t-v)}]^{1-\alpha}}$$

$$L_v(t) = \left[\frac{W_t}{\alpha \beta e^{\lambda v} \, [I(v) \, e^{-\delta(t-v)}]^{1-\alpha}} \right]^{\frac{1}{\alpha-1}}$$

$$= (W_t)^{\frac{1}{\alpha-1}} \left(\frac{1}{\alpha\beta} \right)^{\frac{1}{\alpha-1}} \left(\frac{1}{e^{\lambda v \, over \, \alpha - 1}} \right) \left[I(v) \, e^{-\delta(t-v)} \right]$$

$$= (W_t)^{\frac{1}{\alpha-1}} \left(\frac{1}{\alpha\beta} \right)^{\frac{1}{\alpha-1}} \left(\frac{\lambda v}{e^{1-\alpha}} \right) \left[I(v) \, e^{-\delta t} \, e^{\delta v} \right]$$

$$= (W_t)^{\frac{1}{\alpha-1}} (\alpha\beta)^{\frac{-1}{1-\alpha}} e^{\sigma v - \delta v \bullet\bullet} \, I(v) \, e^{-\delta t} \, e^{\delta v}$$

$$= (W_t)^{\frac{1}{\alpha-1}} (\alpha\beta)^{\frac{-1}{1-\alpha}} e^{\sigma v} \, (e^{-\delta v} \, e^{\delta v}) \, e^{\delta t} \, I(v)$$

$$= (W_t)^{\frac{1}{\alpha-1}} (\alpha\beta)^{\frac{-1}{1-\alpha}} e^{\sigma v} \, I(v) \, e^{-\delta t}$$

$$= Ht \, e^{\sigma v} \, I(v) \qquad \qquad ...(4)$$

Thus, if labour is allocated efficiently over capital of different vintages by equalizing marginal productivity of labour on equipment, then the total output ($Qv\ (t)$) is the sum of the homogeneous outputs of different vintages. Substituting the values of $Lv\ (t)$ and $Kv\ (t)$ in $= n$ (1) we get

$$Qv\ (t) = Be^{-\delta(1-\alpha)t}\ Ht^{\alpha}\ .\ e^{\sigma v}\ I\ (v)**** \qquad ...(5)$$

Aggregate output at any time from machines of all vintages can be obtained by integrating equation (5)

$$Qv\ (t) = Be^{-\delta(1-\alpha)t}\ Ht^{\alpha}\ \int_{-\infty}^{t} e^{\sigma y}\ I(v)\ dv$$

$$Qv\ (t) = Be^{-\delta(1-\alpha)t}\ Ht^{\alpha}\ Jt$$

$$Jt = \int_{-\infty}^{t} e^{\sigma y}\ I\ (v)\ dv$$

Solow calls J as an effective stock of capital which is productivity weighted sum of all surviving capital goods representing all early technological levels.

But the capital goods of smaller vintages receive a smaller weight than new capital goods. He further adds that average age of capital can be lowered by increasing the saving rate and thereby average quality of machines in use can be raised. Thus output per man can be raised.

The model of disembodies technical change is based on the assumption that capital stock is completely homogeneous. New machines are better than old machines and technological progress is embodied in new machines. In the former, capital labour ratios change at all times along the Cobb-Douglas production function.

But in the latter, once a machine is constructed, it has labour requirements.

In other words, **"Each machine is designed to be worked with given crew of men and the size of crew cannot be changed"**.

Mrs. Joanson has rightly observed that this model is said to have ex-ante substitutability between labour and capital and ex-post fixed coefficients or no ex-post substitutability. Phelps puts that it is a putty day model-putty ex-dante and clay ex-post. On the other hand, the model of disembodies technical change is one of ex-ante and ex-post substitutability or a partly model.

Limitations

The drawbacks of technical change model are listed as below

1. It is based on the assumption of perfect competition and hence fails to consider factor market imperfections.

2. Solow assumes that machines depreciate exponentially. But Stieglitz points out that this may be reasonable assumption for telephone poles but not for machines.

3. It does not take into account the influence of wage expectations on machine construction. An investor forms expectations of wage rates extending into future before constructing a machine. In that case, the real wage rate will not equal the marginal productivity of labour on the machine of a given vintage and type, but it will equal the average output per man on the least efficient machine.

4. The entire model is based on the hypothesis that machines are of different types and new machines are better than old ones.

5. The assumption on which this model is based relate to fixed labour requirements. This is unrealistic for an economy with a higher output per man which may have lower capital labour ratio.

6. It concentrates only on technological progress embodied in new machines and ignores the problems of inducing innovations through the process of learning and investments in research.

1.6 Growth Models

The Harrod–Domar model is a classical Keynesian model of economic growth. It is used in development economics to explain an economy's growth rate in terms of the level of saving and productivity of capital. Natural growth is the growth an economy requires to maintain full employment.

The Harrod-Domar Economic Growth Model (With Assumptions)

Let us make an in-depth study of the Harrod-Domar Economic Growth Model:- 1. Introduction to the Harrod-Domar Economic Growth Model 2. General Assumptions 3. Instability of Growth 4. The Domar Model 5. Summary of Main Points 6. Diagrammatic Representation.

Introduction to the Harrod-Domar Economic Growth Model

Ever since the end of Second World War, interest in the problems of economic growth has led economists to formulate growth models of different types. These models deal with and

lay emphasis on the various aspects of growth of the developed economies. They constitute in a way alternative stylized pictures of an expanding economy.

A feature common to them all is that they are based on the Keynesian saving-investment analysis. The first and the simplest model of growth—the Harrod-Domar Model—is the direct outcome of projection of the short-run Keynesian analysis into the long-run.

This model is based on the capital factor as the crucial factor of economic growth. It concentrates on the possibility of steady growth through adjustment of supply of demand for capital. Then there is Mrs. Joan Robinson's model which considers technical progress also, along with capital formation, as a source of economic growth. The third type of growth model is that built on neoclassical lines.

It assumes substitution between capital and labour and a neutral technical progress in the sense that technical progress is neither saving nor absorbing of labour or capital. Both the factors are used in the same proportion even when neutral technical takes place. We deal with the prominent growth models here.

Although Harrod and Domar models differ in details, they are similar in substance. One may call Harrod's model as the English version of Domar's model. Both these models stress the essential conditions of achieving and maintaining steady growth. Harrod and Domar assign a crucial role to capital accumulation in the process of growth. In fact, they emphasise the dual role of capital accumulation.

On the one hand, new investment generates income (through multiplier effect); on the other hand, it increases productive capacity (through productivity effect) of the economy by expanding its capital stock. It is pertinent to note here that classical economists emphasised the productivity aspect of the investment and took for granted the income aspect. Keynes had given due attention to the problem of income generation but neglected the problem of productive capacity creation. Harrod and Domar took special care to deal with both the problems generated by investment in their models.

General Assumptions

The Main Assumptions of the Harrod-Domar Models are as Follows

(i) A full-employment level of income already exists.
(ii) There is no government interference in the functioning of the economy.

(iii) The model is based on the assumption of "closed economy." In other words, government restrictions on trade and the complications caused by international trade are ruled out.

(iv) There are no lags in adjustment of variables i.e., the economic variables such as savings, investment, income, expenditure adjust themselves completely within the same period of time.

(v) The average propensity to save (APS) and marginal propensity to save (MPS) are equal to each other. APS = MPS or written in symbols,

$$S/Y = \Delta S/\Delta Y$$

(vi) Both propensity to save and "capital coefficient" (i.e., capital-output ratio) are given constant. This amounts to assuming that the law of constant returns operates in the economy because of fixity of the capita-output ratio.
(vii) Income, investment, savings are all defined in the net sense, i.e., they are considered over and above the depreciation. Thus, depreciation rates are not included in these variables.

(viii) Saving and investment are equal in ex-ante as well as in ex-post sense i.e., there is accounting as well as functional equality between saving and investment.

These assumptions were meant to simplify the task of growth analysis; these could be relaxed later.

Harrod's Growth Model Raised Three Issues

(i) How can steady growth be achieved for an economy with a fixed (capital- output ratio) (capital-coefficient) and a fixed saving-income ratio?

(ii) How can the steady growth rate be maintained? Or what are the conditions for maintaining steady uninterrupted growth?

(iii) How do the natural factors put a ceiling on the growth rate of the economy?

In order to discuss these issues, Harrod had adopted three different concepts of growth rates: (i) the actual growth rate, G, (ii) the warranted growth rate, G_w (iii) the natural growth rate, G_n. The Actual Growth Rate is the growth rate determined by the actual rate of savings and investment in the country. In other words, it can be defined as the ratio of change in income (AT) to the total income (Y) in the given period. If actual growth rate is denoted by G, then
$$G = \Delta Y/Y$$

The actual growth rate (G) is determined by saving-income ratio and capital- output ratio. Both the factors have been taken as fixed in the given period. The relationship between the actual growth rate and its determinants was expressed as:

$$GC = s \ldots(1)$$

where G is the actual rate of growth, C represents the capital-output ratio $\Delta K/\Delta Y$ and s refers to the saving-income ratio $\Delta S/\Delta Y$. This relation stales the simple truism that saving and investment (in the ex- post sense) are equal in equilibrium. This is clear from the following derivation.

Since
$$G = \frac{\Delta Y}{Y}$$

$$C = \frac{\Delta K}{\Delta Y} = \frac{I}{\Delta Y} \qquad [\because \Delta K = I]$$

Because
$$s = \frac{S}{Y}$$

Substituting the value of G, C, and s in equation (1), we get
$$\frac{\Delta Y}{Y} \times \frac{I}{\Delta Y} = \frac{S}{Y}$$

or
$$\frac{I}{Y} = \frac{S}{Y}$$

or
$$I = S$$

This relation explains that the condition for achieving the steady state growth is that ex-post savings must be equal to ex-post investment. **"Warranted growth"** refers to that growth rate of the economy when it is working at full capacity. It is also known as Full-capacity growth rate. This growth rate denoted by G_w is interpreted as the rate of income growth required for full utilization of a growing stock of capital, so that entrepreneurs would be satisfied with the amount of investment actually made.

Warranted growth rate (G_w) is determined by capital-output ratio and saving- income ratio. The relationship between the warranted growth rate and its determinants can be expressed as
$$G_w C_r = s$$

where C_r shows the needed C to maintain the warranted growth rate and s is the saving-income ratio.

Let us now discuss the issue: how to achieve steady growth? According to Harrod, the economy can achieve steady growth when

$$G = G_w \text{ and } C = C_r$$

This condition states, firstly, that actual growth rate must be equal to the warranted growth rate. Secondly, the capital-output ratio needed to achieve G must be equal to the required capital-output ratio in order to maintain G_w, given the saving co-efficient (s). This amounts to saying that actual investment must be equal to the expected investment at the given saving rate.

Instability of Growth

We have stated above that the steady-state growth of the economy requires an equality between G and G_w on the one hand and C and C_r on the other. In a free-enterprise economy, these equilibrium conditions would be satisfied only rarely, if at all. Therefore, Harrod analysed the situations when these conditions are not satisfied.

We analyse the situation where G is greater than G_w. Under this situation, the growth rate of income being greater than the growth rate of output, the demand for output (because of the higher level of income) would exceed the supply of output (because of the lower level of output) and the economy would experience inflation. This can be explained in another way too when C < C_r Under this situation, the actual amount of capital falls short of the required amount of capital. This would lead to deficiency of capital, which would, in turn, adversely affect the volume of goods to be produced. Fall in the level of output would result in scarcity of goods and hence inflation. This, under this situation the economy will find itself in the quagmire of inflation.

On the other hand, when G is less than G_w, the growth rate of income would be less than the growth rate of output. In this situation, there would be excessive goods for sale, but the income would not be sufficient to purchase those goods. In Keynesian terminology, there would be deficiency of demand and consequently the economy would face the problem of deflation. This situation can also be explained when C is greater than C_r.

Here the actual amount of capital would be larger than the required amount of capital for investment. The larger amount of capital available for investment would dampen the marginal efficiency of capital in the long period. Secular decline in the marginal efficiency of capital would lead to chronic depression and unemployment. This is the state of secular stagnation.
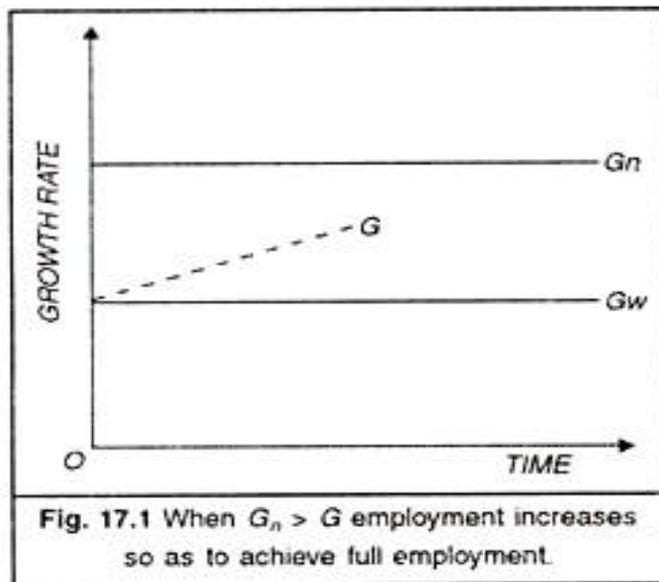
From the above analysis, it can be concluded that steady growth implies a balance between G and G_w. In a free-enterprise economy, it is difficult to strike a balance between G and G_w as the two are determined by altogether different sets of factors. Since a slight deviation of G from G_w leads the economy away and further away from the steady-state growth path, it is called 'knife-edge' equilibrium.

G_n the Natural growth rate is determined by natural conditions such as labour force, natural resources, capital equipment, technical knowledge etc. These factors place a limit beyond which expansion of output is not feasible. This limit is called Full-Employment Ceiling. This upper limit may change as the production factors grow, or as technological progress takes place. Thus, the natural growth rate is the maximum growth rate which an economy can achieve with

its available natural resources. The third fundamental relation in Harrod's model showing the determinants of natural growth rate is
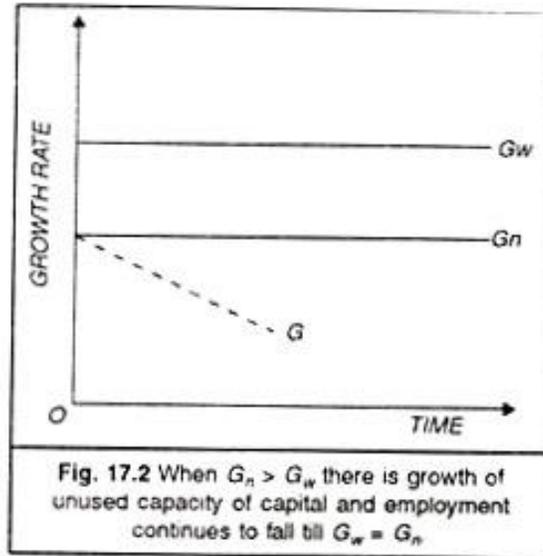
$G_n C_r$ is either = or $\neq s$

Interaction of G, G_w and G_n:

(i) If $\quad$ $G > G_w$*
$\quad$ then $\quad$ $C < C_r$

(ii) If
$\quad$ then $\quad$ $G < G_w$
$\quad\quad\quad$ $C > C_r$

Fig. 17.1 When $G_n > G$ employment increases so as to achieve full employment.

Comparing the second and the third relations about the warranted growth rate and the natural growth rate which have been given above, we may conclude that G_n may or may not be equal to G_w. In case G,, happens to be equal to G_w, the conditions of steady growth with full employment would be satisfied. But such a possibility is remote because of the variety of hindrances are likely to intervene and make the balance among all these factors difficult. As such there is a definite possibility of inequality between G_n and G_w. If G,, exceeds G_w, G would also exceed G_w for most of the time as is shown in Figure 17.1, and there would be a tendency in the economy for cumulative boom and full employment.

Such a situation will create an inflationary trend. To check this trend, savings become desirable because these would enable the economy to have a high level of employment without inflationary pressures. If on the other hand G_w exceeds G,,, G must be below G,, for most of the time and there would be a tendency for cumulative recession resulting in unemployment (Figure 17.2).

Fig. 17.2 When $G_n > G_w$ there is growth of unused capacity of capital and employment continues to fall till $G_w = G_n$

The Domar Model

The main growth model of Domar bears a certain resemblance to the model of Harrod. In fact, Harrod regarded Domar's formulation as a rediscovery of his own version after a gap of seven years.

Domar's theory was just an extension of Keynes' General Theory, particularly on two counts

1. Investment has two effects

(a) An income-generating effect and

(b) Productivity effect by creating capacity.

The short-run analysis governed by Keynes ignored the second effect.

2. Unemployment of labour generally attracts attention and one feels sympathy for the jobless, but unemployment of capital attracts little attention. It should be understood that unemployment of capital inhibits investment and hence reduces income. Reduction of income brings about deficiency in demand and hence unemployment. Thus the Keynesian concept of unemployment misses the root cause of the problem. Domar wanted to analyse the genesis of unemployment in a wider sense.

To understand the implications of Domar model, one should get familiar with the relations listed below

    1. Income is determined by investment through multiplier. For simplicity saving-income ratio (s) is assumed constant. This implies that

$$Y_{(t)} = I_{(t)}/s$$

    where Y is the output, I is the actual investment and s is saving-income ratio (saving propensity) and (t) shows the time period.

    2. Productive capacity is created by investment to the extent of the potential (social) average productivity of investment denoted by a. For simplicity, this is also assumed to be constant. In notation form the relation can be written as

$$Y_{(t)} - Y_{(t-1)} = I_{(t)/\alpha}$$

    where Y shows the productive capacity for output, a is the actual marginal capital-output ratio which is the reciprocal of "potential social average investment productivity" ($\alpha = 1/\sigma$). Therefore, Equation (2) can also be expressed as $\Delta Y_t = \sigma I_t$. This equation shows that the change in productive capacity is the product of capital productivity (σ) and investment. As such it reveals the productivity effect.

    3. Investment is induced by output growth along with entrepreneurial confidence. The latter is adversely affected by "Junking" which means the untimely loss of capital value due to the unprofitable operation of older facilities. This may be due to the shortage of labour or invention of new products or labour-saving inventions. This assumption can be shown by the relation

$$\frac{\dot{I}_{(t)}}{Y_{(t-1)}} = G\left[\frac{Y_{(t-1)}}{Y_{(t-2)}} - \frac{\dot{Y}_{(t-2)}}{Y_{(t-3)}}, d(t)\right]$$

    where G is an increasing function of the rate of output acceleration, but a decreasing function of the "Junking ratio" d(t).

If junking ratio is zero then investment increases at the same rate as output

    4. Employment depends upon the 'utilization ratio' expressed as the ratio between actual output and productive capacity. It may be expressed as

$$\frac{N_{(t)}}{L_{(t)}} \quad H, \left[\frac{Y_{(t)}^{-}}{Y_{(t)}^{s}} \ldots\ldots\ldots\right], H > 0$$

Here A' refers to employment and L to the labour force. II is the employment coefficient, Y^d the actual output and the productive capacity, (I) being the time period. This equation explains that the ratio of employment to labour force is determined by employment coefficient (II) and the ratio of output to productivity. The dots are meant to indicate the existence of other determinants of the employment ratio. If we assume that the employment coefficient takes the maximum value of unity (i.e., $H = I$), then $Yd_{(t)} = Y^s_{(t)}$

5. Past as well as present investment can generate productive capacity at a given ratio. But due to managerial miscalculation, the new investment projects will cause untimely demise of old project and plants. If "junking" exists, it would dampen the productivity of investment. This assumption is considered the central theme of Doinar's model. In the form of notations, it can be expressed as

$$K_{(t)} - K_{(t-1)} = I_{(t)} - [d(t) K(t)]$$

where K is capital, / shows investment, d(t). K(t) is the amount of capital junked, and d(t) is the junking ratio.

Domar viewed growth from the demand as well as the supply side. Investment on the one side increases productive capacity and on the other generates income. Balancing of the two sides provides the solution for steady growth. The following symbols are used in Domar's model.

Y_d = level of net national income or level of effective demand at full employment (demand side)
Y_s = level of productive capacity or supply at full-employment level (supply side)
K = real capital

I = net investment which results in the increase of real capital i.e., ΔK a = marginal propensity to save, which is the reciprocal of multiplier. a = (sigma) is productivity of capital or of net investment.

The demand side of the long-term effect of investment can be summarised through the following relation. This relation is a simple application of Keynes investment multiplier.

$$Y_d = 1/a . I$$

This relation tells us (I) that the level of effective demand (Y_d) is directly related to the level of investment through the multiplier whose value is given by $1/\alpha$. Any increase in the level of investment will directly increase the level of effective demand and vice versa. (ii) The effective demand is inversely related to the marginal propensity to save (a). Any increase in marginal propensity to save (a) will decrease the level of effective demand and vice versa.

The supply side of the economy in the Domar model is shown through the relation.

$$Y_s = \sigma K$$

This relation explains that the supply of output (Y_s) at full employment depends upon two factors: productive capacity of capital (σ) and the amount of real capital (K). Any increase or decrease in one of these two factors will change the supply of output. If the productivity of capital (σ) increases, that would favorably affect the economy's supply. Similar is the effect of the change in the real capital K on the supply of output.

For the economy's long-term equilibrium, the demand Y_d and supply Y_s sides should be equal. Therefore, we can write:

$$Y_d = Y_s$$

or

$$\frac{I}{a} = \sigma K$$

$$I = a \sigma K$$

This relation tells us that steady growth is possible when investment over a period of time equals the product of saving-income ratio, capital productivity and capital stock.

The demand and the supply equation in the incremental form can be written as follows: The demand side is:

$$\Delta Y_d = \Delta I / \alpha \ldots (1)$$

But the increment has not been shown in a because it is a constant in terms of the assumptions. Since $1/\alpha$ is nothing but a and ΔI leads to ΔK, we can write the supply relation as follows:

$$\Delta Y_s = \sigma \, \Delta K$$

This equation shows that a change in the supply of output (ΔY_s) can be expressed as the product of the change in real capital (ΔK), and the productivity of capital (σ). Substituting the value of ΔK as I in the above equation, we get the supply side of the economy as

$$\Delta Y_s = \sigma I \ldots (1)$$

From equations (1) and (2) we can derive the condition for steady growth. Using equations (1) and (2), we get

or

$$\Delta Y_d = \Delta Y_s$$

$$\frac{\Delta I}{\alpha} = \sigma I$$

and by cross-multiplying, we get

$$\frac{\Delta I}{I} = \alpha . \sigma$$

or that

$$\frac{\Delta Y}{Y} = \alpha . \sigma$$

Equation (3) explains that if steady growth is to be maintained, the income growth rate $\Delta Y/Y$ should be equal to the product of marginal propensity to save (α) and the productivity of capital (α). In the words of K.K. Kurihara "It is an increase in productive capacity (ΔY_s) due to increment of real capital (ΔC) which must be matched by an equal increase in effective demand (ΔY_d) due to an increment of investment (ΔI), if a growing economy with an expanding stock of capital is to maintain continuous full-employment.

Domar's condition of steady state growth can be explained with the help of numerical example. Suppose the productivity of capital (σ) is 25% and the marginal propensity to save is 12%, then the growth rate of investment (AHI) would be equal to a, a, i.e.,

$$\frac{25}{100} \times \frac{12}{100} = \frac{3}{100} \text{ or } 3\%$$

Thus income and investment must grow at the annual rate of 3% if steady growth rate is to be maintained.

Analysis of disequilibrium
Disequilibrium (non-steady state) prevails

(i) When $\dfrac{\Delta I}{I}$ or $\dfrac{\Delta Y}{Y} > \alpha\,\sigma$ (ii) When $\dfrac{\Delta I}{I}$ or $\dfrac{\Delta Y}{Y} < \alpha\,\sigma$

Under the first situation, long-term inflation would appear in the economy because the higher growth rate of income will provide greater purchasing power to the people and the productive capacity ($\sigma\alpha$) would not be able to cope with the increased level of income. The first situation of disequilibrium will, therefore, create inflation in the economy.

The second situation, under which growth rate of income or investment is lagging behind the productive capacity, will result in over production. The reduced growth rate of income will put a constraint on the purchasing power of the people, thereby reducing the level of demand and resulting in over-production. This is the situation in which there would be secular stagnation. We have thus arrived at the same conclusion of instability of stendy growth which we had derived from the Harrod model.

Summary of Main Points

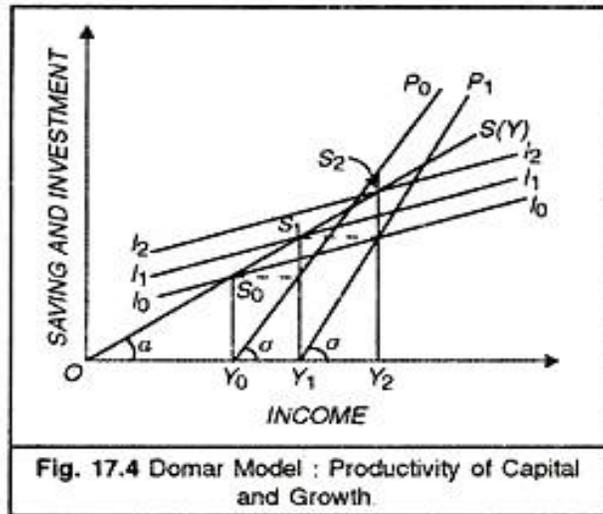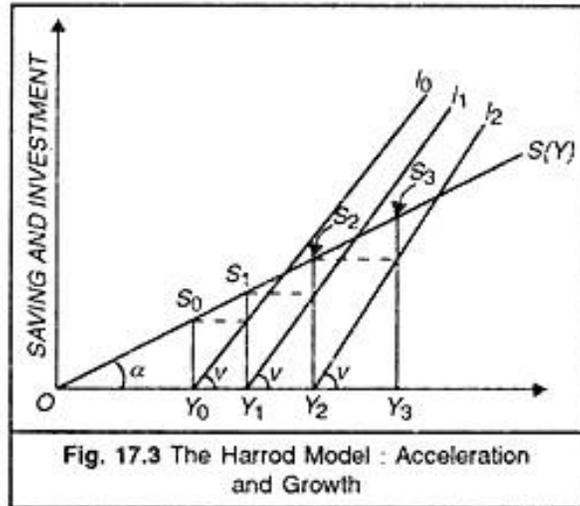**The main points of the Harrod-Domar analysis are summarised below**

1. Investment is the central variable of stable growth and it plays a double role; on the one hand, it generates income and on the other, it creates productive capacity.

2. The increased capacity arising from investment can result in greater output or greater unemployment depending on the behaviour of income

3. Conditions concerning the behaviour of income can be expressed in terms of growth rates i.e. G, G_w and G_n and equality between the three growth rates can ensure full employment of labour and full-utilisation of capital stock.

4. These conditions, however, specify only a steady-state growth. The actual growth rate may differ from the warranted growth rate. If the actual growth rate is greater than the warranted rate of growth, the economy will experience cumulative inflation. If the actual growth rate is less than the warranted growth rate, the economy will slide towards cumulative inflation. If the actual growth rate is less than the warranted growth rate, the economy will slide towards cumulative deflation.

5. Business cycles are viewed as deviations from the path of steady growth. These deviations cannot go on working indefinitely. These are constrained by upper and lower limits, the 'full employment ceiling' acts as an upper limit and effective demand composed of autonomous investment and consumption acts as the lower limit. The actual growth rate fluctuates between these two limits.

Diagrammatic Representation

Refer to Figure 17.3 where income is shown on the horizontal axis, Saving and Investment on vertical axis. The line $S(Y)$ drawn through the origin shows the levels of saving corresponding to different levels of income. The slope of this line (tangent α) measures the average and marginal propensity to save. The slopes of lines $Y_0 I_0$, $Y_1 I_1$, $Y_2 I_2$ measure the acceleration co-efficient v which remains constant at each income level of Y_0, Y_1, and Y_2.

At the initial income level of Y_0, the saving is $S_0 Y_0$. When this saving is invested, income rises from Y_0 to Y_1. This higher level of income increases saving to $S_1 Y_1$. When this amount of saving is reinvested, it will further raise the level of income to Y_2. The higher level of income will again raise saving to $S_2 Y_2$. This process of rise in income, saving and investment shows the acceleration effect on the growth of output.

Fig. 17.3 The Harrod Model : Acceleration and Growth

Fig. 17.4 Domar Model : Productivity of Capital and Growth.

Now we give the diagrammatic exposition of the Harrod model with the help of Figure 17.4.

In this figure, income is shown on horizontal axis, saving and investment on vertical axis. The line S(Y) passing through the origin indicates the level of saving corresponding to different levels of income. I_0I_0, I_1I_1 and I_2I_2 are the various levels of investment. Y_0P_0 and Y_1P_1 measure the productivity of capital corresponding to different levels of investment. The lines Y_0P_0 and Y_1P_1 are drawn parallel so as to show that productivity of capital remains unchanged. This diagram shows that the level of income is determined by the forces of saving and investment. The level of income Y_0 is determined by the intersection of saving line S(Y) and the investment line I_0I_0. At the level of income Y_0, the saving is Y_0S_0. When the saving Y_0S_0 is invested, it will increase the income level from OY_0 to OY_1. The productive capacity will also rise correspondingly. The extent of the income increase depends upon the productivity of capital, which is measured by the slope of the line Y_0P_0 (α). Higher is the level of income higher the productive capacity. Similarly, when the level of income is OY_1 the level of saving is S_1Y_1. With investment of S_1Y_1 income will further rise to the level Y_2. This increase in income means

expansion of purchasing power of the economy. But the coefficient of capital productivity would remain constant, this being an important assumption of Domar's model.

1.7 Kaldor's Model in Neo-Classical Theory of Economic Growth.

Introduction:

It has been seen that the original Harrod-Domar model (hereafter, mentioned as H-D Model) is rigid, light, one sector and specific with respect to three parameters.

A constant proportion of income is assumed to be saved (S_t/Y_t). The full capacity condition means a constant capital output ratio (C/O) and further the condition that on full employment the demand for labour (associated with full capacity output) must grow at the constant rate (n).

Thus, on account of constant saving-income ratio, constant capital-output ratio and constant demand for labour on full employment, the H-D model becomes too rigid to be much use. But the H-D model becomes very useful if these conditions are relaxed. The parameters (constant variables) may be allowed to vary. We may vary the supply of labour and treat it as more flexible on full employment—this has been done by Mrs. Joan Robinson and her colleagues in Cambridge.

we can take a varying band of values for capital-output ratio, thereby increasing the possibility of G_w being equal to G_n. This is the position of Neo-classical models developed by R.M. Solow, T.S. Swan, J.E. Meade, Samuelson, H.G. Johanson, and others. Lastly, we may allow the saving-income ratio to vary according to the distribution of income between wages and profits (Y = W + P). This is the approach adopted by Kaldor and, therefore, we discuss his basic model first of all.

His model is based on certain assumptions:
Assumptions

1. There are two factors of production capital and labour (K and L) and thus only two types of income profits and wages (P and W). All profits are saved and all wages are consumed.
2. There are constant returns to scale and production function remains unchanged over time. Capital and labour are complementary.
3. There is perfect competition as such the rates of wages and profits are same over different places.

4. The marginal propensity to consume of workers is greater than that of capitalists.
5. The investment-income (output) into (I/Y) is an independent variable.
6. There is a state of full employment so that total output or income (Y) is given.
7. There is an unlimited supply of labour at a constant wage in terms of wage goods.

Besides, Kaldor took certain facts as the bases of his model and as a starting point; for example, according to him, there is no recorded tendency for a falling rate of growth of productivity; there is a continued increase in the amount of capital per worker; there is a steady rate of profit on capital at least in the developed country; there is no change in the ratio of profits and wages—a rise in real wages is only in proportion to the rise in labour productivity; the capital-output ratios are steady over long periods—this implies near identity in the percentage rates of growth of production and of the capital stock; there are appreciable differences in the rate of growth of labour productivity and of total output in different sectors or economies.

Features:

The starting point of Kaldor is the belief that the income of the society is distributed between different classes, each having its own propensity to save $(K = W + P)$. The equilibrium can be brought about only by a just and appropriate distribution of income. In other words, growth rate and income distribution are inherently connected elements. Kaldor's model depends on these two elements and their relationships and brings forth the importance of distribution of income in the process of growth— this is one of the basic merits of Kaldor's model.

In his model, on the one hand, the relations of distribution of income determine the given level of saving (or social saving) and, therefore, investment and economic growth rate. On the other hand, the achievement of this or definite growth rate requires a given level of investment and, therefore, of saving and hence, a corresponding distribution of income.

This is illustrated by the following system of equations:
$Y = W + P$; $I = S$; $S = S_w + S_p$,
where Y is the national income ; W—the income of labour (wages) ; P—the income of entrepreneurs (profit) ; I—investment ; S—saving ;

where S_w is the share of saving from wages ; and S_p is the share of savings from profit, substituting for S, we get:

$$I = s_p P + s_w W \qquad\qquad (\because I = S)$$
$$= s_p P + s_w (Y - P) \qquad (\because W = Y - P)$$
$$= s_p P + s_w Y - s_w P$$
$$= (s_p - s_w) P + s_w Y$$

Dividing by Y both sides, we get :

$$\frac{I}{Y} = (s_p - s_w) \frac{P}{Y} + s_w$$

Dividing again both sides by $(s_p - s_w)$, we get :

$$\frac{I}{Y} \times \frac{1}{(s_p - s_w)} = \frac{P}{Y} + \frac{s_w}{(s_p - s_w)}$$

or

$$\frac{P}{Y} = \frac{1}{s_p - s_w} \cdot \frac{I}{Y} - \frac{s_w}{s_p - s_w}$$

where P/Y is the share of profit in the total income and I/Y is the investment income ratio, Now, we can easily see and appreciate Kaldor's thesis. His thesis is that the share of profit in the total income is a function of the ratio of investment to income (I/Y).

In the above equation, it can easily be seen that an increase in the income-investment ratio (I/Y) will result in an increase in the share of profits out of total income (P/Y), as long as it is assumed that both s_w and s_p are constant and further that s_p is greater than $(s_p > s_w)$. Thus, given the mps, of wages earners (s_w) and the mps of entrepreneurs (s_p)}the share the profits (P) in the national income (Y), that is P/Y depends on the ratio of investment (I) to total income or output (Y), that is I/Y. In other words, P/Y is a function of

$$\frac{I}{Y}, \text{ i.e., } \left[\frac{P}{Y} - f\left(\frac{I}{Y} \right) \right].$$

Of greater importance to us is the underlying economic rationale for Kaldor's theorem that the share of profit in the total income (P/Y) is a function of the investment-income ratio (I/Y). Under full employment conditions an increase in investment must in real terms, bring about an increase in both the ratio of investment to income (I/Y) and also an increase in the savings income ratio (S/K). This is necessary if equilibrium at a higher level of real investment is to be obtained.

If the saving-income ratio did not rise, the result would be a continuous upward movement of the general level of prices. The heart of Kaldor's theory lies in his demonstration "that shift in the distribution of income is essential to bring about the higher-saving income ratio,

which is the necessary condition for a continued full employment equilibrium with a higher absolute level of investment in real terms. This is illustrated by the given Fig. 44.3.
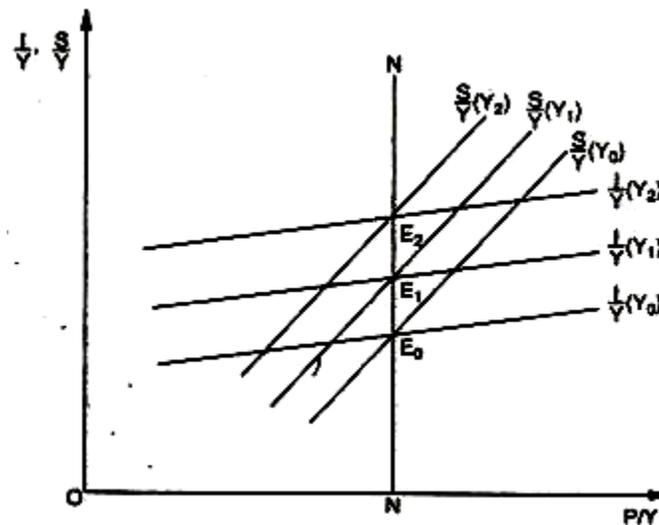

Fig. 44.3

In the Fig. 44.3, a direct relationship between P/Y and I/Y is assumed. The ratio of investment to income depends upon exogenous (outside) factors and is assumed as independent altogether. Since, propensities to save for the two income classes differ the mps out of profit income are more than the mps out of wage income.

Assumption of $s_p > s_w$, according to Kaldor, is a necessary condition for both stability in the entire system and an increase in the share of profit in income when the investment- income ratio rises. Given the full employment income Y_0, the investment-income ratio and the saving-income ratio (I/Y) and (S/Y) are I/Y (Y0) and S/Y (Y_0) and the system is in equilibrium with the profit income ratio fixed by the vertical line AW.

If there is an increase in income, both S/Y and I/Y function shift by such magnitudes that they assume the position S/Y (Y_1) and I/Y (Y_1). The equilibrium profit share will remain constant as measured by the line NN. Had there been a shift in the I/Y with S/Y function at S/Y (Y_0), there would have been an inflationary price movement.

But an increase in P/Y, assuming that $S_p > S_w$, pushes up the S/Y function to ensure equilibrium at full employment. If this smooth movement between I/Y with S/Y persists the system will sustain itself at full employment and the equilibrium share of profit to income will remain constant. The underlying idea is that with fixed level of real income (assumption of full employment), the only way in which it is possible to bring about an increase in S/Y for the entire

economy is either through a rise in the propensity to save itself, which has been ruled out by Kaldor through his assumption that S_p and S_w are constant, or through a shift in the distribution of real income from low saving groups to the high saving groups.

The mechanism which brings about the redistribution of income in favour of the profit share whenever there is a rise in the investment-income ratio is essentially that of the price level. The increase in investment expenditure under full employment conditions, leads initially to a general rise in prices. But wages cannot rise as fast and as much as the rise in prices.

The failure of money wages to keep pace with the rise in prices will reduce real income of wage earners and it will increase the profit margins of entrepreneurs. Since the mps of the latter group is, on the average higher than that of wage earners, the inflation induced shifts in the distribution of real income in favour of profits will increase the overall level of real saving in the economy.

This process will continue until the saving- income ratio (S/Y) is once again in equilibrium with the investment income ratio (I/Y). Thus, it is quite clear that the assumption of $s_p > s_w$ is of crucial importance in the Kaldor's model. In the absence of this assumption, the real S/Y will not rise irrespective of any change in the distribution of income. Consequently, the system may remain unstable.

Kaldor and Harrod:

We find, that $s_p > s_w$ is the basic equilibrium and stability condition. If $s_p < s_w$, there will be a fall in prices and cumulative decline in demand, price and income. Similarly, if $s_p > s_w$, there will be a rise in prices, cumulative rise in demand and income. The degree of stability of the system is dependent on the difference between the marginal propensities to save. If the difference between the two propensities (s_p and s_w,) is small, the coefficient $1/ s_p - s_w$ will be large with the result that small changes in the investment-income ratio (I/Y) will lead to relatively large changes in income distribution (P/Y) and vice-versa.
Kaldor, in his writing or model, tries to find these causes (of this stability or instability) in the purely techno- economic regularities or irregularities of growth. To simplify the reasoning, he assumes that the mps of wage earners (s_w) is zero.
In these circumstances, the equation given above becomes:

$$\frac{P}{Y} = \frac{1}{s_p - s_w} \cdot \frac{I}{Y} - \frac{s_w}{s_p - s_w} , \text{ (since } s_w = 0)$$

Therefore,
$$\frac{P}{Y} = \frac{1}{s_p} \cdot \frac{I}{Y} - 0.$$

According to Harrod's model, the rate of accumulation (I/Y) is determined by the growth rate and the capital output ratio, that is

$$\frac{I}{Y} = G \cdot C_r, \text{ therefore, } \frac{P}{Y} = \frac{1}{s_p} \cdot \frac{I}{Y} = \frac{1}{s_p} \cdot GC_r$$

The economic meaning of this equation is that the share of profit in income is determined by the share of savings out of profit income (s_p), the growth rate (G) and the capital output ratio (C_r). If the first two indicators remain constant, the stability of the share of profit in income (P/Y) will then be determined by the stability of capital coefficient (C_r). To explain and to substantiate this stability, Kaldor introduced his famous technical progress function. Thus, under Kaldor's model, the share of profit, the rate of profit—which establishes S and I identity, assisted by technical progress function,[1] provides the mechanism of growth, stability and dynamics.

Critical Evaluation:

The basic features or novelties of Kaldor's model may be summed up as follows:

(a) Its great merit lies in the development of the concept of technical progress function and the belief that the technical progress acts as the main engine of growth. Technical progress function under Kaldor's model replaces the usual production function. According to him, the basic functional relationship is not the production function expressing output per man as an increasing function of capital per man—but a technical progress function expressing the rate of increase in output per man as an increasing function of the rate of increase of investment.

(b) Another great merit of Kaldor's model lies in the views—that the inducement to invest does not depend on MEC or interest rate comparisons ; the rejection of long-run underemployment equilibrium; the introduction of a distribution mechanism into Harrod's model. Kaldor's model though essentially based on Keynesian concepts and Harrodian dynamic approach differs from them in a number of ways. Kaldor believes that economic growth and its process are based on the interdependence of the fundamental variables like savings, investment, productivity, etc.

In Kaldor's opinion a dynamic process of growth should not be presented and cannot be understood with the help of certain constants (like constant S_t/V_t or C/O ratio under Harrod's model) but in terms of the basic functional relationships. The basic fundamental relationships

among the fraction of income saved, the fraction of income invested and the rate g increase of productivity per man, determine the outcome of the dynamic process.

Limitations of the Model:

(a) Since Kaldor seeks to relate the functional distribution of income directly to variables that are of crucial importance in the determination of the level of income and employment, his analysis is rightly described as an aggregate or macroeconomic theory of income distribution. But his analysis is severely restricted by its underlying assumptions. The theory does not tell us how the distribution of income in a functional sense will be affected by changes in real income below the full employment level, though it does tell that any attempt to increase capacity and full employment is reached, will bring about a relative increase in the non-wage share in the total income. In this sense, Kaldor's model has a distinct classical flavour, even though his framework is that of modern employment theory.

(b) It is on account of its restrictive assumptions that Kaldor's model is not easily generalised for more than two classes. His assumption of invariable shares of income saved (s_p and s_w)—is much too rigid. Empirical analysis shows that these shares tend to change over time depending on income growth and other factors. While Kaldor himself remarks on the excessively generalised nature of his conception, one must say that its fundamental methodological flow amounts to more than that. It is an attempt to fit into the rigid framework of purely technological change the whole complexity of socio-economic changes, which characterise the growth of free competitive capitalism into monopoly and state monopoly capitalism—changes which had/have an effect on the distribution of the national income (in a manner postulated by Kaldor according to his assumptions).

(c) Moreover, Kaldor's abstract model takes no account at all of the vast unproductive expenditure which burden modern capitalist society, especially government military spending. The introduction into his model of state income with a corresponding 'propensity to save' could upon up a source of growth and rising rates of accumulation other than the wage earner's income.

(d) Kaldor's model, in its present state cannot be accepted either as a model of growth or as a model of macro-distribution. His model depends upon a unique profit rate, which has the needed value to produce or ensure steady—state growth—but he doesn't tell or show, how this unique rate of profit is determined ? This, in fact, is a great shortcoming of his model and the line of thought has to be developed further to make it more fruitful; the aim being to develop a general

equilibrium model of growth. The model, therefore, needs to be supplemented by a theory of income distribution.

(e) His distribution mechanism through what has been described above as 'Kaldor Effect' has also been criticised. A continuing rise in prices has different results like over spending, wage inflation, wage-price spiral and these consequences determine income distribution. His model attributes all profits to capitalists, thereby implying that workers savings are transferred as a gift to capitalists, this is obviously absurd—for under these conditions, no individual will save at all. That is why it is remarked whether Kaldor's model of distribution does provide a satisfactory alternative or does it involve a jump from the frying pan into the fire?

That is why Prof. J.E. Meade remarked that—can it be really maintained that when Kaldor effect takes place and prices and selling prospect are improving—wages will remain unchanged ? Will not the entrepreneurs bid up the wage rate against each other to employ labour under the impact of Kaldor effect? How else can one explain the notorious phenomenon of wage drift? Will not the authorities take steps to correct or offset the initial inflation of investment? Mr. Kaldor's theory of distribution is more appropriate for explaining short- run inflation than long-run growth.

(f) Kaldor's Model fails to take into consideration the impact of redistribution of income on human capital. His theory lays emphasis on physical capital. McCormik remarks, "the failure of the theory to incorporate human capital leaves the theory too simple to explain the complexities of the real world." With an increase in I/Y, the share of profit (P/Y) will increase and the share of labour will fall, deteriorating human capital—which in turn, will bring a reduction in income output.

1.7 (A) Tobins Model

James Tobin (1965) presented a simple model of monetary growth which follows the Solowian model (which Tobin had independently developed in a 1955 model) in all respects plus one: the existence of government debt (net "outside" wealth). For our purposes, let us assume there is only one such type of outside wealth: money. Let money yield a certain rate of return which we shall denote as i (we are concerned with a broad aggregate for money).

In the original Solow model, savings, as a constant proportion of income, translated immediately into the accumulation of physical capital (investment). This implied, of course, that physical capital was the only form of wealth that existed. However, money is an important

alternative store of wealth. Tobin (1965) proceeded to place his portfolio propositions in a growth context. How does behavior change under these circumstances?

The Tobin proposition is based on a quite simple closure with the equation of exchange, $MV = PY$. Dynamizing, and assuming constant velocity, we get $(dM/dt)/M = (dP/dt)/P + (dY/dt)/Y$ or simply:

$$g(M) = g(P) + g(Y)$$

where $g(x)$ represents the proportional growth rate of a variable x. Rewriting this, we see that $g(P) = g(M) - g(Y)$, thus the rate of inflation ($g(P)$) is merely the difference between the rate of money growth and the rate of output growth. The greater the difference, the higher the inflation rate. Note the important implication that if money stock is constant ($g(M) = 0$), then prices will fall at the rate of growth of output ($g(Y)$) and real money balances, M/P, will grow at that same rate.

Let real wealth (A) be held in two assets, real money (M/P) and physical capital (K), in a proportion such that:

$$A = B(M/P) + (1-B)K$$

where b lies between 0 and 1.

The proportion B is thoroughly "Tobinesque" - to be endogenously determined by portfolio allocation. Money yields a real rate of interest defined as $r = i - g(P)$, where i is the nominal interest rate and $g(P)$ is the inflation rate. Capital, on the other hand, gains a return equivalent to its marginal productivity (f_K). So the portfolio allocation decision basically resolves into:

$$B = h(r - f_K)$$

Where h(.) is some positive function. Thus, if the return on money is greater than the return on capital, ($r > fK$) so the portion of the portfolio allocated to money climbs (B rises). If, on the contrary, $r < fK$, then B falls and more wealth is held in the form of capital. Inflation, as is obvious, will decrease the demand for money and increase the allocation of wealth to capital.</f

There is, however, a second behavioral modification. Primarily, we have two sorts of income for each individual: from per capita output ($f(k)$) and the growth in the valuation of money, $d(M/P)/dt$. Thus income per capita, y, is given by:

$$y = f(k) + [d(M/P)/dt]/L$$

Where L is the number of individuals, d(M/p)/dt is, then, is the growth in the value of money which constitutes an "increase" in wealth. Let us denote "real balances per person" as m (= M/pL). The growth of real per capita money balances, dm/dt, can be easily derived. Given that m = M/pL, then, taking the derivative of the logs of this term:

$$g(m) = g(M) - g(P) - g(L)$$

where g(m) = (dm/dt)/m is the growth rate of the real money-labor ratio. Assuming full employment, then g(L) is merely the population growth rate, i.e. g(L) = n. Thus multiplying through by m:

$$dm/dt = m[g(M) - g(P) - n]$$

Thus, an increase in inflation (g(P)) will obviously result in lower real money balances per person. Similarly, an increase in population growth necessarily means that real money per capita is less (since there are more people to share it). Obviously, an increase in nominal money supply will increase per capita money holdings.

Let us now take simply M/P. Taking the time derivative of the logs, we obtain g(M/P) = g(M) - g(P). Multiplying through by M/P, we get d(M/P)/dt = M/P[g(M) - g(P)] so that dividing through by L:

$$[d(M/P)/dt]/L = m(g(M) - g(P))$$

since M/PL = m as stipulated earlier. Now total wealth, W, is merely K + M/P. Thus, in per capita terms, total wealth becomes (k + m). Now, as we know, m is a fraction B of total per capita wealth, i.e. m = B(k + m). Thus, solving this for m:

$$m = Bk/(1-B)$$

then, plugging into our equation:

[d(M/P)/dt]/L = (g(M) - g(P))Bk/(1-B)

so inputing our term for [d(M/p)/dt]/L into the per capita income equation y = f(k) + [d(M/P)/dt]/L, we get:

y = f(k) + (g(M) - g(P))Bk/(1-B)

Since savings are a portion (s) of income, then savings per capita are now:

sy = sf(k) + s(g(M) - g(P))Bk/(1-B)

Now comes the great departure from the traditional Solowian formulation. Solow had posited that savings equals investment but now a portion of savings is dedicated to the accumulation of real money balances. Therefore, S is no longer equal to I. Rather:

$$S = I + d(M/p)/dt$$

aggregate savings are applied either to the accumulation of capital (I = dK/dt) or the accumulation of real money balances (d(M/p)/dt) - depending, of course, on the relative returns of the alternative assets. Therefore, we can rewrite the system as:

$$dK/dt = S - d(M/p)/dt$$

Now, let us do as before. Recall that $k = K/L$ so $g(k) = g(K) - g(L)$. As $g(L) = n$, then $g(K) = g(k) + n$ or, simply $dK/dt = K(dk/dt)/k + nK$. Cancelling terms and rearranging $dK/dt = L(dk/dt) + nK$ thus equating with our earlier term:

$$L(dk/dt) + nK = S - d(M/p)/dt$$

and reorganizing a bit:

$$dk/dt = S/L - [d(M/p)/dt]/L - nk$$

Now, S/L is merely per capita savings, and we know this to be $sf(k) + s(g(M) - g(P))Bk/(1-B)$ from before. Similarly, we know that $[d(M/P)/dt]/L = (g(M) - g(P))Bk/(1-B)$ from before. Thus, plugging all this in:

$$dk/dt = sf(k) + s(g(M) - g(P))Bk/(1-B) - (g(M) - g(P))Bk/(1-B) - nk$$

or, cleaning up a bit:

$$dk/dt = sf(k) - (1-s)(g(M) - g(P))Bk/(1-B) - nk$$

which is similar to our Solowian differential equation, except that instead of $dk/dt = sf(k) - nk$, we now subtract an extra term in the middle, $(1-s)(g(M) - g(P))Bk/(1-B)$. Now, in Solowian steady-state, $dk/dt = 0$ so that $sf(k) = nk$ which was shown in our previous diagram (and is reproduced in our diagram at point A), as the intersection between the nk line and the sf(k) curve at A - with per capita output y* and capital-labor ratio k*.
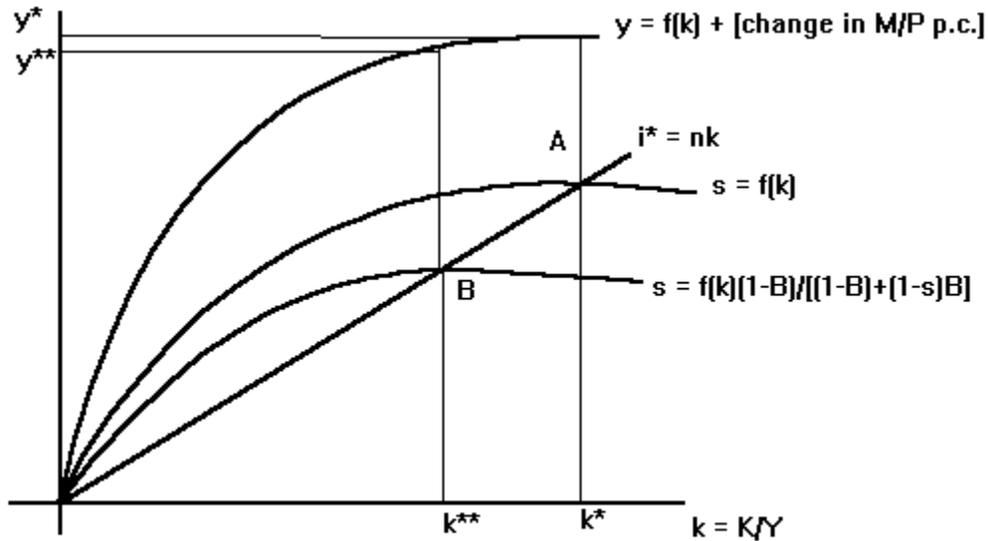
However, under the Tobin (1965) formulation, we would have instead as a steady state condition that $dk/dt = 0$ *and* $dm/dt = 0$. The second condition, steady per capita money balances, implies that (from our previous equation):

$$dm/dt = m(g(M) - g(P) - n) = 0$$

where, since $m > 0$, this implies that $g(M) - g(P) - n = 0$, or, expressing for $g(P)$:

$$g(P) = g(M) - n$$

so plugging that in for $g(P)$ in our other steady-state condition ($dk/dt = 0$), we get:

$$dk/dt = sf(k) - (1-s)(g(M) - (g(M) - n))Bk/(1-B) - nk = 0$$

or

$$sf(k) - (1-s)Bnk/(1-B) - nk = 0$$

or:

$$(1-B)sf(k) = [(1-B) + (1-s)B]nk$$

so, solving for nk:

$$sf(k)(1-B)/[(1-B) + (1-s)B] = nk$$

which is our steady-state condition for the Tobin model. As is obvious, if $B = 0$ (all allocation of wealth goes into capital and none into money), then this reduces to $sf(k) = nk$. However, if $B > 0$, then we see immediately that:

sf(k)(1-B)/[(1-B) + (1-s)B]

savings are lower because (1-s)B > 0. Thus, in comparison with sf(k), the savings function is smaller: some savings are being siphoned off into money holdings instead of being invested. Therefore, as shown in our figure, we get smaller savings function with an equilibrium at B - as compared with the regular Solow equilibrium at A. [Note: we really should have budged y = ? (k) and hence sf(k) slightly upwards to account for d(M/p)/dt, growth in money values]. Note, immediately, that the steady-state capital-labor ratio under the Tobin model (k**) is lower than the steady state capital-labor ratio under Solow (k*). Similarly, there is lower per capita output under Tobin (y**) than under Solow (y*). Thus, the equilibrium settles at a lower capital-labor ratio and lower output-labor ratio with the presence of money - although the rates of growth of the aggregate variables are the same (both at n).

We can see, then, that with the existence of money, output per capita collapses. Thus, the greater the money demand, the smaller savings available for investment, and the lower the rate of growth. This is why Tobin (1965) recommended that moderate levels of inflation be instituted to eat away at the rate of return on money (r = i - p), increasing the relative attractiveness of capital as a store of value (as f_K would rise far above r plus any equity premium). As such, then, people would prefer to store their wealth in capital (B declines) -leading to higher rates of growth. For instance, if the rate of return on money falls to zero so that no money is held, the new equilibrium will be at the Solow equilibrium, k*. If we had started from the Tobin level, k*, then there will be capital-deepening and higher rates of growth as k rises above k** towards k*. Thus, inflation can lead to higher rates of growth - what is commonly known as the "Tobin Effect".

It follows, then, from this that money is not neutral. Changing the growth of money supply will change the rate of return on money which will then change the steady-state capital-labor ratio. Money, then, has real effects.

Finally, we should note that Tobin (1965) constructed this model in order to address a particular problem originally contained in the Harrod-Domar model. Namely, if the warranted rate of growth is greater than the natural rate of growth, then capital accumulation will occur without bound and the marginal product of capital will fall continuously - possibly even negative. However, if the marginal product of capital falls below the rate of interest, this implies that investment (which responds to ? $_K$) will lie always below savings (which responds to interest). Thus, we obtain stagnation. But, by placing a floor on f_K, continual stagnation might be averted. This floor, adequately enough, could very well be the rate of return on money. Thus, when f_k hits r, then accumulation will tend to halt as people switch from accumulating into accumulating money. Now, if there is a surge of inflation, then r will fall and, in essence, the "floor" to f_K will be lower, so further capital accumulation can occur. However, if inflation is very high, then the value of money (M/p) approaches zero.   Thus, there is little point of

switching into low value money. Thus, the lesson from Tobin is that a little inflation can avert stagnation but too much will be self-defeating.

D. Levhari and D. Patinkin (1968) and H.G. Johnson (1967) objected to Tobin's model on the basis of the fact that it treats money solely as a store of value and, in effect, ignores the services it performs in overcoming transactions costs, etc. As a result, they implicitly argued that Tobin should really have developed, at some point, the idea of placing money in the utility function.

This is what Miguel Sidrauski (1967) set out to do. Sidrauski complained that Tobin's assertion of the non-neutrality was not justified. In an effort to upstage Tobin's conclusions, Sidrauski attempted to construct a growth model with money which explicitly took long-run neutrality (even super-neutrality) into the system but allowed for short-run non-neutrality as the system moved towards its steady-state values.

Sidrauski's (1967) model is similar to Tobin's in that money is treated as an alternative store of wealth to capital and is created by deficit spending on the part of the government. Following Patinkin's (1956) service arguments, let us place money into a utility function so that utility at time t is $U(c_t, m_t)$, i.e. utility is gained from per capita consumption of goods (c_t) and per capita real money balances (m_t). Therefore, following the representative agent framework of Cass-Koopmans, the object of the agent is to maximize intertemporal utility:

$$U = \int_0^\infty U(c_t, m_t)\, e^{-pt}\, dt$$

Where p is the subjective rate of time preference. As in Tobin (1965), Sidrauksi proposes that wealth can be held in the form of either money or capital, i.e. total assets A = K + M/p. So, normalizing in per capita terms:

a = k + m

Where a = A/L, k = K/L and m = M/pL where L is the labor supply. We can establish a per capita production function, y = f(k). Savings can be resolved either into capital investment or increasing real money holdings. We impose the condition that money is supplied by the government and the debt is financed that way - thus money growth is identical to the current deficit which we shall call Q. So, in per capita terms, then:

S/L = I/L + Q/L = i + q

Where i is gross per capita capital accumulation and q is gross per capita money growth (the meaning of "gross" shall be given subsequently). We assume that all government spending consists of transfer payments, e, so that the budget each individual faces each period is:

f(k) + e

So equating our two per capita savings terms:

f(k) + e - c = i + q

Now, i, gross per capita investment, assuming zero depreciation, can be resolved into i = dk/dt + nk where dk/dt is net capital accumulation for existing members of society and nk is the new accumulation necessary to endow new members (n is the population growth rate). Similarly, gross money growth can be resolved into:

q = dm/dt + (g(P) + n)m

Where dm/dt is net money accumulation for existing members of society and (g(P) + n)m is the money accumulation necessary to endow new population (nm) and keep existing assets intact in real terms (mg(P)). This is no different than what we saw in Tobin. Plugging all back into our savings function:

f(k) + e - c = dk/dt + nk + dm/dt + (g(P) + n)m

rearranging:

dk/dt = f(k) + e - c - nk - (g(P) + n)m - dm/dt

Which is the equation for capital accumulation. Note that dm/dt, money accumulation, is being subtracted. Recall that a = k + m, and also da/dt = dk/dt + dm/dt, thus rearranging terms:

da/dt = dk/dt + dm/dt = f(k) + e - c - na - mg(P)

Which states that accumulation (of both types of assets) is equal to the difference between income (from f(k) as well as transfer payments, e) and consumption - with accumulation accounted for to endow new members, na, and money expansion to keep up with inflation (to keep real balances intact), mg(P).

Following Cass-Koopmans, we maximize intertemporal utility (where, recall, utility is a function of consumption and real money per capita) with a pair of stock and flow constraints:

$$U = \int_0^\infty U(c_t, m_t)\, e^{-\rho t}\, dt$$

$a = k + m$

$da/dt = dk/dt + dm/dt = f(k) + e - c - na - mg(P)$

The second flow constraint establishes that investment cannot be greater than savings both into physical assets a stock constraint, which will establish that the value of assets must be left unchanged. We can plug the first into the second constraint so we end up with only one constraint:

$da/dt = dk/dt + dm/dt = f(k) + e - c - n(k + m) - mg(P)$

Note the important difference, in this model, that the objective of the consumer is not only to maximize intertemporal consumption but also to maximize intertemporal money holdings. If all wealth is held in the form of money, then he is reducing future growth (by inhibiting capital accumulation) and hence lower future wealth. However, if all is held in the form of capital, then he is ignoring the presence of money balances in the utility function. The object, then, is to find some convenient balance between money and capital which also involves a balance between savings and consumption. Therefore, there are two control variables: money holdings and consumption.

Setting up the current-value Hamiltonian then:

$H = U(c, m) + v[f(k) + e - c - n(k + m) - mg(P)]$

Where v is the present-value costate. The necessary conditions for a dynamic maximum are merely the first order conditions with respect to consumption and money holdings:

(1) $dH/dc = dU/dc - v = 0$

(2) $dH/dm = dU/dm - v(n + g(P)) = 0$

(3) $- dH/dk = dv/dt - pv = -v(f_k - n)$

(4) $dH/dv = dk/dt = f(k) + e - c - n(k+m) - mg(P)$

Note that the first condition yields $dU/dc = U_c = v$ and $dU/dm = U_m = v(n + g(P))$. Thus:

$U_m/U_c = n + g(P)$

Which simply states that the marginal rate of substitution between money and consumption is equal to the nominal rate of interest (real rate plus inflation). [if we conceive of this as somehow proxying for present/future consumption relation, then this condition is similar to the old Fisher result of equating the rate of interest with the marginal rate of time preference.] Further, note that third condition yields:

$$dv/dt = - v(f_k - n - p)$$

So, at the steady-state, $g(v) = (dv/dt)/v$, it must be true that $f_k = n + p$, i.e. the rate of return on capital (i.e. the rate of interest) is equal to the natural rate of growth (n) plus the rate of time preference (p) - which is the Golden Utility condition once again. Thus, the rate of interest has absolutely no monetary variables. Furthermore, since the real rate of interest determines optimal capital levels, then inflation, which does *not* affect f_k, has therefore no effect on capital accumulation - contradicting, then, the Tobin Effect.

The main lesson of the Sidrauski story, then, is that the steady-state rate of interest is, again, independent of any monetary variables. This implies that not only is money neutral but it is also superneutral. Its rate of growth (and inflation) does not affect the rate of growth of real variables. However, its neutrality is *not* maintained during the process of adjustment towards the steady state. But neutrality is only meaningful in a long-run sense to begin with

1.7(B) Patinkin Model

David Levhari and Don Patinkin (1968) introduced a model of economic growth in which money is treated as consumer's good. They demonstrated that if the aggregate price level changes at a constant rate and the demand for real balances with respect to the money rate of interest is inelastic, then the balanced growth path is also stable.

The model consists of the following equations:
Production is function of labour and capital:
$Y = F(K, L) = Lf(k)$ (1)
$f'(k)>0, f''(k)<0, \lim k \to 0 f'(k)=\infty;\ \lim k \to \infty f'(k)=0$
It is homogenous of degree 1 in capital (K) and labour (L) and has the usual neo-classical properties. The per capita output i.e. Y/L can therefore be expressed as a function of capital-labour ratio 'k' and labour supply grows at a constant rate 'n'.
$k \equiv K/L$ (2)

Saving 'S' is a constant fraction of disposable income. The assumption of constancy of the saving rate can be related with nominal money supply which grows at the rate μ, and 'P' is the price level which changes at the rate π. The real rate of return on capital (r) is the marginal product of capital i.e. $f'(k)$. If we do not take in to account the utility yield of holding money balances, then the saving function is:

$S=[Y+MP(\mu+r)]$ (3)

Disposable income is obtained by as the output 'Y' plus the real value of government transfer payments μMP less the loss in real value of existing cash balances due to inflation

πMP plus the opportunity cost of holding money which is $(r+\pi)(MP)$. Not all of the savings go in to investment. The rate of change of real balances i.e. $(\mu-\pi)$ can not be held in the form of physical assets. Hence, under the conditions of equilibrium in capital market, 'I' the investment function and can be defined as:

$$I=S-(\mu-\pi) \qquad (4)$$
$$DK=\dot{K}=I-\delta K \qquad (5)$$
$$r=f'(k) \qquad (6)$$
$$DLL=\dot{L}L=n \qquad (7)$$
$$M/PK\equiv m=(i)f(k)/k \qquad (8)$$
$$i=r+\pi \qquad (9)$$
$$DMM=\dot{M}M=\mu \qquad (10)$$
$$DPP=\dot{P}P=\pi=\mu-n-\dot{M}M \qquad (11)$$

Total consumption is now represented by $(1-s)[F(K, L) + (M/P)(\mu+r)$. But according to Levhari and Patinkin, in deduct from total output, not the total consumption expenditure but the physical consumption. Hence, the change in capital stock is,

$$\dot{K}=F(K,L)-\{(1-s)[F(K,L)+MP(\mu+r)]-MP(r+\pi)\} \qquad (12)$$

It is further assumed that the price level instantaneously adjusts itself so as to equate the demand and supply for real balances, that is

$$Mdp=(K,L)=MP \qquad (13)$$

The desired level of physical consumption, Cp, should be represented not by the second term of equation (12) but by:

$$Cp=(1-s)[F(K,L)+MP(\mu+r)]-MdP(r+\pi \qquad (14)$$

Thus, the disposable income which determines the desired total consumption, the relevant quantities are the volume of the transfer payments actually received by individuals i.e. μMP and the imputed income from real balances actually held (i.e. rMP. Individuals always try to achieve the desired balance in their real balances which they consider to be convertible in to physical capital at 'r' rate of return. On the other hand, the desired level of consumption, is determined by the amount of liquidity services which individuals have. The real balance effect of equation (14) can be derived by differentiating it partially w.r.t. (M/P). $\partial Cp\partial(M/P)=\mu+r$

Levihari and Patinkin have argued that any rationale for holding money is actually to use it to purchase the consumer's goods or producer's goods. If money is treated as a consumer's goods then it means that people derive utility from money holdings as money provides protection against uncertainties. However, there is some opportunity cost of holding money which is

expressed in terms of nominal rate of interest (i) which is equal to real rate of return (r) plus the rate of inflation (π).

The demand for real balances can be written as:

$$MdPL=h(i,y), \quad hi<0; \quad hy>0$$

This indicates that the demand for real balances is negatively associated with nominal rate of interest and positively associated with the level of output. Other things remaining the same, if the rate of return on capital and/or rate of inflation increases, the demand for real balances falls. Since money supply is growing at the rate 'μ', total money supply in the economy consists of $(t)=M0\exp(\mu t)$

Thus, the expected cost of holding money balances is equal to $r+\mu-n-m\hat{m}/$. Here, the rate of inflation is equal to $\mu-n-m\hat{m}/$.

The symbols md and ms are equal to $MdPL$ and $MsPL$, respectively. It is assumed that money market is in equilibrium and $md=ms$. Further, it is also assumed that it is the price level that brings this equality. The excess demand in the commodity market is equal to the gap between planned investment and planned savings in goods. $(IL-SL)+(md-ms)=0$

Here, 'ω' is the adjustment factor and assume that the excess demand for asset flows is a constant proportion to excess demand for asset stocks and the planned investments are assumed to be equal to the planned savings. But the change in capital stock is the difference between availability of capital and rate of change of real balances i.e

$K=S-[\ MP(\mu-\pi)\ ]$
and, $KL=k+nk$
Using all these functional relationships, the investment function in equation (4) becomes:
$kk=\emptyset(k)-n$
this can also be termed as the dynamic path of capital intensity.

$$\emptyset(k)=sf(k)k-(1-s)nmk+simk \tag{15}$$

$\emptyset'(k)<0$. For steady-state equilibrium:

$$\emptyset'(k)=skf'(k)-f(k)k2-[(1-s)n-si]d(m/k)dk+(sm/k)didk \tag{16}$$

$[(1-s)-si]>0$

Increase in capital stock has an uncertain effect on excess demand for capital but may either increase or decrease savings since the income and wealth effects on savings work in opposite directions. If the system is near the golden rule then the second term is positive but the first and the last terms are unambiguously negative. Assuming the steady state path, the effective labour supply and the nominal quantity of money grow, respectively at the constant rates that are 'n' and 'μ' where, the former is always positive, but the latter can be negative. From constancy of capital labour ratio, it follows that:

$$kk=KK-LL=KK-n=0 \tag{17}$$

In this system, the real value of per capita physical capital denoted as $m=MPL$ is also assumed to be constant i.e.

$$\hat{m}\,m = M\,M - \hat{p}\,p - L\,L = \mu - \pi - n = 0 \qquad (18)$$

Thus, total physical capital and total real money balances both expand at 'n'. Now it is important to find the steady state value of 'k'. This can be found by substituting (13) in to (12) and dividing both sides by 'K', we obtain,

$$(K,L)\,K\,\{\lambda n - [1 + (n + \pi + r)]\} + n = 0 \qquad (19)$$

Using equations 17 and 18 and dividing and multiplying the first term of equation (19) by 'L', we get

$$(k)\{[1 + (n + \pi + r)] - \lambda n\} = nk \qquad (20)$$

The distinguishing feature of a market economy is that not all the savings need to be devoted to augmenting the capital stock, some of it can also be used for maintaining the real balances. The savings devoted to physical capital are:

$$Sp = S - (\ )\,dt \qquad (21)$$

But this function of physical savings can also be written as $Sp = Y - Cp$, hence, the equation (21) can be rewritten as:

$$Sp = s\,[Y + M\,P\,(\mu + r)] - M\,P\,(\mu - r) \qquad (22)$$

Both Levhari and Patinkin consider the services emanating from the holding of real money balances as influencing individual's disposable income. They show that when money is introduced as a consumer good in a single sector neo-classical growth model, the effect of inflation upon the degree of capital intensity in steady state equilibrium is ambiguous. They argue that it is the dropping of the assumption of 'a constant saving ratio' rather than the different definition of disposable income which yields qualitatively different results from those of the Tobin Model.

Money can also be considered as a producer's good i.e. it is held as it enables the economic unit in question to acquire or produce a larger quantity of commodities. Thus, money is being considered as an inventory. Here, the real value of money can be introduced in to the production function.

$$Y=G(K,L,M/P)$$

This is linearly homogeneous in all variables. The relationship in this equation shows that the production is function of labour (L), physical capital (K) as well as the real value of the working capital or real money balances. But it is also assumed that money is an exogenous variable which is without any cost of production and administration.

Actually, this theory by Levhari and Patinkin has been presented as dealing with the effects of the rate of monetary expansion in the growth path of the system. However, the effects of a monetary expansion differ in accordance with the use of this additionally created money. The government may use it for transfer payments, consumption (expenditures from the current budget on goods and services) and investment (corresponding expenditure from the development budget). Even if the government does not itself carry out investment, it can affect the level of capital intensity in the economy by varying the proportion of its budget devoted to the consumption of goods and services as against transfer payments. It actually increases the physical consumption in the economy and reduces the savings and ratio of capital by transferring its expenditure from transfer payments to consumption of goods and services by government. Actually, in this case the money transfers from the household sector which has a propensity to consume less than one to the government which has a unitary marginal propensity to consume. Moreover, it has been assumed that money is issued by the government and is therefore, an outside variety. But if we consider money as an inside generation of money through deposit creating activities of the banking sector or bonds/loans market, it is held by this theory that the behaviour of the individuals would not be affected by either the rate of change in prices or by the rate of expansion of the money supply. Hence, the system is neutral, especially in the second sense which states that if nominal quantity of money is twice as high as before then a price level will also be twice high which will enable the system to return to equilibrium with all the real variables having the same values as before. To sum up the theory by Levhari and Patinkin, we can say that money can be used as a consumption good as well as the producer's good and it can play both these roles simultaneously. Hence, a general model of demand for money should analyze it both as a utility function and production function.

1.7(C) Johnson's Views on Money Demand

H. G. Johnson (1962) has given a complete analysis of Classical, Keynesian and the IS-LM approach of determination of rate of interest. He proposed that the full Keynesian theory, in which the interest rate, income, saving and investment, demand for money and supply of money are all mutually interdependent, can be represented by the IS-LM curves. Johnson states that although, the IS-LM approach was originally developed by J. R. Hicks which proved very useful standard tool for monetary theory but it can also be adapted to take account of more general assumptions that Keynes made – e.g. saving depends partly on income and that both demands for money demand on both income and the interest rates and investment, partly on income, and that both demand for money depend upon income and interest rate, it can be used to explain a number of important relationships to solve several monetary problems. Johnson suggested that this can be done by combining the Keynesian and Hicksian analysis. Let us first focus on figure 1. The figure shows the supply curve of output (Xs) which is based on the assumption that the diminishing returns operate on variable factor i.e. labour. This depicts the upward sloping nature of the supply curve. The curves Yts show different combinations of real output and prices giving

a downward sloping curve. The equilibrium price level and output level are given by intersection of the supply curve with the real output curve.
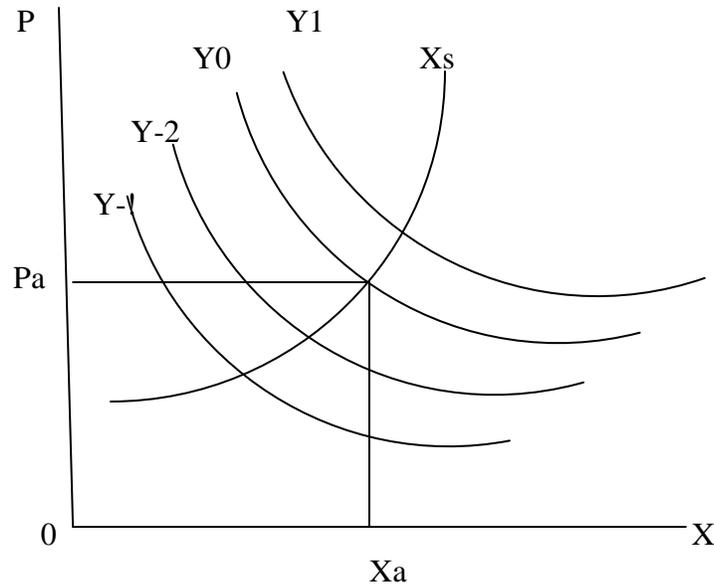
P

Y1

Y0

Xs

Y-2

Y-

Pa

0

X

Xa

Figure 1

In figure 2, we can see real wage earned by labour (the marginal productivity of labour) and the relation between the real wages earned by labour and the quantity of labour employed which is equal to its marginal product and hence shown by the MPL curve or the demand for labour curve. On the supply side, we can see the relation between the real wage earned and the labour supplied i.e. the LS curve. Although, the classicals say that the level of employment is determined by the intersection of the demand labour curve and the supply of labour curve, yet in the Keynesian theory, the levels of employment and real wages are determined by aggregate demand and the levels of output due to the technological relationship between them. If the real wage rate is OW0, the difference in actual employment and the labour supplies i.e. L0LE shows the involuntary unemployment. This indicates the additional output, it could produce and hence reduce the prices
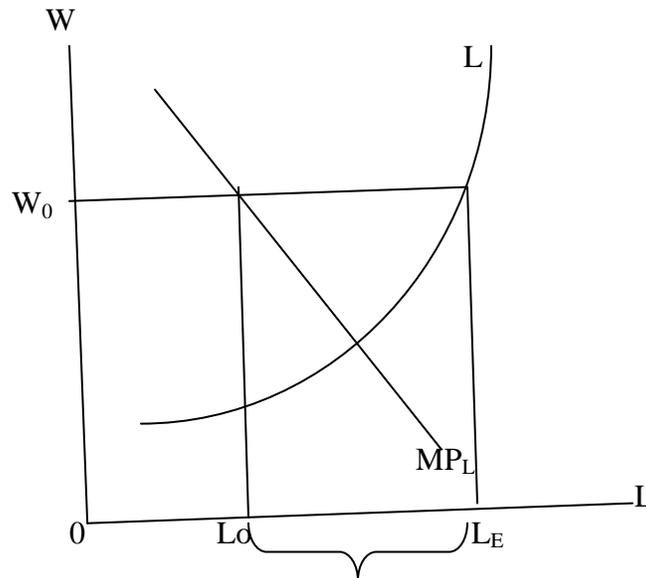
Figure 2

Johnson says that the chief argument of Keynes' theory relates to the question if underemployment equilibrium depends on the assumption of rigid wages. He says that the answer lies on effect of increase in money supply on wages and employment. Actually, the effect of a wage cut in the system is the same as the effect of an increase in money supply as with fall in wages and prices, less money is required for transactions, more is available for speculative balances. With large quantities of money, there will be fall in rate of interest leading to increase in investment and then employment. But the achievement of full employment depends upon the fact if the increase in money supply is adequate enough to push the economy towards full employment. There can be two cases in which increased money supply will not lead to full employment. These are:

1. The economy is already in 'Liquidity Trap'.

2. The economy is so interest elastic that at positive interest rates, investment does not increase, or savings fall, to a level consistent with full employment.

Thus, full employment will not be achieved by monetary expansion or say, a wage cut, if saving from a full employment income would exceed investment at the lowest rate of interest, the money market will allow.

Johnson further highlights certain controversies of viewing the Keynesian theory of employment as a theory of interest. These are:

1. Keynes himself initiated the debate if rate of interest is a real or monetary phenomenon. Johnson says that since Keynes' speculative demand for money is based on the relation

between actual and expected rates of interest, the real forces ought to enter into liquidity preference in shape of profitability of investment.

2. Since in Keynesian theory, interest is a relation between the present and the future, expectations must influence the rate as determined in the market.

3. Another debate is related with the issue if rate of interest is determined by demand and supply of money or by the demand and supply of securities. To deal with this issue, we can divide the economy in three markets – the markets for output, cash and securities. The sum of excess demand in these three markets, Xg, Xm and Xs, respectively, must be identically equal to zero.

1. $Xg + Xm + Xs = 0$

Under full equilibrium in the economy, the rate of interest equates both the demand and supply of money and demand and supply of securities but if there is disequilibrium in the goods market, we can not say that the rate of interest is determined in either of the two markets, unless it is assumed that the remaining markets behave in such a way that the excess demand for output i.e. excess of investment over savings, is financed by bonds sales and loanable funds so that when total demand for money is the economy is lumped together, it is just equal to the total supply of the same.

On the other hand, in case of post-Keynesian versions, Johnson says that in case of inducement to investment, the important development is the introduction of the relation between capital stock and output in the form of accelerator or simply the capital-output ratio as a determinant of investment decision. This permits the conversion of the static equilibrium of Keynesian system into cycles and growth models in which the fixed capital investment can be considered as important determinant of income. The liquidity preference theory had been improved in a number of ways particularly by extending the motives of holding money to asset holding as well. Johnson says that in monetary theory, the main contribution of Keynesian theory has been to emphasise the function of money as an asset, alternative to other assets, and to break the quantity theory assumption that there is a direct connection between money quantity and aggregate demand. But this theory needs to be adapted to suit the non-depression conditions.

Summary

Recognizing the importance of money in production, we can see that the approach of treating real money balances as an input in the production function highlights the central role played by money in production. But this is an inadequate approach at least for two reasons. Firstly, money should not be considered as an input of the production function in the same way as the physical capital and labour. Money capital is a catalyst. It has no direct marginal product but operates only by influencing the way in which other factors are used. Including money in the

production function precludes the analysis of how money affects the efficiency and organization of production. The theory by Levhari and Patinkin has dealt with the effects of the rate of monetary expansion in the growth path of the system. However, the effects of a monetary expansion differ in accordance with the use of this additionally created money. To sum up, the theory by Levhari and Patinkin, we can say that money can be used as a consumption good as well as the producer's good and it can play both these roles simultaneously and hence, a general model of demand for money should analyze it both as a utility function and production function. On the other hand, Johnson tried to show that the Keynesian theory of employment and output can easily be fitted in to the framework showing simultaneous equilibrium in money as well as the real market. He said that the monetarists' success was transitory because its central problem, inflation was inherently less socially important than unemployment. Johnson tried to incorporate the valid ideas of previous orthodoxy in to the new framework. He argued that the success of a new idea in creating a revolution would depend upon the opportunity to escape from the intellectual authority of the past work by deploying novel analytic and empirical techniques.

1.8 Endogenous Growth Model

Endogenous growth theory holds that economic growth is primarily the result of endogenous and not external forces.[1] Endogenous growth theory holds that investment in human capital, innovation, and knowledge are significant contributors to economic growth. The theory also focuses on positive externalities and spillover effects of a knowledge-based economy which will lead to economic development. The endogenous growth theory primarily holds that the long run growth rate of an economy depends on policy measures. For example, subsidies for research and development or education increase the growth rate in some endogenous growth models by increasing the incentive for innovation.

Models

In the mid-1980s, a group of growth theorists became increasingly dissatisfied with common accounts of exogenous factors determining long-run growth. They favored a model that replaced the exogenous growth variable (unexplained technical progress) with a model in which the key determinants of growth were explicit in the model. The work of Kenneth Arrow (1962), Hirofumi Uzawa (1965), and Miguel Sidrauski (1967) formed the basis for this research.[2] Paul Romer (1986), Robert Lucas (1988), Sergio Rebelo (1991)[3] and Ortigueira and Santos (1997) omitted technological change; instead, growth in these models is due to indefinite investment in human capital which had spillover effect on economy and reduces the diminishing return to capital accumulation.

The AK model, which is the simplest endogenous model, gives a constant-savings rate of endogenous growth and assumes a constant, exogenous, saving rate. It models technological progress with a single parameter (usually A). It uses the assumption that the production function

does not exhibit diminishing returns to scale to lead to endogenous growth. Various rationales for this assumption have been given, such as positive spillovers from capital investment to the economy as a whole or improvements in technology leading to further improvements (learning by doing). However, the endogenous growth theory is further supported with models in which agents optimally determined the consumption and saving, optimizing the resources allocation to research and development leading to technological progress. Romer (1987, 1990) and significant contributions by Aghion and Howitt (1992) and Grossman and Helpman (1991), incorporated imperfect markets and R&D to the growth model.

The AK model works on the property of absence of diminishing returns to capital. The

simplest form of production function with non-diminishing return is:

Versus Exogenous Growth Theory

In neo-classical growth models, the long-run rate of growth is exogenously determined by either the savings rate (the Harrod–Domar model) or the rate of technical progress (Solow model). However, the savings rate and rate of technological progress remain unexplained. Endogenous growth theory tries to overcome this shortcoming by building macroeconomic models out of microeconomic foundations. Households are assumed to maximize utility subject to budget constraints while firms maximize profits. Crucial importance is usually given to the production of new technologies and human capital. The engine for growth can be as simple as a constant return to scale production function (the AK model) or more complicated set ups with spillover effects (spillovers are positive externalities, benefits that are attributed to costs from other firms), increasing numbers of goods, increasing qualities, etc.

Often endogenous growth theory assumes constant marginal product of capital at the aggregate level, or at least that the limit of the marginal product of capital does not tend towards zero. This does not imply that larger firms will be more productive than small ones, because at the firm level the marginal product of capital is still diminishing. Therefore, it is possible to construct endogenous growth models with perfect competition. However, in many endogenous growth models the assumption of perfect competition is relaxed, and some degree of monopoly power is thought to exist. Generally monopoly power in these models comes from the holding of patents. These are models with two sectors, producers of final output and an R&D sector. The R&D sector develops ideas that they are granted a monopoly power. R&D firms are assumed to be able to make monopoly profits selling ideas to production firms, but the free entry condition means that these profits are dissipated on R&D spending.

Implications

An endogenous growth theory implication is that policies that embrace openness, competition, change and innovation will promote growth. Conversely, policies that have the effect of restricting or slowing change by protecting or favouring particular existing industries or

firms are likely, over time, to slow growth to the disadvantage of the community. Peter Howitthas written

Sustained economic growth is everywhere and always a process of continual transformation. The sort of economic progress that has been enjoyed by the richest nations since the Industrial Revolution would not have been possible if people had not undergone wrenching changes. Economies that cease to transform themselves are destined to fall off the path of economic growth. The countries that most deserve the title of "developing" are not the poorest countries of the world, but the richest. [They] need to engage in the never-ending process of economic development if they are to enjoy continued prosperity. (Conclusion, "Growth and development: a Schumpeterian perspective", 2006.

Criticisms

One of the main failings of endogenous growth theories is the collective failure to explain conditional convergence reported in empirical literature.[6]

Another frequent critique concerns the cornerstone assumption of diminishing returns to capital. Stephen Parente contends that new growth theory has proved to be no more successful than exogenous growth theory in explaining the income divergence between the developing and developed worlds (despite usually being more complex).[7]

Paul Krugman criticized endogenous growth theory as nearly impossible to check by empirical evidence; "too much of it involved making assumptions about how unmeasurable things affected other immeasurable things.

Questions

1. Discuss the endogenous growth model.
2. Define economic development. Distinguish between development and growth.
3. Explain the Adam smith's theory of economic development.
4. Examine the Harrad-Domar model of economic growth.
5. Evaluate the theory of unbalanced growth.
6. Explain the role of industry in economic development.
7. Examine the concept of 'stationary state' in the Ricardian model of economic growth.
8. Explain the importance of technology as a factor in economic growth.
9. What are the changing characteristics of LDCs?
10. Write a short note on capital accumulation

UNIT II

Theories of Development

2.1 Classical Theory of Economic Growth

The basic theme of the classical model was the development of the economy from a progressive state into a stationary state. However, **"the ultimate arrival, at which wages would have reached a minimum acceptable level and net investment would have ceased because of low profits, could be postponed indefinitely by a stream of highly productive inventions."** The classical theory is basically a synthesis of the doctrines put forward by Adam Smith, T. R. Malthus, David Ricardo, J. S Mill and others.

The following classical propositions are worth mentioning in this connection:
1. According to the classicists, one central feature of the progressive state was a high level of accumulation, which permitted an increase in the output of the community by raising labour productivity (as also that of land) by adding to the productive resources available. The rate of accumulation basically depended on the level of profit.
2. Total profits depended on two primary factors: the total product of labour, and the level of wages. As a corollary, it also depended on the marginal productivity of labour.
3. The productivity of labour depended on the stock of capital as also the technique employed.
4. In the short run actual or market wages could lie above the subsistence level which would warrant an increase in population. But in the long run, due to population growth, wages tended to approach the subsistence level. And, as a result, population growth would come to a halt.

The classical model may be summed up in terms of the basic Baumol- diagram. To start with, we assume that in the early stage of the classical economy population is small compared to natural resources. Consequently, profits the rate of accumulation, and thus wages are all relatively high. It is also assumed that population adjusts itself relatively quickly to a change in the level of market wages (the wages actually paid in practice). In Fig. 5, the total wage payments, if subsistence wages were always just paid, would be given by a straight line OS through the origin. The slope of OS (VW divided by OV) is thus **"Total subsistence wage payments divided by the size of the working population, i.e., the wage necessary to keep one person at the minimum standard."**
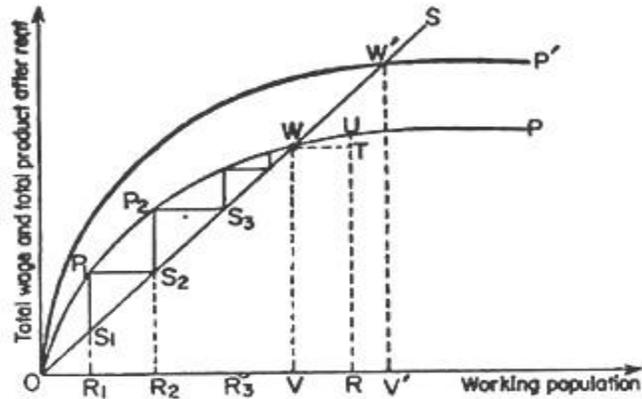
Fig. 5 : The classical theory of growth

Here, the OP curve gives the total product of the economy after rent payment. This curve is convex upward due to a twofold reason: the operation of the law of diminishing returns and rise in rent payments with population growth.

Thus, for instance, when population increases from zero to OR_1, total product after rent payment increases by R_1P_1. But, when working population is higher than an equal increase in population, this time from OV to OR, allows only a small increase in product (TU here). Let us start from a population OR_1. If wages are pegged at the subsistence level total wage Payments Would be R_1S_1 and an amount S_1P_1, the difference between total product minus rent and total will be left over for profit. This will lead to capital accumulation.

As a result wages will be pushed up to R_1P_1 since there is high demand for labour in an expanding economy. But once this wages is reached the surplus of the capitalist disappears altogether since workers eat up the entire product. And accumulation ceases. This is thus a position of temporary equilibrium. However, high wages will induce population growth. This will go on until wages are again driven down to subsistence level, i.e., population will rise to OR_2. Here again there will be profits, given by S_2P_2, so accumulation will begin again. Wage payments will then be driven up to R2P2, and population will grow to OR_2, and so on. In a series of steps represented by the stepped line $S_1P_1S_2P_2S_3$ …………, this gradually approaching the point W where the two curves OP and OS intersect.

At point W there will be no profits even with wages at subsistence level, VW, since these wages will exhaust total product minus rent. There would thus be no motive for further accumulation and population will remain stationary at OV. The classical stationary will have been reached. In this condition, the mass of mankind is generally miserable. Only the landowner would be better off. The increase in population has made land very scarce and would have raised rents considerably. Technological changes or innovations may cause a shift in the productivity curve (from OP to OP' in the diagram) and postpone the day of judgment but cannot help matters much.

2.2. Adam Smith Theory of Development in Economics (Main Features)

Adam Smith is considered to be the father of economics. It is not so because he was first explorer in the field of economics, also not because he revolutionized economic planning by his maiden ideas, but because he abbreviated what he had received from his predecessors and handed it down as a guide to the coming generations. He was the editor and not the author, organizer and not the originator of economic science. "He was the man of systematic work and balanced presentation, not of great new ideas but a man who carefully investigates the given data, criticizes them cooly and sensibly, and coordinates the judgements arrived at with others which have already been established".

Adam Smith contained all his ideas in his "Wealth of Nations". The most important aspect of this book was a Theory of Economic Development. Physiocracy came into existence due to mercantilism. They believed in science of natural laws and emphasised the significance of agriculture and contended that it is the only industry that can make country wealthy. Adam Smith's 'Wealth of Nations' was scientific not because it contained the absolute truth but because it came as a turning point, the beginning of all that came after, as it was the end of all that came before.

The main points of the theory are as under:
Natural Law:

Adam Smith proposes natural law in economic affairs. He advocated the philosophy of free and independent action. If every individual member of society is left to peruse his economic activity, he will maximize the output to the best of his ability. Freedom of action brings out the best of an individual which increases society wealth and progress. Adam Smith opposed any government intervention in industry and commerce. He was a staunch free trader and advocated the policy of Laissez-Faire in economic affairs. He opines that natural laws are superior to law of states. Statutory law or manmade law can never be perfect and beneficial for the society, that is why Smith respects nature's law because nature is just and moral. Nature teaches man the lesson of morality and honesty. These exercise favourable effects on the economic progress of society.

Laissez Faire:

Adam Smith's theory is based on the principle of 'Laissez-Faire' which requires that state should not impose any restriction on freedom of an individual. The theory of economic development rests on the pillars of saving, division of labour and wide extent of market. Saving or capital accumulation is the starting point of this theory. He believed that "there is a set of rules or rights of justice and perhaps even of morality in general which are, or may be known by all men by hello either or reason or of a moral sense, and which possesses an authority superior to that of such commands of human sovereigns and such customary legal and moral regulations as may contravene them". The policy of laissez-faire allows the producers to produce as much they like, earn as much income as they can and save as much they like. Adam Smith believed that it is safe to leave the economy to be propelled, regulated and controlled by invisible hand i.e. the

forces of competition motivated by self interest be allowed to play their part in minimizing the volume of savings for development.

Production Function:

Adam Smith recognized three factors of production namely labour, capital and land i.e.

$Y = f(K, L, N)$

K = Stock of Capital

L = Labour force

N = Land

He emphasized labour as an important factor of production along with other factors and observed, "The annual labour of nation is the fund which originally supplies it with all necessaries and conveniences of life which it annually consumes and which consists always either in immediate produce from other nations". Since the growth is a function of capital, labour, land and technology and land being passive element is least important. Prof. Adam Smith regarded labour as father and land as mother. He wrote, "To him (farmer) land is the only instrument which enables him to earn the wages of his labour and to make profits of this stock".

The production function does not conceive the possibility of diminishing marginal productivity. It is subject to law of increasing returns to scale. Smith argued that real cost of production shall tend to diminish with the passage of time, as a result the existence of internal and external economies occurring out of the increases in market size.

Adam Smith asserted that division of labour does not depend merely on technological feasibility, it greatly depends on the extent of the market as well and the size of market depends on the available stock and the institutional restrictions placed upon both domestic and international trade. Smith observes that, "when the market is small, no person can have encouragement to dedicate himself entirely to one employment, for want of power to exchange all the surplus part of production of his own labour, which is over and above his own consumption, for such parts of the produce of other man's labour as he has occasion for".

Smith also recognizes the importance of technological development for improvement in productivity and which is possible only if sufficient capital is available. He wrote, "The person who employs his stock in maintaining labour, endeavors, therefore, both to make among his workmen the most proper distribution of employment and furnish them with the best machines which he can either invent or afford to purchase. His ambition in both these respects is generally in proportion to the extent of his stock or to the number of people which it can employ".

Division of Labour:

The rate of economic growth is determined by the size of productive labour and productivity of labour. The productivity of labour depends upon technological progress of a country and which, in turn, depends upon the division of labour. This division of labour becomes the true dynamic force in Adam Smith's theory of growth. The only remarkable feature of Smith's account of division of labour is pointed by Prof. Schumpeter as "nobody, either before

or after Adam Smith ever thought of putting such a burden upon division of labour. With Adam Smith it is practically the only factor in economic progress".

Division of labour increases the productivity of labour through specialization of tasks. When a work is sub-divided into various parts and the worker is asked to perform small parts of whole job, his efficiency increases as now he can focus his attention more carefully. Thus, the concept of division of labour means the transference of a complex production process into number of simpler process in order to facilitate the introduction of various methods of production. Adam Smith concentrated upon the social division of labour which emphasized the co-operation of all for satisfaction of the desires of each. It is the process by which different types of labour which produce goods to satisfy the individual needs of their producers are transformed into social labour which produces goods for exchanging them for other goods.

Adam Smith in his book 'Wealth of Nations' pointed out three benefits of division of labour:
1. Increase of dexterity of workers.
2. Saving time required to produce commodity.
3. Invention of better machines and equipment.

The third advantage implies that invention is the result of worker's intelligence. But Smith wrote that workers become 'as stupid and ignorant as it is possible for human creature to become as a result of division of labour'. Division of labour necessarily leads to exchange of goods, which highlights the importance of trade. In short, division of labour leads to exchange of goods which, in turn, promotes trade and widens the extent of market. Wide extent of market is an essential pre- requisite for economic development.

Capital Accumulation:

It is the pivot around which the theory of economic development revolves. The growth is functionally related to rate of investment. According to Smith, "any increase in capital stock in a country generally leads to more than proportionate increase in output on account of continually growing division of labour".

Capital stock consists of:
(a) Goods for the maintenance of productive workers.
(b) Goods for helping the workers in their productive activities.

Adam Smith distinguished between non capital, circulating capital and fixed capital goods. Non capital goods refer to those which are useful directly and immediately to their owner. Fixed capital refers to those goods which are directly used in production processes, without changing hands. Fixed capital consists of all the means of production. Capital is increased by parsimony and diminished by prodigality and misconduct. The rate of investment was determined by the rate of saving and savings were invested in full. The classical economists also believed in the existence of wage fund. The idea is that wages tend to equal to the amount necessary for the subsistence of labourers.

If the total wages at any time become higher than subsistence level, the labour force will increase, competition for employment will become keener and the wages come down to the subsistence level. Thus, Smith believed that, "under stationary conditions, wage rate falls to the subsistence level, whereas in periods of rapid capital accumulation, they rise above this level. The extent to which they rise depends upon the rate of population growth". Thus, it can be concluded that wage fund could be raised by increasing the rate of net investment.

According to Smith, "investments are made because the capitalist want to earn profits on them. When a country develops and its capital stock expands, the rate of profit declines. The increasing competition among capitalists raises wages and tends to lower profits". So it is a great difficulty of finding new profitable investment outlets that leads to falling profits. Regarding the role of interest, Smith postulated a negatively sloped supply curve of capital implying that supply of capital increased in response to decline in interest rate. Smith wrote that with the increase in prosperity, progress and population, the rate of interest falls and as a result, capital is augmented. With the fall in interest rate, the money lenders will lend more to earn more interest for the purpose of maintaining their standard of living at the previous level. Thus, the quantity of capital for lending will increase with the fall in rate of interest. But when the rate of interest falls considerably, the money lenders are unable to lend more in order to earn more to maintain their standard of living. Under these circumstances, they will themselves start investing and become entrepreneurs. Smith believed that economic progress- involves rise in money as well as real rentals, and a rise in rental share of national income. This is because the interest of land owners is closely related to general interest of the society.

Agents of Growth:

Smith has observed that farmers, producers and businessmen are the important agents of economic growth. It was the free trade, enterprise and competition that led farmers, producers and businessmen to expand the market and which, in turn, made the economic development inter-related. The development of agriculture leads to increase in construction works and commerce. When agricultural surplus arises as a result of economic development, the demand for commercial services and manufactured articles arises. This leads to commercial progress and establishment of manufacturing industries. On the other hand, their development leads to increase in agricultural production when farmers use advanced techniques. Thus, capital accumulation and economic development take place due to the emergence of the farmer, the producer and the businessmen.

Process of Growth:

"Taking institutional, political and natural factors for granted, Smith starts from the assumption that a social group may call it a 'nation' will experience a certain rate of economic growth that is accounted for by increase in numbers and by savings. This induces a widening of market which, in turn, increases division of labour and thus, increases productivity. In this

theory, the economy grows like a tree. This process is no doubt exposed to disturbances by external factors that are not economic… but in itself, it proceeds continuously and steadily.

Each situation grows out of preceding one in a uniquely determined way and the individuals whose act combine to produce each situation count individually for no more than the individual cells of a tree". The process of growth is cumulative. Division of labour made possible by accumulation of capital and expansion of market, increases national income and output, which in turn, facilitates saving and further investment and in this way, economic development rises higher and higher. Smith's progressive state is in reality the cheerful and hearty state to all the different orders to the society. But this progressive state is not endless. It ultimately leads to stationary state. It is the scarcity of natural resources that stops growth. An economy in stationary state is characterized by unchanged population, constant total income, subsistence wage, elimination of profit in excess of the minimum consistent with risk and absence of net investment. In his opinion, an economy is stationary state finds itself at the highest level of prosperity consistent with its natural resources and environment.

The competition for employment reduces wages to subsistence level and competition among the businessmen brings profits as low as possible. Once profit falls, it continues to fall. Investment also starts declining and in this way, the end results of capitalist is stationary state. When this happens, capital accumulation stops, population becomes stationary, profits are minimum, wages are at subsistence level, there is no change in per capita income and production and the economy reaches the state of stagnation. The stationary state is dull, declining, melancholy life is hard in stationary state for different sections of the society and miserable in declining state. Smith's theory is explained with the help of a diagram 1.
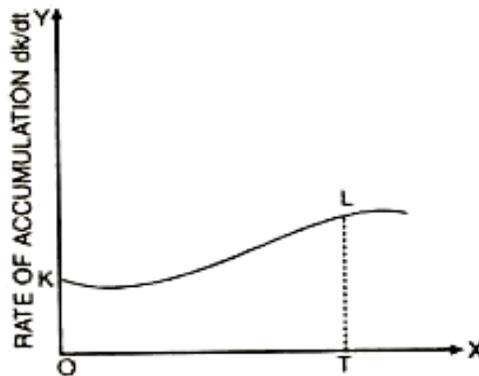

Fig. 1

Time is taken along the X-axis and the rate of accumulation along the Y-axis. The economy grows from K to L during the time path T. After T, the economy reaches stationary state. Linked to L where further growth does not take place because wages rise so high that profits become zero and capital accumulation stops.

Conclusion:

It can be concluded that Prof. Adam Smith did not propound any specific growth theory. His views relating to economic development are part of general economic principle propounded by him. R. Lekachaman says, "A good deal of Smith's analysis reads as though written with todays UDC's in mind". In a very important aspect then this book (Wealth of Nations) was the theory of economic development.

2.2.a Ricardian Theory of Development

Economics as a science is, on the one hand, a body of knowledge and on the other hand, an engine of analysis.As a result of knowledge, it contains generalizations about the working of economic system. Prof. Ricardo added little to the economic knowledge gathered by Smith. As an analytical engine, economics provides an apparatus through which actual economic problems are analyzed. Ricardo's greatest contribution to economics is the provision of engine of analysis. By using the technique of deductive or abstract reasoning, he constructed a rigorous model in which some selected economic variables were systematically placed to form a logic. Such a theoretical model helps to understand how a system works and how the change in variables affects the working of the system. Ricardo propounded no theory of development. He simply discussed the theory of distribution. This theory is based on the marginal and surplus principles. The marginal principle explains the share of rent in national output and surplus principle explains the division of the remaining share between wages and profits.

Assumptions:

The Ricardian theory is based on certain assumptions which are as under:

1. Supply of land is fixed.
2. Land is used for production of corn and the working force in agriculture helps in determining the distribution in industry.
3. Law of diminishing returns operates on land.
4. Demand for corn is perfectly inelastic.
5. Labour and capital are variable inputs.
6. Capital consists of circulating capital.
7. There is capital homogeneity.
8. All workers are paid subsistence wages.
9. The state of technological knowledge is given.
10. There is perfect competition.
11. Demand for labour depends upon accumulation of capital.
12. Demand and supply price are independent of the marginal productivity of labour.
13. The supply price of labour is given and constant.
14. Capital accumulation results from profits.

Ricardian system considers agriculture as the most important sector of the economy. The difficulty of providing food to expanding population is the main problem. According to Ricardo, there are three major groups in the economy. They are landlords, capitalists and labourers among whom the entire productive land is distributed. It is the capitalists who initiate the process of economic development in the society by reinvesting profits and, thus, increasing capital formation.

The total national output is distributed among the three groups as rents, profits and wages, respectively and the share of each group can be determined as under:
1. Rent per unit of labour is the difference between average and marginal product or total rent equals the difference between average product and marginal product multiplied by the quantity of labour and capital on land.
2. The wage rate is determined by wage fund divided by number of workers employed at subsistence wage. Thus, output of total corn produced and sold, rent has the first right and the residual is distributed among wages and profits, while interest is included in profits.

Production Function:
Ricardo's production function assumes the existence of three factors-land, labour and capital and it is subjected to the restriction of diminishing marginal productivity due to perfectly inelastic of land and its variable quality He regarded economic development as the process of these factors of production. The marginal productivity of land, labour and capital declines with the increase in cultivation. In agriculture, the rate of innovation introduced would be insufficient to affect the tendency for diminishing returns to set in at either intensive or extensive margin of cultivation. Thus, the introduction of improvements in the agriculture techniques might check the progress of diminishing returns it could have temporary effect on cost of agricultural production.

For the overall growth of the economy, it is necessary to examine as to which of these patterns prevail with respect to the output of industry and agriculture together. Ricardo is of the opinion that "Although, then it is probable that under the most favourable circumstances, the power of production is still greater than that of population, it will not long continue so, for the land being limited in quantity and differing in quality, with every increased portion of capital employed on it there will be a decreased rate of production while the power of population continues always to be the same". As Smithian economy grows at an accelerated rate, Ricardian economy develops at a progressively slower pace.

Ricardian production function is given as:
Y = F (K ,N,L)
K = Capital
N = Labour
L = Land

This production function is subjected to following constraints imposed by diminishing marginal productivity:

$$\frac{\partial^2 F}{\partial K^2} < O \quad \frac{\partial^2 F}{\partial N^2} < O \quad \frac{\partial^2 F}{\partial L^2} < O$$

Since the pace of economy's technological progress regulates to a large extent the rate of onset of diminishing returns, we may write,

$$\frac{\partial^2 F}{\partial K^2} = g\left(\frac{ds}{dt} \cdots\cdots\right)$$

$$\frac{\partial^2 F}{\partial N^2} = h\left(\frac{ds}{dt} \cdots\cdots\right)$$

$$\frac{\partial^2 F}{\partial L^2} = j\left(\frac{ds}{dt} \cdots\cdots\right)$$

Since ds/dt is one of the determinants of the extent of diminishing returns, it must also appear as a determinant of marginal productivity of the factors of production themselves. To simplify the calculations, we may introduce S in the production function *i.e.*

$$Y = f(K, L, N, S)$$

The rate of progress of the economy is obtained by differentiating the above equation

$$\frac{dy}{dt} = \frac{\partial F}{\partial K} \cdot \frac{dK}{dt} + \frac{\partial F}{\partial L} \cdot \frac{dL}{dt} + \frac{\partial F}{\partial N} \cdot \frac{dN}{dt} + \frac{\partial F}{\partial s} \cdot \frac{dS}{dt}$$

$\frac{dK}{dt} \rightarrow$ Capital accumulation

$\frac{dN}{dt} \rightarrow$ Land increases

$\frac{dL}{dt} \rightarrow$ Labour growth

$\frac{dS}{dt} \rightarrow$ Technological progress.]

Capital Accumulation:

Ricardo emphasized the rate of capital accumulation as capital acts as an engine of growth. "Capital" is the part of the wealth of a country which is employed in production and consists of food, clothing tools, raw materials, machinery etc., necessary to give effect to labour.

Capital accumulation depends upon two factors:
(a) Capacity to save.
(b) Will to save.

The capacity to save is more important in capital accumulation. This depends on the net income of society which is a surplus out of the total output after meeting the cost of workers subsistence. The larger the surplus, the larger will be the capacity to save. Landlords and capitalists invest through this surplus and the size of this surplus depends upon the rate of profit.

The Profit Rate:

      The rate of profit is the ratio of profits to capital employed. But since capital consists of working capital, it is equal to the wage bill. So, as long as rate of profit is positive, the process capital accumulation will continue and the economy will progress. The labour force will grow proportionately and the total wage fund will increase. The profit depends upon wages, wages on price of the corn and price of the corn on the fertility of marginal land. Hence, profits and wages are inversely proportional to each other.

      When there is improvement in agriculture, the productivity power of land increases and there is fall in the price of corn and as a result, subsistence wage also falls, but profits increase and there is more capital accumulation. This will increase the demand of labour and wage rate will rise, which will increase population and demand for corn and its price. Since the wages rise, the profit will decline and there will be less capital accumulation. The process of growth will continue till the profits fall to zero or the whole of the total product less rent is used for the maintenance of labour at subsistence level. At this stage, capital accumulation stops and the progress of the economy reaches a stationary state.

Increase in Wages:

      In Ricardian Scheme, wages play an active role in determining income between capital and labour. The wage rate depends upon the number of workers and wage fund. The wage rate falls with the increase in number of workers and vice-versa. If the wage rate is sufficient to enjoy the comforts of life by labourers, the population is expected to increase and if the wage rate is the lowest the working class cannot meet the necessities of life, the population will decrease. Thus, there is positive co-relation between wage rate and size of population. The increase in wages with the increase in population absorbs the rise in price of corn. Since wages also increase, profits decline. These opposite tendencies ultimately retard the capital accumulation.

Declining Profits in Other Industries:

      According to Ricardo, "The profits of the farmer regulate the profits of all other trades". Ricardo uses agricultural profits as a basis and it is the agricultural profit which determines the industrial profit. The money rate of profit earned on capital must be equal in equilibrium in both agriculture and industry. The rate of profit in the agricultural sector determines the rate of profit in the industrial sector of an economy. Thus, when the profit declines in the agricultural sector, it also declines in the industrial sector. The industry would have to raise the wages of labourers with the increase in price of corn and which in turn, reduces the profit. Thus, the price of corn determines the rate of profit in an industry. When profit declines in agricultural sector, it declines in all trades.

Other Sources of Capital Accumulation:

Ricardo is of the view that economic development depends upon the difference between production and consumption. He stresses on increasing production and reducing unproductive consumption. The productivity of labour can be increased through technological changes and better organisation and thereby stimulating capital accumulation. But the use of machines will employ less workers which will lead to unemployment and reduced wages since the economic condition of workers decreases with the employment of more machines. So Prof. Ricardo regards the technological conditions as given and constant. Taxes are the source of capital accumulation in the hands of the government. According to Ricardo, taxes are levied only to reduce conspicuous consumption; otherwise the imposition of taxes on capitalists, landlords and labourers will transfer resources from these groups to government. Taxes adversely affect the investment. Therefore, Ricardo is not in favour of imposition of taxes, as taxes reduce income, profit and capital accumulation.

Prof. Ricardo is in favour of free trade as it is an important factor of development of the country. Free trade provides vast opportunities of investment to capitalists. The capitalists can make investment in export oriented industries and earn profits. The re-investment of profit by the capitalists will further enhance the developing activities. The capital accumulation can be raised by importing corn. But the import of corn leads to fall in demand for labour which deteriorates the economic conditions of labourers. On the other hand, landlords and capitalists do not think it fit to import cheap corn from the foreign countries, as a result, their profits decline. Ricardian theory has been illustrated with the help of a diagram (Fig 2).
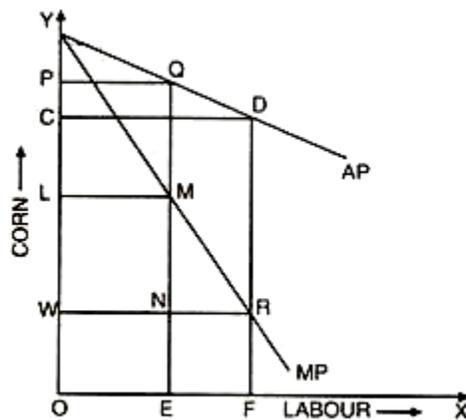

Fig. 2

The quantity of corn is measured along the vertical axis and labour along the horizontal axis. The curve AP represents average product of labour and MP represents the marginal product of labour. With OE amount of labour, total corn produced is OPQE. Rent is shown by rectangle PQML, as the difference between AP and MP. At subsistence wage rate OW, the supply curve of labour WN is infinitely elastic and total wage is OWNE.

Total profits WLMN, are the residue after deducting rent and wages from the total output:

WLMN = OPQE — (LPQM — OWNE)

Stationary State:
　　　When the economic development proceeds real wage rate remains at the subsistence level and profit tends to fall. When the capital accumulation rises with increase in profit, total output increases which raises the wage fund. With the increase in the wage fund' population increases which raises the demand for corn and its price. As population increases, inferior grade lands are cultivated to meet increasing demand of corn. Ricardo assumes that labourers and landlords spend all their income on consumption and hence, save nothing. The saving is done by the capitalist for profit earners. But as the society progresses, the share of profit begins to decline. Fall in the rate of profit slackens the process of capital accumulation and the development receives a set back and at this stage, there is no further increase in capital and the economy enters in a stationary state.

　　　In this state, capital accumulation stops, population does not grow, the wage rate is at subsistence level and technological progress ceases. "The basic casual force in this scheme is the fact of diminishing returns in agriculture, a grim tendency which can be postponed temporarily by technical progress. But technical progress cannot prevent the ultimate disappearance of profit and the onset of stationary state". The phenomenon of stationary state is explained with the help of a diagram 3. With the increase in capital accumulation, profits and wages tend to increase and the rise in wages bring about a decline in profits. The decline in profits will continue till a stage comes when the net product curve intersects the wage line OW at P. At this point, wages are equal to net product and the profit is nil. Any disturbance to the right of point P, will make the net product less than wage level which is impossible. So P is the point at which economy is in a stationary state.
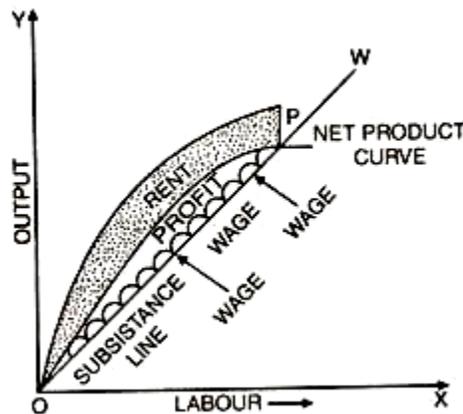

Fig. 3

Thus, "Ricardian system of development formulated certain interrelations among capital, population and output on the basis of these relations, it traces the course of rent, wages and profits every time and finally it concedes with the celebrated forecast of the eventual advent of a stationary state".

Conclusion:

The model tries to deal with the various problems relating to development. It determines the relative shares of different agents of production in national income. The economy in this model is considered to be ever changing with the passage of time, till it reaches stationary state. This theory highlights the importance of major development variables such as capital accumulation, population, profits, wages and rent etc. Harrod observed, "May I remind you the bare bones of Ricardo's dynamic theory? It was a large part of this whole theory. The prime motive for these was the tendency to accumulate. This may be identified with what we regard as savings and is rightly treated by Ricardo as dynamic concept……. "

2.2.b Essentials of Economic Development given by Malthus

T.R. Malthus formed the trinity of pessimistic economists. He pioneered the theory of population which was more precise and significant than his views on growth. In his opinion, no enquiry could be more important than that which traced the causes of any difference between potential and actual outputs of a country. According to him, population growth is an end product of the whole process of economic development but the increase in population cannot take place without proportionate increase in wealth. Mere increase in population cannot provide a stimulus to economic expansion. Population growth encourages development only if it brings an increase in effective demand.

The demand for labour depends on rate of capital accumulation. Malthus does not deny the need of savings and investment for economic growth but he suggests a level of optimum propensity to save. Thus, Malthus had a picture of an advanced economy enjoying growth with consumption, investment and savings expanding together.

Concept of Development:

Malthus contends that the process of growth is not automatic but it needs a deliberate effort on the part of the people. He did not conceive any movement towards stationary state but he emphasized that the economy reaches slump many a times before attaining the optimum level of development. Thus, the process of development consists of many ups and downs and it is not smooth. Malthus was concerned with the progress of wealth and the wealth of a country depends partly on the quantity of production obtained by its labour and partly on the valuation of the produce. But "the wealth of country does not always increase in proportion to increase in value because increase in value may sometimes take place under an actual diminution of commodities.

Population Growth and Economic Development:

Prof. Malthus was first to introduce a new branch of study in economics and to give an impulse to the serious study of that branch. His principle of population states that population grows more rapidly than food supply. Malthusian theory of population is based on the theory of differential rent in which he emphasized the law of diminishing returns in agriculture. Population growth increases wealth only if it increases effective demand and it is the increase in effective demand which leads to increase in wealth.

Role of Production and Distribution:

Malthus regards production and distribution as two major elements of wealth. If they are combined in an appropriate proportion, the wealth of a country can be increased in a very short time. But if they are taken separately, it may take thousands of years to increase the wealth. Thus, the potentialities of economic development in a country should be raised by large production and fairer distribution.

Factors in Economic Development:

He defines the problem of development as explaining the difference between potential gross national product and actual gross national product. Malthus does not believe in any long run theory, he is concerned with the short period fluctuations of wealth. But the principal problem is one of attaining a high level of potential gross product. According to Malthus, the size of potential gross national product depends upon land, labour, capital and organisation. When these four factors are combined in right proportion, they maximize the production in two major sectors viz. the agricultural sector and the industrial sector of the economy. The increase in agricultural and industrial production can be made by accumulation of capital, fertility of soil and technological progress. Despite this, he also emphasizes the importance of non- economic factors in economic development. They are the security of property, good constitution and excellent laws properly administered and hard working and regular habits. He observed "… there is little reason to apprehend any permanent evil from the increase in machinery".

Capital Accumulation:

The accumulation of capital is the most important determinant of economic growth. He regards capital as indispensable to development. According to him, "No permanent and continued increase of wealth can take place without its increase of capital". The main source of capital accumulation is higher profits and they come from the savings of the capitalists because workers are too poor to save. If the capitalists save more and spend less on consumer goods in order to have higher profits, economic growth will be retarded. Malthus suggested the concept of optimum propensity to save.

This means, "Saving from the stock which might have been destined for immediate consumption and adding to that which is to yield a profit or in other words… the conversion of revenue to capital". He concluded that excess of savings would destroy the motive of production. Malthus underlined the importance of foreign trade in speeding up economic growth. It provides incentive for investing since it leads to the extension of the market for goods produced and for greater division of labour resulting in increased output.

Role of Effective Demand:

Malthus regarded the role of effective demand in economic growth. He refuted the Say's Law of Market and over-ruled the concept that there can't be general over production. Malthus was of the opinion that the law of demand and supply determines the value of a commodity, though he continues to regard labour commanded by commodity as the best measure of its value. Productive labour creates economic surplus over and above the labour costs. It produces commodities which command greater labour than is embodied in their production. Production of labour brings profits into existence but these profits can only be realized if there is an effective demand. Thus, production depends upon effective demand and over production is the result of deficiency of effective demand.

The employment of productive labour is the source of insufficiency of effective demand which, in turn, results in general over production and unemployment in the economy. Since productive labour produces commodities which command greater labour than is required to produce them, labourers will receive less than the value of commodities they produce and wages will form only a part of total price of produce. Thus, the workers are unable to purchase all commodities in the market. On the other hand, capitalist being parsimonious in nature prefer to save rather to spend. Thus, an unsold stock of commodities tends to increase in the market which can be purchased neither by productive labourers nor by capitalists. This is how the deficiency of effective demand creates the situation of over production and it leads to fall in prices, profits, savings, investment and capital accumulation.

Economic Stagnation:

Malthus believed that supply of labour is inelastic in short run. He wrote "From the nature of population, and increase of labourers can't be brought into market, in consequence of a particular demand, till after the lapse of sixteen or eighteen years". The supply of capital can be increased faster than the increase in population. As capitalist invests on productive labour to increase supply of capital hence wages rise due to competition. Rise in wages does not increase effective demand because workers prefer leisure to increased consumption. As a result, prices fall, profits decline, investment falls and both the power of accumulation and the motive to accumulate are strongly checked. Thus, gluts and under consumption leads to economic stagnation.

2.2.c. Mill's Theory of Development

  J.S. Mill made a valuable contribution to the theory of economic development. He analyzed various factors of economic growth. He regarded economic development as a function of land, labour and capital. While land and labour are two original factors of production and capital is stock previously accumulated of the products of former labour. The wealth of a nation can increase only if land and capital help to increase production faster than labour force. Wealth refers to those things which can be kept for sometime before they are put to use. It consists of tools, machines and the skill of labour force.

  Mill emphasizes the materiality of the product. He also distinguishes between productive consumption and unproductive consumption. Productive consumption is that which goes to maintain and increase the productive powers of the community. Only the productive consumers are productive labourers but all consumption is not productive. Worker's consumption of subsistence goods is productive while that of luxuries is unproductive.

Control of Population Growth:

  Mill believed in Malthusian theory of production. The law of population growth throws light on the tendency of population to increase faster than the increase in the means of living. The result is restriction on population growth by the checks or preventive checks. Positive checks are made in UDC and among laboring classes, preventive checks are generally practiced among the middle classes of advanced countries. Emigration is an effective measure to relieve the excessive population problem.

Wage Fund:

  The elasticity of labour supply is very high in response to rise in wages. Wages generally exceed the subsistence level. Wages are paid out of capital and hence they are limited by the existing fund of capital. Wages are determined by the demand and supply of labour. By capital, Mills means "only circulating capital and not even the whole of that but the part of which is expanded in the direct purchase of labour" and by population is meant "the numbers only of the laboring class, or rather of those who work for hire". Any change in wage rate is affected by change in capital or population.

  Mill pointed out that wages cannot rise buy by an increase of the aggregate funds employed in hiring labourers, or a diminution in the number of the competitors for hire, nor fall except either by a diminution of the funds devoted to paying labour or by an increase in the numbers of labourers to be paid. Thus, the rise and fall in wages depends upon whether capital grows faster than population or population than capital. This is based on Mill's notion that,

"demand for commodities is not demand for labour". It implies that income invested on advances of wages to labour create employment and not income spent on consumer goods. Thus, increase in consumption will lead to decline in the investment. So increase in investment leads to increase in the wage fund and it leads to economic progress.

Role of Capital Accumulation:

Capital is defined as the stock previously accumulated of the products of formal labour. Greater the capital larger will be the size of wage fund and higher will be the demand for productive labour. Capital is the result of saving and saving means the abstinence from present consumption for the sake of future goods.

According to Mill, capital accumulation depends upon:
   a. The amount of fund from which saving can be made.
   b. The strength of the disposition to save which, in turn, depends upon the rate of return of saving or the rate of profit and the willingness to save at a given rate of profit.

For Mill, profit depends upon cost of labour, so that rate of profit is the ratio of profit to wages. When profit rises or wages fall, the rate of profit increases which, in turn, increases the rate of capital accumulation. Similarly, the rate of capital accumulation can be increased by increasing the desire to save.

Rate of Profit:

According to Mill, the ultimate tendency in an economy is for the rate of profit to decline due to diminishing returns in agriculture and increase in population at a Malthusian rate. In the absence of technical improvements in agriculture and the growth rate of population being higher than rate of capital accumulation, the rate of profit is "within a hand's breadth of minimum", and the country is "on the verge of stationary state".

The preventive measures for minimum rate of profits are as under:
1. Capital losses during crisis.
2. Technical improvements.
3. Expansion of foreign trade.
4. Government borrowing for unproductive expenditure.
5. By capital exports to colonies to produce consumer goods for home country.

But none of these factors can continue indefinitely so ultimately the profits would have the tendency to be at the minimum level and the rate of accumulation declines.

Role of State:

J.S. Mill was a staunch supporter of the policy of laissez-faire. Every departure from it unless required by some great good is a certain evil. He, therefore, assigned the minimum role to

the state in economic affairs. Mill recognized a number of exceptions to the general rule of Laissez-faire and felt the necessity of government intervention. The government has an important function to civilize the citizens by educational facilities. Education must be compulsory. Mill was first to put forward an economic justification for government intervention in the field of education. 'The uncultivated cannot be competent judges of cultivation' i.e. the buyer of education is not a competent judge of commodity.

Mill did not think of education as an investment in human capital which directly stimulates economic growth, but education contributes to economic growth indirectly by raising the character of people, by promoting civic peace and by reducing the numbers. Mill further favoured free trade and was against protection and defended the imposition of protective duties temporarily in the case of infant industries.

Stationary State:

Mill thought that stationary state was imminent—"at the most a few years ahead and no more"—its arrival postponed by above factors. He welcomed the stationary state as it leads to improvement in income distribution and large remuneration for labour. But this is possible only through control on increase in numbers of working classes, through provident habits and education. Thus, "In Mill's stationary state, there could be no increase in either population or stock of capital, profit having reached the minimum necessary to prevent net disserving by the economy as a whole. However, there might still be a rising standard of living due to improvements in the art of living and increased leisure through technical progress".

2.2. d Karl Marx Theory of Economic Development

Karl Marx, the father of scientific socialism, is considered a great thinker of history. He is held in high esteem and is respected as a real prophet by the millions of people. Prof. Schumpeter wrote *"Marxism is a religion. To an orthodox Marxist, an opponent is not merely in error but in sin".* He is regarded as the father of history who prophesied the decline of capitalism and the advent of socialism.

The Marxian analysis is the greatest and the most penetrating examination of the process of economic development. He expected capitalistic change to break down because of sociological reasons and not due to economic stagnation and only after a very high degree of development is attained. His famous book 'Das Kapital' is known as the Bible of socialism (1867). He presented the process of growth and collapse of the capital economy.

Assumptions of the Theory:
Marxian Economic theory of growth is based on certain assumptions:
1. There are two principal classes in the society. (1) Bourgeoisie and (2) Proletatiat.
2. Wages of the workers are determined at subsistence level of living.
3. Labour theory of value holds good. Thus labour is the main source of value generation.

4. Factors of production are owned by the capitalists.
5. Capital is of two types: constant capital and variable capital.
6. Capitalists exploit the workers.
7. Labour is homogenous and perfectly mobile.
8. Perfect competition in the economy.
9. National income is distributed in terms of wages and profits.

Marxian Concept of Economic Development:

In Marxian theory, production means the generation of value. Thus economic development is the process of more value generating, labour generates value. But high level of production is possible through more and more capital accumulation and technological improvement. At the start, growth under capitalism, generation of value and accumulation of capital underwent at a high rate. After reaching its peak, there is a concentration of capital associated with falling rate of profit. In turn, it reduces the rate of investment and as such rate of economic growth. Unemployment increases. Class conflicts increase. Labour conflicts start and there is class revolts. Ultimately, there is a downfall of capitalism and rise of socialism.

2.3. **Unlimited supply of labor theory by Lewis**

According to Lewis the theory of unlimited supply of labor is tenable for economic development. He believed that underdevelopment countries have unlimited supply of labor at subsistence wage. He believed in a two sector economy i.e. the subsistence agriculture and the capitalist sector. Capital accumulation takes place if the surplus labor is withdrawn from subsistence sector to capitalist sector. Capitalist sector is that part of the economy which uses reproducible capital and pays capitalists for its use. It employs labor for earning profits. The subsistence sector is that part of economy which does not use reproducible capital. In the subsistence sector output per head is lower than in the capitalist sector.

According to Lewis supply of labor is fully elastic at subsistence wage in underdeveloped countries. In his view these countries are overpopulated compared to capital and natural resources. The marginal productivity of labor is negative, zero or negligible. As the labor supply is unlimited, new industries spring up or existing ones are expanded without limit at the current wage at subsistence level. But it is important to note that capitalist sector required skilled labor which they obtain by providing training facilities for unskilled labor

Capitalist Surplus

In practice capitalist wages are more than 50% higher than subsistence wages are due to:-

I. A substantial increase in the output of the subsistence sector by raising real income might induce workers to ask for a higher capitalist wage before offering themselves for employment.

II.   After the withdrawal of labor from the subsistence sector, if the total

III.   product remains the same the average product and real income of those left behind will rise and withdrawn workers might insist on a higher wage in the capitalist sector. III. The high cost of living may cause the employers to raise the real wage or with government might insist a higher wage for workers unions with support for their wage-bargaining efforts. Since the marginal productivity in the capitalist sector is higher than the capitalist wage, capitalist surplus is the consequence.

Capital formation based on capitalist surplus Capitalist surplus is reinvested in new capitalist assets. There is capital formation and more workers are employed from the subsistence sector. The process goes on until capital-labor ratio rises and the supply of labor becomes inelastic. In his own words Lewis says 'the key to the process is the use which is made of the capitalist surplus. In so far as it is reinvested in creating new capital, the capitalist sector expands taking more people into capitalist employment out of the subsistence sector, the surplus is then larger still, the labor surplus disappears.' Lewis does not make any distinction between growth of technical and growth of productive capital and treats them as a 'single phenomenon' with the results that technical progress tends to raise profits and increase employment in the capitalist sector.

According to Lewis 'the central problem in the theory of economic development is to understand the process by which a community which was previously saving and investing 5% of its national income or less converts itself into an economy where voluntary saving is running at about 15% of national income or more. This is the central problem because the central fact of economic development is rapid capital accumulation.

The dominant classes of land lords, traders, money lenders, priests, soldiers, princes spend more on consumption and not on production. So the state capitalist and indigenous private capitalists who create capital out of profits earned. The state capitalist can accumulate capital even faster than private capitalists. Capital formed but only through profits but also through bank credits. Underdeveloped countries have national resources more in idleness and due to shortage of capital. Credit creation has the same effect on capital formation leads to inflation in prices for the same period. Similarly, surplus labor if engaged and paid through credit money, price rises due to increase in income while consumer goods output remains constant. This is only temporary because as production of goods rise, prices ultimately go down.

End of the growth process

The Lewis theory shows that if unlimited supply of labor is available at a constant real wage and if any part of profit is reinvested in productive capacity, profits will grow continuously relative to the national income. However, the process cannot go on indefinitely, it has to stop at some point. According to Lewis, end of growth occurs if:-

I.   No surplus labor is left

II. The capitalist sector expands so rapidly that it reduces the population in the subsistence sector and the average productivity and labor rises in the subsistence sector as there are few persons to share the product and so the capitalist wage rises in the former sector

III. As a result of the expansion of the capitalist sector relative to the subsistence sector, the terms of trade turn against the capitalist sector with rising prices of raw materials and food, the capitalists have to pay higher wages to the workers

IV. The subsistence sector adopts new techniques of production; real wages rise in the capitalist sector and so reduce the capitalist surplus

V. The workers in the capitalist sector imitate the capitalist way of living and agitate for higher wages and if successful in raising their wages, the capitalist surplus and the rate of capital formation will be reduced.

Criticism of Lewis theory

a) Not all underdeveloped countries have an unlimited supply of labor. Actually many countries in Africa and South America are rather thinly populated

b) Limited enterprise/capitalist initiative. According to Lewis a capitalist class exists in underdeveloped countries. The process of development is dependent on the existence of such a class that is developing and harnessing the necessary skills and accumulating wealth. In many underdeveloped countries such a class is rather limited

c) and agitate for higher wages and if successful in raising their wages, the capitalist surplus and the rate of capital formation will be reduced. Criticism of Lewis theory I. Not all underdeveloped countries have an unlimited supply of labor. Actually many countries in Africa and South America are rather thinly populated II. Limited enterprise/capitalist initiative. According to Lewis a capitalist class exists in underdeveloped countries. The process of development is dependent on the existence of such a class that is developing and harnessing the necessary skills and accumulating wealth. In many underdeveloped countries such a class is rather limited living in the capitalist sector stands in the way of mobility of labor to this sector.

d) Marginal productivity of labor is not zero if marginal productivity of labor in the overpopulated underdeveloped countries in zero or negligible, the subsistence wage would also tend to zero. As every worker gets a subsistence wage it is difficult to find out the exact number of surplus labourers who are ready to move to the capitalist sector.

Merits

Despite the demerits, Lewis theory explains a very clear cut process of development. The two sector theory has a good analytical value. The theory touches on some key real life problems such as credit, inflation, population growth, technological progress and international trade.

2.4 Schumpeter's Innovation Theory of Profit
Definition:

The Innovation Theory of Profit was proposed by Joseph. A. Schumpeter, who believed that an entrepreneur can earn economic profits by introducing successful innovations. In other words, innovation theory of profit posits that the main function of an entrepreneur is to introduce innovations and the profit in the form of reward is given for his performance. According to Schumpeter, innovation refers to any new policy that an entrepreneur undertakes to reduce the overall cost of production or increase the demand for his products.

Thus, innovation can be classified into two categories; The **first category** includes all those activities which reduce the overall cost of production such as the introduction of a new method or technique of production, the introduction of new machinery, innovative methods of organizing the industry, etc.

The **second category** of innovation includes all such activities which increase the demand for a product. Such as the introduction of a new commodity or new quality goods, the emergence or opening of a new market, finding new sources of raw material, a new variety or a design of the product, etc.

The innovation theory of profit posits that the **entrepreneur gains profit** if his innovation is successful either in reducing the overall cost of production or increasing the demand for his product. Often, the profits earned are for a shorter duration as the competitors imitate the innovation, thereby ceasing the innovation to be new or novice. Earlier, the entrepreneur was enjoying a monopoly position in the market as innovation was confined to himself and was earning larger profits. But after some time, with the others imitating the innovation, the profits started disappearing.

An entrepreneur can earn **larger profits for a longer duration** if the law allows him to patent his innovation. Such as a design of a product is patented to discourage others to imitate it. Over the time, the supply of factors remaining the same, the factor prices tend to rise as a result of which the cost of production also increases. On the other hand, with the firms adopting innovations the supply of goods and services increases and their prices fall. Thus, on one hand the **output per unit cost increases** while on the other hand the **per unit revenue decreases**.

There is a point of time when the difference between the costs and receipts gets disappear. Thus, the profit in excess of the normal profit disappears. This innovation process continues and also the profits continue to appear or disappear.

Suhumpeter had an advantage for about four decades he studies the economic conditions closely as he was fortunate enough during that period to life in four countries and three continents. He did not believe capitalism to be capable of producing high rates pf growth without social evils accompanying it. At the same time he was not averse to a kind of society and civilization produced by "pure" capitalism. He showed preference for European capitalism and its cultural achievement which existed before First

World War. But he was doubtful of its role since then. He had some liking even for the semi feudal capitalism of pre war Japan.

It seems quite clear that capitalism, as advanced through the modern age in a modified form, had created certain misgivings in Schumpeter's mind. As a consequence just a few years before his death, he almost advocated a sort of corporative state under the guidance of the Roman Catholic Church. He was, of course, not a fascist. On the other hand, they believed that the capitalism brings on its back economic and social progress, through the cost of the existence of a class structure.

Though he admired capitalism he understood its gloomy prospects. He felt that capitalism will eventually stagnate and breakdown. According to him, 1 it was not the failure of capitalism but its very success that would lead to the disaster of the goose that lays the golden eggs. This is of course. His pessimistic conclusion. Though he may not like socialism as an alternative to capitalism, he accepted or probably approved of what is like socialism as an alternative to capitalism, he accepted or probably approved of what is likely to follow the decline of capitalism, why? Because he was intellectually more indebted to Marx than to any other figure in the history of economic thought.

We are not concerned here with his personal or political views. We are concerned only with his analytical framework.   We are interest in knowing how for his model would be useful in tackling the growth problems of undeveloped and advanced countries today.

We are not concerned here with his personal or political views. We are concerned only with his analytical framework. We are interested in knowing how for his model would be useful in tackling the growth problems of undeveloped and advanced countries today.

2.4.a OUTLINE OF THE MODEL

a) Production function

In his production function Schumpeter was not different from the classical school and Marx. Thus he stated that.

$$O = f (K, L, N, T) \qquad\qquad \ldots\ldots (1)$$

b) Savings, Wages Profits interest rate

According to the classicists, the capitalists were alone capable of savings. But Schumpeter thought that saving meant 'saving up' for future consumption or for investment. So, both capitalists and labourers would save more as their income rose. However, Schumpeter retained in his system of the neo-classical idea of the savings being the function of the interest rate. So, capitalists and workers would increase the saving out of their income in accordance with the rise in interest rates. Thus we may write.

$$S = S (W, R, r) \qquad\qquad \ldots\ldots (2)$$

c) Investment

One of the important contributions of Schumpeter was that he distinguished between Induced Investment and Autonomous Investment Induced investment (ii) is stimulated by recent increase in output, income sales or profit. Autonomous investment (IA) is invariably the result of some long-term considerations as technological change. Thus we have

$$I = li + IA \qquad \qquad \ldots \ldots (3)$$

d) Induced investment, profits and interest rate

There are many factors determining induced investment. But Schumpeter followed again the neo-classical tradition in laying emphasis on the relationship between profits (R) and the rte of interest (R). Induced investment tend to rise as current profits rise while it tends to fall as the interest rate goes up. It is therefore determined by the difference between profits and the interest rate. However, if capital has already been accumulated more, the excess of profits over interest will also be more so that more investment is induced. The equation is

$$Li = I (R, r, K) \qquad \qquad \ldots \ldots (4)$$

$$\delta R \leq 0 \ \frac{\delta l\iota}{\delta r} < 0. \qquad \qquad \frac{\delta l\iota}{\delta k} < 0.$$

(e) Autonomous Investment, Resource Discovery Technology

The most important part of private investment is determined by long-run factors such as resource discovery, technological progress, etc., This is Schumpeter's major contribution to the theory of investment.

According to Schumpeter, innovation was the mainspring of autonomous investment. This may be regarded either as technological progress or resource discovery or both.

Innovation is, in general and change in the production function which would bring an increase in output. If things are done differently, this may increase in productivity available factors of production. This is called innovation.

Schumpeter listed five major forms of innovation. They are: (1) introduction of a new good: a new good is one with which the consumers are not familiar: or the good may be of a new quantity. (2) the introduction of a new method of production: it is the method, not yet tested by experience, founded upon a scientifically new discovery and it can also exist in a new way of handling commodity commercially. (3) the opening of a new market into which the particular branch of manufacture has not entered previously, whether this market has existed before or not. (4) the conquest of a new source of raw materials or of semi-finished goods, again whether this source existed before or was newly created. (5) the re-organization of an industry creating a monopoly position or breaking it.

It the term 'K' means the rate of resource discovery through time dk/dt and the term 'T' means the rate of technological progress through time dT/dt then we can write.

$$IA - la \text{ ('KT)}$$

Thus, according to Schumpeter, autonomous is a function of the rate of resource discovery and the rate of technological progress. But according to Keynes-Hansen theory of development, population growth plays a prominent role in stimulating autonomous investment. We have omitted this factor in the equation (5) of our model of the Schumpeter system.

Schumpeter accepts the view that population growth under certain conditions, may raise the long-run investment. Likewise, a tapering off of population growth might reduce it. But he did not consider population growth as an economic force but as an external factor. Only, so, population does not become an integral part of the Schumpeter system.

At the same time, Schumpeter treated population growth as a factor leading to growth of the economy. Here he distinguished between growth and development.

According to him development required qualitative change. It means changes in economic life caused by factors arising from within. The economic itself should initiate such factors in the direction qualitative of changes.

The growth of population and wealth may indicate merely the growth of economy. But this may not be designated as a process of economic development. Rather these do not suggest any qualitatively new phenomena. These are only processes of adaptation of the same kind the changes in the natural data. Schumpeter is interested in other phenomena. So he regards increase in wealth and population as changes in data only.

f) Technology, Resource Discovery and Entrepreneurs

Schumpeter laid great stress upon the leading role of an entrepreneur in economic development. The entrepreneur is an innovator but not a technician or a financier. Though Marx considered the entrepreneurial function important, he did not emphasize it as much as Schumpeter.

The entrepreneur may assume the managerial functions but this role do not make him an entrepreneur, he may introduce a new technique or a new commodity, an improved organization or he may develop newly discovered resources. He raises money for a new enterprise, assembles the factors of production chooses top managers, and sets the organization going. But he is not a capitalist. So, entrepreneurs do not form a social group like capitalists or workers.

According to Schumpeter, neither inventions nor discoveries have economic effect unless identified and used by the entrepreneurs. It is the entrepreneur who sees the economic potential of inventions and discoveries and uses them in enterprise.

So, technological progress (T) and the rate of resource discovery (K) depend upon the supply of entrepreneurs (E) Thus

$$T = T(E) \qquad \ldots \ldots (6)$$

$$K = K(E) \qquad \ldots \ldots (7)$$

(g) Supply of Entrepreneurs, Profits and Social Climate

Like Marx, Schumpeter lays emphasis on sociological factors. These factors are not quantifiable. Schumpeter's concept of "social climate" is a complex phenomenon reflecting the social, political and socio-psychological atmosphere within which entrepreneurs must operate. This may include social values, class structure, educational system, etc. This also includes social attitude, towards business, success, prestige and other social rewards. The entrepreneur is to understand this social climate. Thus, the supply of entrepreneurs (E) depends on profits (R) and social climate (x).

$$E = E (R, X) \qquad \ldots \ldots (8)$$

(h) GNP, Savings, Investment and Supermultiplier

An excess of investment over voluntary savings, financed by credit creation, will raise gross national product (in money terms) by an amount which will be some multiples of the original gap between investment and savings. Thus,

$$O = K (IS) \qquad \ldots \ldots (9)$$

Likewise, the change of GNP over time is some multiple of the gap between the rate of growth in investment and the rate of growth in time in voluntary savings, So

$$\frac{do}{dt} = K \left(\frac{dl}{dt} - \frac{ds}{dt} \right) \qquad \ldots \ldots (a)$$

(i) Wages and Investment

This relationship is common to both the classical school and Marx Wage incomes increase with investment. So,

$$W = W (1) \qquad \ldots \ldots (10)$$

(j) Social Climate and Distribution of Income

Schumpeter considered income distribution to be a good "thermometer" of the social climate. According to him, social climate deteriorates with the squeezing of profits caused by trade union growth, progressive income taxes, social welfare programmes. Govt intervention to curb profit and to redistribute income.

Schumpeter gives a historic example to illustrate his point. According to him, Great Depression of the 1930s and its depth and duration were cuased by labour legislation social security, public works spending, progressive tax structure and "New Deal" policies. Thus, the rules of the game" were changed radically so that enterprise was discouraged and this retarded

investment. These had an impact on the relationship between wages and after-tax profits. The ratio of profits represents all factor influencing social climate, Thus

$$X = X \ \frac{R}{W} \qquad\qquad \ldots\ldots (11)$$

(k) An Identity

To close the system, GNP equals profits plus wages. Thus

$$O = R + W \qquad \ldots\ldots (12)$$

Now we have 12 equation and 12 unknowns.

 OPERATION OF THE MODEL

General equilibrium theory left open the question of economic development, for the theory assumed technology as well as consumer preferences to be constant. But economic development would mean that the economy expands the productive system structurally changes and the quality and composition of the final product change also.

Schumpeter takes the Walrasian equilibrium as a starting poing for his development theory. In Walrus theory the same process repeats itself in the field of both production and consumption. A firms management is reduced to mere routine, the same quantities and types of goods being produced and the factors being combined in the same way. This is a circular flow of economic life with competition in equilibrium, with costs equaling interest receipts, with prices equaling average costs, with profits and rate being zero and with no involuntary unemployment of resources. Likewise, every household will be in long-run equilibrium.

The essence of development is a discontinuous disturbance of this equilibrating circular flow. Schumpeter feels that this stationary state will be broken by radical changes in production methods, by innovation. We have already discussed what innovations mean

It is the entrepreneurs who introduce innovations. Such entrepreneurs are unknown in the stationary state. The entrepreneurial activity causes profit. As innovations do not exist in the stationary state, profit cannot exist either.

The first stage of capitalism is competive capitalism. It is characterized by firms that are not too large in relation to the overall size of the market. Here, with the introduction of innovations new firms come up.

The second stage trustified capitalism. At this stage large firms tend to predominate and they keep the innovatory process within themselves, so that innovation does not imply the appearance of new firms in competition with the old ones.

In a capitalist society the real competition is not between small firms producing the same commodity but between the innovating firms in which entrepreneurial activity is present and the

others. The competition is not between identical goods (produced in the same way) but between the new products and the old between the new methods of production and the old ones. This competitive process is called by Schumpeter as "creative destruction". This emphasizes that competition is the effect of innovations on existing firms. Once innovations are introduced, and if they do not become widespread the original innovators try to maintain a certain degree of monopoly.

Schumpeter then analyses economic fluctuations. The cause of trade cycle is that innovations are not uniformly distributed through time, but tend to crowed together at certain periods. In order to introduce an innovation, a series of social obstacles must be broken. The lag between the time when an innovation is adopted and the time it begins to bear fruit in the form of goods to be sold varies according to the innovation itself. This is the origin of cycles of different frequencies.

When big innovations come up, they generate huge waves of investment. Huge investment is financed by new bank credit. That is, the investment is assumed to be financed by monetary expansion rather than by increase in current savings. This produces a spread between investment and savings and generates and upswing.

With the completion of new plants the rate of investment drops to the level necessary for replacement only. Now plants start producing more consumer goods, and prices start palling. This fall in prices is accentuated by reduction in money supply. Money supply falls as new plants by selling their products get more income which is used to reduce their bank loans. On the one hand, money supply falls and on the other production of goods increase and naturally prices fall. Some firms incur losses. Total profits decline. Expectations become gloomy. The innovative activities are checked Depression ensues.

Schumpeter's theory is not itself a complete theory of business cycles. But the has made an important contribution to the theory of development by his systematic exposition of the Marxian thesis that capitalist development tends to proceed by leaps and bounds only to fall at the end.

AN EVALUATION

Let us summarise the system as outlined above

$$O = f(K, L, N, T) \qquad \ldots (1)$$

$$S = S(W, R, r) \qquad \ldots (2)$$

$$I - I_i - I_a \qquad \ldots (3)$$

$$L_i = (R, r, k) \qquad \ldots (4)$$

$$I_A = (K\ T) \qquad \ldots (5)$$

$$T = T\ (E') \qquad \ldots (6)$$

$$K = K(E) \qquad \ldots (7)$$
$$E = E(R, x) \qquad \ldots (8)$$
$$O = K (I - S) \qquad \ldots (9)$$
$$W = W(I) \qquad \ldots (10)$$
$$X = X(R/W) \qquad \ldots (11)$$
$$O = R + W \qquad \ldots (12)$$

When we compare the Schumpeterian set of equations with those of the classical or Marxian system, we find three major differences. First is that the interest rate determines savings. But the relationship of savings to the level of interest rates is not much clear. Second is that autonomous investment is separated from induced investment, and it is influenced by the distinct factor called 'innovation'. Thirdly entrepreneurship is treated as a vital force in the economy. This feature is the most important, and gets into later growth theories. But the social climate as determining the supply of entrepreneurs seems to be vague.

According to Schumpeter, capitalism will ultimately break down. As capitalism advances, the entreprentrial function becomes obsolete. In the early stage of capitalism the driving impulse came from entrepreneurs. But under modern conditions, it is not individual, but teams of entrepreneurs who perform such function. Again, it is research institutions set up by the firms, which produce inventions. So, it is a bureaucracy of trained managers which has made innovations into just a routine, a dragging activity, Entrepreneurs have thus lost the unique role of original, creative, innovative leaders.

Secondly, technological progress has created greater scope for economics of large scale production and distribution for industrial concentration and for giant corporations Big concerns have produced a class of salaried executives in the place of entrepreneurs and share-holders and even owners. Capitalists institutions of properly and freedom of contract have been undermined.

Thirdly, family life is disintegrated, Larger families have lost their relevance. Smaller families have become the norms. With the fall in the size of the family, desire to accumulate wealth is diminished. This is an indication of declining capitalism. Finally, the emergence of intellectuals leads to the mobilization of masses against the existing social orders. The intellectuals sound the death knell of capitalism.

2.4 .b. Structural Analysis and Development
Structural Change Theories

Structural-change theory focuses on the mechanism by which underdeveloped economies transform their domestic economic structures from traditional to an industrial economy. Adam Smith's and Lewis model of development are representative strands in this model of development.

ADAM SMITH'S THEORY OF DEVELOPMENT

Adam Smith's ideas on economic development are expounded on his publication of 1776 titled 'An inquiry into the Nature and Causes of the Wealth of Nations'. Salient Features

1. **i.Natural Law**: - every man is directed by the 'invisible hand' and everyone is free to act. He argued that in free trade without government intervention and competitive markets tend to maximise national wealth.

2. **ii. Division of labor**: - According to Adam Smith, division of labor tends to result in greatest improvement in the productive powers of labor. He argues that the increase in productivity would arise as a result of (a) efficiency of every worker (b) saving in time with more goods production (c) invention of more labor-saving machines.

3. **iii. Process of capital accumulation:** - According to Adam Smith, capital accumulation must precede the introduction of division of labor. He says 'As the accumulation of stock must, in the nature of things, be previous to the division of labor, so labor can be more subdivided in proportion only as stock is previously more and more accumulated'. Economic development needs capital accumulation. According to Adam smith capital is that portion which a person saves annually.

   a. Why Capitalists make Investments: - Capitalists invest to earn profits on their investments in future. According to Adam Smith profits tend to fall in economic development. In his own words 'when the stock of many rich merchants are turned into the same trade, their mutual competition naturally tends to lower the profit, and when there is like increase of stock in all the different trades carried on in the same society, the same competition must produce the same effect on all of them'. In this way, competition among enterprisers for scarce labor tends to increase in wages and profits go down.

   b. Interest: - with the increase in prosperity, progress and population the rate of interest fall and the supply of capital is increased. The fall in rate of interest tends to increase in capital accumulation and economic progress.

   c. vi. Agents of growth: - According to Smith, producers and businessmen are agents of progress and economic growth. The market expands with free trade. Development in agriculture leads to increase in construction work and commerce. Further there is demand in commercial service and manufactured articles.

   d. vii. Process of growth: - Smith starts from the assumption that a social group-say a nation' will experience a certain rate of economic growth that is accounted for by increase in number and by saving. This induces a widening of market which in turn increases division of labor and thus increases productivity… "In this theory the economy grows like a tree. This process is no doubt exposed to disturbances by external factors, that are not economic but in itself it proceeds steadily, continuously. Each situation grows out of the proceeding one in a uniquely

determined way, and the individuals whose acts combine to produce each situation count individually for no more than the individual cells of a tree.

Limitations

i. Rigid division of society: - The Adam Smith theory of development is based on socio-economic environment prevailing in Europe. It assumes the existence of a rigid society between capitalists and laborers. The modern society has an important place for the middle class. In this sense, Adam Smith theory completely neglects the role of middle class and the role it plays in giving the necessary impetus to economic development.

ii. ii. One-sided saving base: - Smith puts saving capitalists, landlords and moneylenders. This is thought to be one-sided base savings.

iii. iii. Unrealistic Assumption of Perfect Competition: - Perfect competition is not found in any economy.

iv. Neglect of Enterpriser: - The enterpriser is the focal point of development. Smith neglects the role of the enterpriser.

v. Unrealistic assumption of stationery state: - Smith puts the end result of a capitalist economy in the stationery state. There is progress but is steady, uniform and regular. This characterization of the economy is now realistic because development takes place in fits and starts and is not uniform and steady.

Applicability of Smith's Theory to Underdevelopment Nations

It has limited application in developing countries because the markets are small, there is little savings and income is low. Political, social and institutional assumptions do not apply as conditions do not allow them. The government has to play a big role in bringing about development

Questions

1. Discuss the Schumpeterian model of economic development.
2. Discuss the surplus value concept of Marxism

UNIT 3

Partial Theories of Growth and Development

3.1 Introduction

In the early modern period, some people in Western European nations developed the idea that economies could "grow", that is, produce a greater economic surplus which could be expended on something other than mere subsistence. This surplus could then be used for consumption, warfare, or civic and religious projects. The previous view was that only increasing either population or tax rates could generate more surplus money for the Crown or country.

Now it is generally recognized that economic growth also corresponds to a process of continual rapid replacement and reorganization of human activities facilitated by investment motivated to maximize returns. This exponential evolution of our self-organized life-support and cultural systems is remarkably creative and flexible, but highly unpredictable in many ways. As there are difficulties in modeling complex self-organizing systems, various efforts to model the long term evolution of economies have produced mixed results.

Further theories of development imply a change in the *way* goods and services are produced, not merely an increase in production achieved using the old methods of production on a wider scale. Economic growth implies only an increase in quantitative output; it may or may not involve development. Economic growth is often measured by rate of change of gross domestic product (e.g., percent GDP increase per year.) Gross domestic product is the aggregate value-added by the economic activity within a country's borders. In this unit we are going to some related approaches to partial theories of growth and development.

3.1.(A) Vicious circle of Poverty

Poverty is the lack of essential needs to live that is the lack of proper shelter, clothing and food. Poverty is living on a day to day basis with the uncertainty of what the future can bring. freedom of expression. Poverty occurs when the income of any family or country is less than the level of consumption. The root of poverty is money. Lack of money can lead to people doing many bad actions and in turn result in bad consequences which end up impoverishing more people.

In a sentence, we can summarise it as: Poverty gives rise to crime and crime impoverish people! Think about poverty, and one of the things that come to your mind is Unemployment. people having no job thus families starving for they have no food. And here is specifically where politicians tend to exploit us and do some finger pointing at their rivals stating that the latter are responsible. Unfortunately this part is very tricky: There is no magic to get unemployed people a job, even if jobs were available, you have to have the qualified people! And qualified people are not obtained overnight; it takes time, months of training and even years.   And now unemployed people need to live, they need food, they need shelter, and they need clothing. Where do you think these will be obtained from, space? In a crude language, it will be "kill or die". Killing here refers to committing crimes, like robberies, while die will mean starving yourself and your family as well.

But unfortunately, that's not the end of the story my dear friends; these poverty-compelled 'criminals' often end up in jail serving for lengthy sentences while their family suffers even more with the loss of a potential bread-winner. If these families have kids, guess what they will be doing to survive…crimes of course! Like most readings we come across on the issue of poverty, I am almost certain that you are expecting me to spit something like "Education is the key"! and you will be wrong this time, unfortunately education is an important aspect to tackle in the fight against poverty but the real enemy is out there: Politicians and Businessmen! Do you really believe that poverty cannot be eradicated if everybody in this world wishes so? It can!!! But, there are people out there who are thinking…and they think: "what do I gain if there is no poor people?", "Is it not more profitable to have poor people?". It is common knowledge that politicians are prime users (or rather exploiters) of poor people; just go to the talk shows of famous politicians during election period and listen how they artistically use the poor for their own benefit.

And businessmen, with all the millions of dollars given to the poor, why do I say they need poverty? As a matter of fact, these donations are not done because they are happy to do so; it's simply a way for tax deduction! Next time you see Bill Gotes funding charities, know that his company had to pay the money anyway.

There are both internal and external factors which affect a country's development. One internal factor affecting a country's development is its economy. By economic factors one usually means factors that are essential for production, for example labour, land resources and capital. In the model "The vicious circle of poverty" the link between lack of capital and underdevelopment is emphasised. The theory of the vicious circle of poverty can be used both at the national and individual levels, but we will concentrate on the individual level in this report. We think that by studying poverty on the individual level one can more concretely see what causes poverty. On the individual level, the vicious circle of poverty starts with the statement that a poor person (A) cannot pay for an adequate supply of food, and (B) thus is physically weak (C) and cannot work efficiently (D), and unable to earn much money (E), and thus is poor (A). The circle starts all over again with a situation where the person does not have money to get nutritious food (B). This process goes on and on.
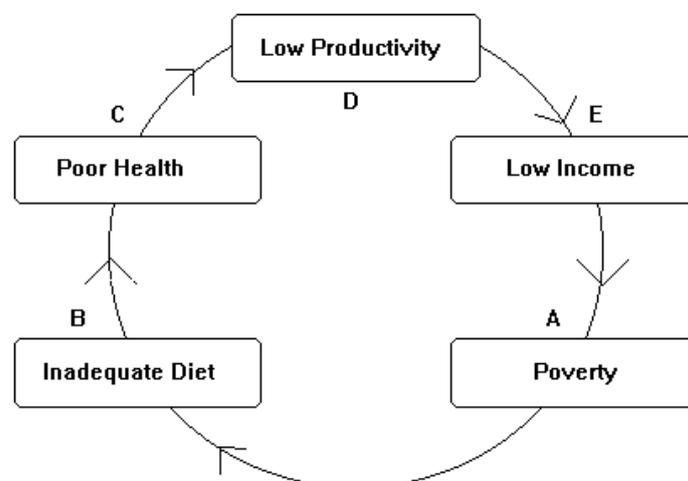

Figure 1: The vicious circle of poverty - Individual level

There have been some criticism raised against this model which state that the circle is inadequate as a total explanation of poverty and underdevelopment. The model does not explain why the person is poor or what is the cause of their poverty. Another thing is that the model does not consider the difference between LDC's, it assumes that all countries are on the same level of poverty. Social conditions are not taken into account either, the model implies that these societies are static and unchanging. The vicious circle of poverty does not tell you anything about how an individual or a country can break out of the circle.

3.1.(B) Circular Causation

Myrdal opposes the strategy of development poles because social systems and economic processes do not develop towards equilibrium but, on the contrary, factors tend to cumulate to positive or negative cycles. Under laissez faire' conditions in developing countries, there is a tendency towards a negative cumulation. In principle, Myrdal's theory is a negation of the mono causal explanation of problems of developing countries by economic factors alone. Rather, in a comprehensive way, all social relations have to be incorporated. At national level—different stages of development between regions—as well as international level—trade between industrialized and developing countries—differences tend to increase because of the spread effects in the more developed areas and modern sectors and backwash effects in backward areas and traditional sectors. For instance, industrial import goods are in competition with traditional crafts; terms of trade deteriorate; capital is being transferred, etc. The direction of processes depends on the initial situation and the factors causing the change. Under the conditions in developing countries, increased regional dualism often is a consequence of such processes of circular causation.

Circular and Cumulative Causation (CCC) has been a critical principle of political economy for over a hundred years. While the roots of the concept go back further Thorstein Veblen (1857-1929) utilized the concept in his examination of the evolution of institutions. Gunnar Myrdal (1898-1987) scrutinized the conditions of African Americans and Asian underdevelopment through the lens of CCC; influenced as he was by Knut Wicksell (1851-1926) (Myrdal 1939).

Comparison of Myrdal and Kaldor on CCC

Myrdalian and Kaldorian CCC traditions have significant commonalities as well as important differences. They have three main things in common. The first is the principle of circular causation, where the variables are interrelated, and the general manner of interaction between variables is complex and manifold. Circular causation is a multi-causal approach where the core variables and their linkages are delineated. CCC eschews single factor theories. Both Myrdalian and Kaldorian CCC examine circular relationships, where the interdependencies between factors are relatively strong, and where variables interlink in the determination of major processes.

The second similarity is cumulative causation, where the variables tend to operate as positive feedback processes, magnifying and multiplying the combined impact of the interactions through historical time. The coefficients of interaction between variables will play some role here, as will the extent of any negative feedback (drawback) effects working in the opposite direction. These cumulative interactions are crucial to Myrdalian and Kaldorian empirical studies of money, growth, demand, development and ethnicity. Both

forms of CCC examine cumulative dynamics, where the feedback within and between variables often tend to have a multiplier or amplified impact on the overall outcomes.

The third similarity relates to traverse, path dependence, and hysteresis that move the system through time in a typically non-equilibrium fashion. Both approaches to CCC recognize the importance of history and time, as well as space and geography, since changes to the social and political economy condition the path of evolution and transformation; and there are regional differences to growth and development as well. The acquisition of knowledge, technical skills and economies of scale/scope affect the path of growth and development in complex and multifarious ways. Both theories explain real world processes that impact nations and regions, and which help explain differences in the outcomes between regions and areas.

The fourth similarity is that cumulative processes often have endogenous contradictions embedded in their dynamics. This aspect has been under-emphasized in the literature, yet it is very important since it means that cumulative changes may sow the seeds of their own demise. When David Gordon (1991), for instance, criticized Kaldor's theory for having too much cumulation and not enough contradiction, he was cognizant of the problem but underplayed the degree that Kaldor himself recognized the problem (e.g., see Kaldor 1966). Setterfield (2001) has set the record straight for Kaldor, since, for instance, regimes of accumulation often have norms and mores that become locked-in, even when industrial change is required (see also Argyrous 2001 and Toner 2001). For Myrdal, on the other hand, the contradictions are more obvious, since cumulation occurs more specifically in tandem with uneven development; and counteracting forces can often be strong (though themselves cumulative, perhaps in a different direction).

3.1(C) THE "BIG PUSH" THEORY

Rosentein Rodan has given the "big push" theory. The thesis is that a big push or a comprehensive programme of a high minimum amount of investment is necessary for the development of the less developed countries. This warrants external economics arising from the simultaneous development of interdependent industries. Thus invisibilities and external economics from a minimum (but high) investment is needed for massive development.

There are three types of indivisibilities and external economy, they are discussed below.

a) Indivisibilities in the Production Function:

This means the indivisibility of the supply of overhead capital. This is lumpiness of capital. According to Rosenstein Rodan, the indivisibilities of inputs or processes lead to increasing returns. Social overhead capital comprising basic industries like power, transport and communications is indirectly productive.

It has a long gestation period. A large initial lump of investment has to be made. There social overhead capital has four indivisibilities. First, it is irreversible I time so that it should precede other directly productive investment. Second, it has a minimum durability and hence it is lumpy. Third, it has a long gestation period. Last, it has an irreducible minimum industry mix of different public utilities. These indivisibilities are obstacles to economic development. So, a high initial investment in social overhead capital is necessary before quick yielding investment projects are taken.

b) Indivisibility of Demand

It also means complementarily of demand. Interdependent industries should be set up simultaneously. That is investment decisions are interdependent. If an individual investment project is undertaken in an isolated manner, it has to face the risk because of uncertainly as to whether there is a market for its products. Rosenstein gives the examples of a shoe factory whose workers may not spend their entire wages of shoes. The people outside the factory may be too poor to spend on shoes. As a result the factory will not thrive for lack of demand.

c) Indivisibility in the supple of savings

This refers to high income elasticity of savings. A high minimum size of investment requires high level of savings. But I underdeveloped countries, savings are low as income is low. Because of these three undivisibilities arresting development a "big push" or a high minimum quantum of investment as required for economic development.

Criticism

1. The big push theory relies for its success upon external economics. But external economics due to large investment I exports and import substitutes are negligible.

2. Investment in consumer goods and public utilities may not have large external economics. Investments in the case of fairly inelastic demand are cost reducing rather than output expanding. External economics are meager in the case of cost reducing investment.

3. Investment in the agricultural sector is neglected in this theory.

4. High investment on social overheads is expensive. There is a long gestation period. There will be shortage of consumer goods. This would generate inflationary pressures.

5. There are also some administrative and institutional difficulties.

3.1(D) Balanced and Unbalanced Growth

3.1.1BalancedGrowth

In macroeconomics, balanced growth refers to classes of equilibrium growth paths, while in development economics the term refers to a particular development strategy. These two uses of the term are clearly distinct, and each will be discussed in turn.

The concept of a balanced growth path is a central element of macroeconomics. It refers to equilibrium in which major aggregates, usually but not exclusively output and the capital stock grow at the same rate over time, and the real interest rate is constant. Most textbook growth models are constructed in a way that delivers this outcome. This is partly motivated by theoretical convenience, but also by historical observation. The conventional wisdom is that real interest rates and the capital-output ratio are surprisingly stable over long spans of time, at least in developed countries. Balanced growth is not an inevitable property of growth models. It was not until the publication of classic papers by Solow (1956) and Swan (1956) that economists saw how a balanced growth path might arise from relatively appealing assumptions. The key insight is that a stable equilibrium path requires the possibility of substitution between capital and labour. The Solow-Swan model has subsequently underpinned much empirical work on economic growth, and has also influenced short-runmacroeconomics.

The existence of a balanced growth path requires strong assumptions. The usual derivation assumes that aggregate output can be written as a function of the total inputs of capital and labour, with diminishing returns to each input and constant returns to scale overall. In addition to the conditions needed for aggregation, either the production function should be Cobb-Douglas, or technical progress should be restricted to the labour-augmenting type. In other words, when technology advances, it should be "as if" the economy had more labour than before, and not "as if" it had more capital.

Because these assumptions are strong, any use of balanced growth to rationalize the data tends to create new puzzles. For example, why should technical progress be exclusively labour-augmenting, as stability of real interest rates would require? Acemoglu (2003) has examined this question using an incentives-based model of technical change, but in general, balanced growth seems a less than inevitable outcome of a real-world growth process. The picture is even more complicated when there are multiple sectors, whether differentiated as capital and consumer goods, or as different types of final goods. As might be expected, where multiple sectors are present, the conditions needed for balanced growth become even stricter. Greenwood et al. (1997) and Kongsamut et al. (2001) are two useful references on multi-sector growth models. None of this is to deny that balanced growth is a useful concept.

The idea plays an important role in teaching and research in macroeconomics because of its simplicity and explanatory power. As with all organizing frameworks, however, it is a good idea to be aware of its limitations, and the possibilities that lie outside it. In macroeconomics, balanced growth is usually associated with constant returns to scale. For most development economists, the term is more strongly associated with increasing returns, and a debate that began with Rosenstein-Rodan (1943). He argued that the post-war industrialization of Eastern and South-Eastern Europe would require coordinated investments across several industries. The idea is that expansion of different sectors is complementary, because an increase in the output of one sector increases the size of the market for others. A sector that expands on its own may make a loss, but if many sectors expand at once, they can each make a profit. This tends to imply the need for coordinated expansion, or a "Big Push", and potentially justifies a role for state intervention or development planning. Another influential contribution by Nurkse (1953) made similar points, giving more emphasis to the links between market size and the incentives to accumulate capital.

3.1.2 The Unbalanced Growth

Unbalanced growth is a situation in which the various sectors of a given economy are not growing at a rate similar to one another. Specific sectors of the economy will be growing at a rapid rate, while other sectors are either stagnant or experiencing a significantly reduced rate of growth. When economic growth patterns such as unbalanced growth appear, the phenomenon usually indicates that major shifts in the overall economy are about to take place.

There are a number of different theories about what produces unbalanced growth. Some opinions are based on an imbalance between imports and exports connected with the economy of the country. This understanding involves production that once took place within the country has now moved to another nation. While the goods are still available, they are now imported rather than produced domestically. The result is the elimination of jobs within a given industry, a rise in unemployment, and a reduction in disposable income. While

imports rise, other economic segments of the consumer market fall. This creates an unbalanced growth overall.

Depending on the conditions surrounding unbalanced growth, the country may or may not have the resources to bring the overall growth back into some sort of balance. For example, the country may no longer have the production facilities to manufacture goods that are now imported regularly. Even if the facilities exist, the average production cost per unit may render the domestic goods unable to compete with the low cost associated with imported goods. Industry can sometimes make adjustments that will help restore a degree of balance to unbalanced growth patterns within an economy. This may include finding ways to cut production costs as a means of lowering prices and stimulating consumer purchases in depressed markets. While theorists disagree on what can be done about unbalanced growth, many do agree there is no one magic formula that will apply in all situations. This means that each incident of unbalanced growth must be addressed individually, the origins determined and appropriate steps taken to correct the situation.

Contrary to the theory of balanced growth, in Hirschman's opinion, the real bottleneck is not the shortage of capital, but lack of entrepreneurial abilities. Potential entrepreneurs are hindered in their decision-making by institutional factors: either group considerations play a - great role and hinder the potential entrepreneur, or entrepreneurs aim at personal gains at the cost of others and are thus equally detrimental to development. In view of the lack of entrepreneurial abilities there is a need for a mechanism of incentive and pressure which will automatically result in the required decisions. According to Hirschman, not a balanced growth should be aimed at, but rather existing imbalances— whose symptoms are profit and losses—must be maintained. Investments should not be spread evenly but concentrated in such projects in which they cause additional investments because of their backward and forward linkages without being too demanding on entrepreneurial abilities. Manufacturing industries and import substitutions are relevant examples. These first investments initiate further investments which are made by less qualified entrepreneurs. Thus, the strategy overcomes the bottleneck of entrepreneurial ability.

Point to ponder is that being one of the strongest nations in the world USA did not show streamlined growth at the time of Bush as the president of USA. The fiscal house left by the Bush Administration is in shambles. His last year yielded a one trillion dollar deficit which produced nothing. With the deficit running 3 billion dollars a day he still managed to lose 3.6 million jobs. Even without this loss Bush still had the worst job creation record since Hoover. Obviously nothing in Bush's economic plan has worked. Thus it would seem to be imperative to reverse the Bush spending increases and tax cuts either before or concurrently with new spending plans.

The required steps would be to rescind all of the Bush tax cuts even those "middle class" cuts immediately. Reverse the efforts at privatization now costing 400 billion per year. Dramatically reduce the one trillion going for defense, Wars, CIA, black ops, Homeland Insecurity etc. There has never been a better time to employ fiscal conservatism than now in regards to the Republican inspired fiscal fiasco. Everything Bush must go! Republicans want budget cuts, give them a truckload.

3.2 Critical Minimum Effort Thesis

Prof. Harvey Leibenstein recommends a "critical minimum effort" to lift the underdeveloped economy from the low level equilibrium of low per capital income and lend it to sustained development every economy is subject to "shokes" which reduce per capita income and "stimulants" which raise it. When income-raising stimulants are more pressing than income depressing shocks, the critical minimum effort takes place and the economy moves on to development.

According to Leibenstein, population growth rate is a function of the level of per capital income. There is a biologically determined maximum population growth rate 3 to 4%. In order to overcome this population hump, the necessary critical minimum effort should be large enough. Fig(3) explains this.
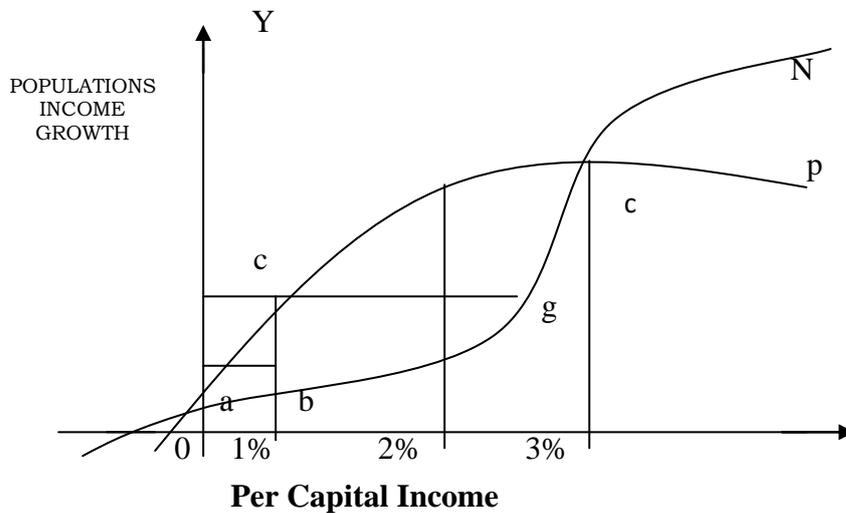
Per Capital Income

The curve N indicates national income growth generated by the level of capital income, the curve P Indicates population growth at each level of per capita income. Point 'a' is subsistence equilibrium point where there is absence of population and income growth. At this stage, fertility and morality rates are high AT1% to 3% level of per capital income population growth in higher than income growth. This is caused by decreasing mortality rate coupled with the birth rate not declining. At and beyond 3% level of per capital income, population growth starts declining due to fall in birth rate. The per capital income is an income generating force while population growth rate induced by the former is a depressing factor. It is thus imperative that the initial investment effort must be above a certain minimum to generating higher per capital income I order to overcome the depressing force of population.

There are other depressing forces like internal diseconomies due to indivisibilities of factors, of production cultural and institutional factors. In order to overcome them also, the critical minimum effort should be much above the subsistence income level to generate sustained development. The rationale of the critical minimum effort rests on certain growth agents like the entrepreneur, the investor, the saver and the innovator, there are also certain incentives such as zero sum incentives which do not raise national income, but have only a

distributive effect and the positive sum incentives that raise national income. The letter incentives promote development.

Criticism

We shall indicate very briefly the defects of this thesis, the raising per capital income may not bring about a fall in birth rate. The thesis ignores the State efforts to reduce the birth rate. It also not likely that the higher than 3% growth rate, would lead to the take into off. The theory does not take into account the time taken for reaching sustained growth. It also not does not explain the impact of foreign capital on income, saving and investment.

3.2(A) Nelson's Low Income equilibrium trap

The theory of Low Level Equilibrium Trap has been developed by R.R. Nelson for underdeveloped countries. It states that when per capita income increases above the minimum specific level, population tends to increase. But when the growth rate reaches an upper physical limit as the per capita income increases, the growth starts declining. To put in the words of Nelson, "The malady of underdeveloped economies can be diagnosed as a stable equilibrium level of per capita income at or close to subsistence requirements." At this stable equilibrium level of per capita income, both rate of investment and saving are low.If the per capita income is increased above the specific level through saving and investment, it increases a growth in population. The increase in population growth as a result pushes down per capita income to its stable level of equilibrium. Thus, the economy is caught in a low level equilibrium trap. To come from this trap, the rate of increase of growth of income must be higher than the rate of increase in population.

Conditions for Trapping:

There are certain conditions conducive to trapping as detailed below:

1. A high correlation between the level of per capita income and rate of population growth;
2. A low propensity to direct additional per capita income to increase per capita investment;
3. Scarcity of uncultivated arable land;
4. Inefficient production methods;
5. Cultural inertia and economic inertia.

1. Income Determination Equation:

The income depends upon capital stock, size of population and the level of technique. Capital consists of produced goods and arable land used in production process. Economies caught in low level equilibrium trap are often marked by considerable stock i.e. the existing inputs are not producing the maximum amount of output.

2. Population Growth:

Low per capita income can bring temporary changes in the rate of population growth and this change is brought by change in death rate. The change in death rate is caused by the change in the level of per capita income. But when the per capita income reaches to a specific level, it has no effect on the death rate.

3. Net Capital Formation:

Net investment consists of capital created out of savings. Capital can be created out of current income at an alternative cost of consumption and if that is unused land then capital may be increased by putting this land to cultivation. The rate at which the additional units of land are cultivated is positively related to increase in population.

Diagram Representation:

With these three relationships, it is easy to verify that an underdeveloped economy is caught in a low level trap.
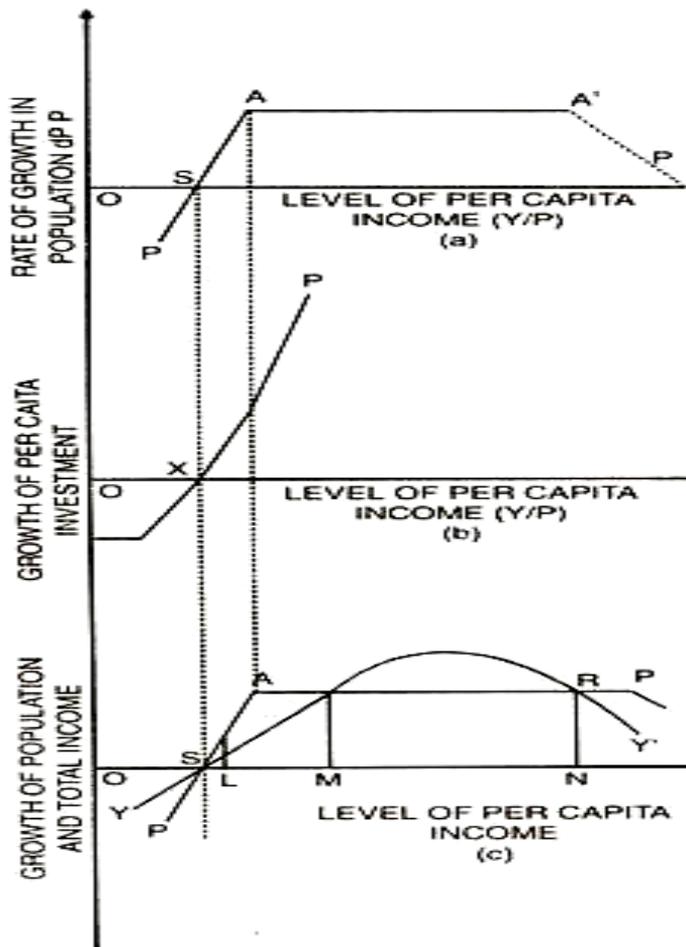

Fig. 1

Its Explanation is as under:

In fig. (1) (a), per capita income y/p is expressed on X- axis and rate of growth in population on Y-axis. In this figure, the point S is the minimum specific level of per capita income, where the level of per capita income is equal to the growth curve of population. The population towards left of this point starts decreases above the certain minimum specific level, the population increasing till it reaches its 'upper physical limit'.

For sometime, population will grow with the increase in real income i.e. from A to A'. The growth of population will continue up to the point of A' and after this, it starts declining. This decrease is due to rise in per capita income level and at this stage, people become conscious about their living standard and try to adopt small family. Therefore, the curve pp represents the population growth path at different levels of per capita income.

In fig. 1 (b), level of per capita income is taken on X-axis and growth of per capita investment is taken on Y-axis. In the diagram, X denotes the level of income with zero saving i.e. all income is spent on consumption. There is negative investment towards the left of X because savings are negative. The per capita income rises above the zero saving level as it moves towards right of X. As a result, investment curve 'I' rises and it has no upper physical limit.

In fig. 1 (c), level of per capita income is represented along X-axis and rate of growth of population and total income along Y-axis. For simplicity, it is assumed that minimum specific level of per capita income S is the same as the zero saving level of per capita income. The point S in this diagram represents the point of the low level equilibrium trap. It shows that the inter-section of population growth curve PP' and the income growth curve YY' occurs at the zero rate of growth. This exhibits that the growth rate of income equals the growth rate of population.

The two economists John Fei and Gustav Ranis presented their dual economy model. There was a flaw in Lewis model that it did not pay enough attention to the importance of agri. sector in promoting industrial growth. But **Fei-Ranis (FR) model of dual economy** explains how the increased productivity in agri. sector would become helpful in promoting industrial sector. In this respect, it presents three stages whereby a UDC moves from stagnation to self-sustained economic growth. Thus, this model is treated as an improvement over Lewis model of unlimited supply of labor.

Basic Thesis of the Model:

This theory is concerned with a poor economy which has following properties:
  I.   There is an abundance of labor in such UDC and shortage of natural resources.
  II.   The population growth rate is very high which results in mass unemployment in the economy.
  III. The major share of population is engaged in agriculture. But agriculture sector is stagnant. Hence, the marginal productivity of labor is zero and negative in agriculture sector.
  IV.   There are certain non-agrarian sectors in the economy where there is reduced use of capital.
  V.   There is a dynamic industrial sector in the economy.

Thus the model suggests that:

"Economic development would be taking place if agricultural laborers are transferred to industrial sector where their productivity will increase".

As we told earlier that it is a dual economy where there is a stagnant agri. sector and dynamic industrial sector. The situation where MPL - 0, labor can be transferred to industrial sector without any loss in agricultural output. The real wages in industrial sector remains

fixed and it is equal to the initial level of real income in agri. sector. Such wages are given the name of institutional wages.

3.3 Dualism Theories

Dualism theories assume a split of economic and social structures of different sectors so that they differ in organization, level of development, and goal structures. Usually, the concept of economic dualism (BOEKE 1) differentiates between two sectors of economy:

- the traditional subsistence sector consists of small-scale agriculture, handicraft and petty trade, has a high degree of labour intensity but low capital intensity and little division of labour;
- the modern sector of capital-intensive industry and plantation agriculture produces for the world market with a capital-intensive mode of production with a high division of labour.

The two sectors have little relation and interdependence and develop each according to its own pattern. The modern sector can be considered an economic enclave of industrial countries, and its multipli-cator and growth effects will benefit the industrial countries but have little effect on the internal market.

Several authors stress the dualism of specific factors. ECKHAUS (4), for instance, differentiates, in his concept of technological dualism, between labour and capital-intensive sectors. GANNAGE (7) explains regional dualism as a lack of communications and exchange between regions, the capital sometimes being an island which, in geographical terms, belongs to the developing country, in economic terms, however, to the industrialized country. Economic, technological, and regional dualism are often the consequence of a social dualism, the absence of relationships between people of different race, religion, and language, which, in many cases, is a legacy of colonialism.

Development in dualism concepts is the suppression of the traditional sector by concentrating on and expanding the modern sector. In time, it is assumed that the trickle down effects will reduce and abolish dualism. In this line of thinking, the main problem is capital formation because its degree determines the scope and speed of expansion of the modern sector. In general, agriculture has to provide the resources, labour as well as capital, for expanding the modern sector. In details, the strategies vary. Some authors, like LEWIS (14) and FEI/RANIS (5), assumed that a reduction of the labour force in agriculture, because of the widespread disguised unemployment, would not reduce agricultural production. The productive employment of these labourers in the modern sector would increase the total production of the economy and hence priority of investment in industry is necessary. Concentration on the modern sector led to an increasing regional disparity, rural urban migration, urban unemployment, a decrease in agricultural production, and hindrance in industrial development because of a lack of purchasing power in the rural areas. The anticipated trickle-down effects hardly ever happened. In praxis, development plans following this line of thinking led to failures like the early Indian development planning. Therefore, other authors, like JORGENSON (10), LELE (12), and MELLOR (17), emphasize the important role of agriculture at the beginning of development, i.e., preceding or parallel to industrial development in order to provide enough internal resources for the development process.

3.4 Stages of Fei-Ranis Model:

Fei and Ranis develop their dual economy model with the help of three stages of economic growth. They are presented as:

Diagram/Figure:
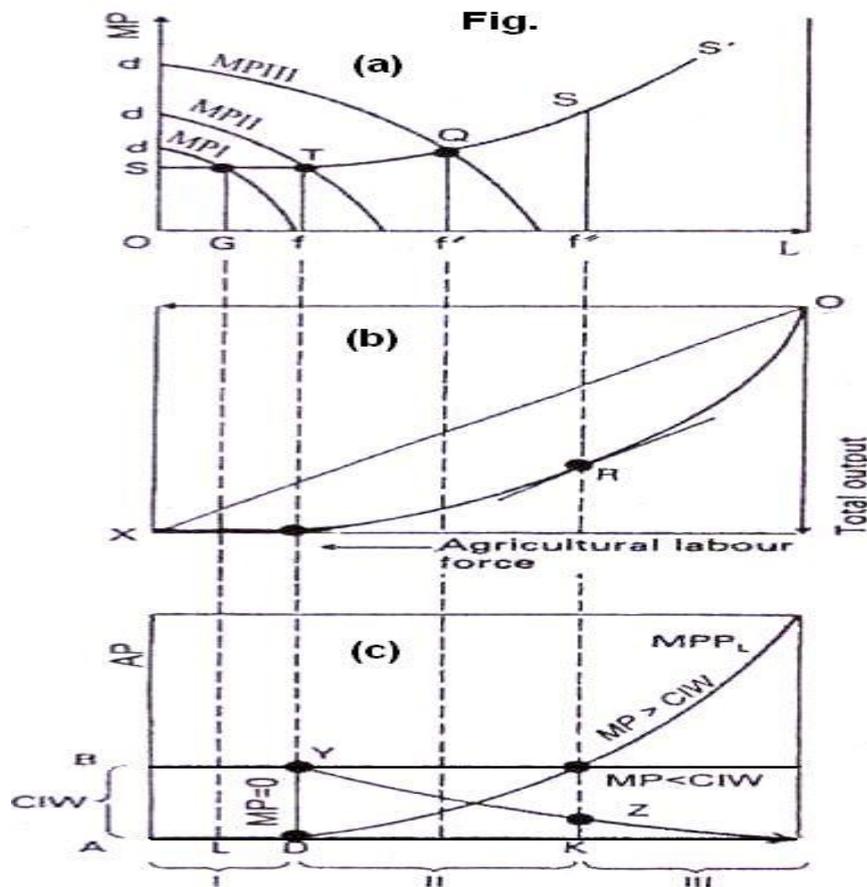
In the (a) part of the Fig., the labor supply curve is perfectly elastic, as between S and T. In phase (I) as shown in (c) part of Fig., the MPL = 0. In other words AL = MPL = 0. But here APL = AB. Following Lewis the FR model argues that AD units of labor are the surplus amount of labor in agri. sector which is prey to disguised unemployment. Therefore, they can be withdrawn from agri. sector without changing agri. output. In phase (II) APL > MPL, but after AD, MPL begins to rise (c part of Fig). The growth of labor force in industrial sector increases from zero to OG (a part of Fig). The APL in agri. sector is shown by BYZ curve (c part of Fig).

After AD as migration takes place from agri. sector to industrial sector MP, > 0, but AP[_ falls. This shows a rise in real wages for industrial labors because of shortage of food supply. An increase in real wages will reduce profits and the size of 'surplus' which could have reploughed for further industrialization.

The investment in industrial sector (with the surplus earned) will shift the MP curve outward right as from aa to bb and then to cc. In this way agri. sector will be able to get rid of labor until the MPL = real wages = AB = constant institutional wage (CIW) which is obtained by dividing the total agri. output ORX (b part of Fig) by AD amount of labor. In

other words, the slope of ORX curve represents real wage rate. Thus the MPL = CIW where the tangent to the total output line ORX at X is parallel to OX. In the second phase DK amount of labor were employed. But still MPL < CIW or CIW > MPL. It means that in this phase still a certain amount of labor is surplus or they are prey to disguised unemployment.

The *first stage of FR model* is very similar to Lewis. Disguised unemployment comes into being because the supply of labor is perfectly elastic and MPL = 0. Therefore, such disguised unemployed are to be transferred to industrial sector at the constant institutional wage.

In the **second stage of FR model** (phase) agri. workers add to agri. output but they produce less than institutional wage they get. In other words, in the second stage the labor surplus exists where APL > MPL, but it is not equal to subsistence (institutional) wages. Accordingly, such disguised unemployed also have to be transferred to industrial sector. If the migration to industrial sector continues a situation is eventually reached where the farm workers produce output equal to institutional wages. This would mean that productivity in agri. sector has gone up. With this the third phase (stage) starts.

In the *third stage of FR model* the take-off situation comes to an end and there begins the era of self-sustained growth where the farm workers produce more than the institutional wage they get. In this stage of economic growth the surplus labor comes to an end and the agri. sector becomes commercialized sector. All such is explained with the Fig.

Accordingly, they have to be shifted to industrial sector. As labor are transferred to industrial sector a shortage of labor will develop in agri. sector. In other words, it will be difficult for the industrial sector to get the labor at same prevailing constant wages. As a result, the wages in the industrial sector will rise as from T to Q in (a) part of Fig.

After point T the turn which occurs in the SZ curve is known as "Lewis Turning Point". In the 3rd phase the agri. laborers produce more than CIW. (As here MPL > CIW shown in (c) part of Fig). In this phase the take off comes to an end and self-sustained growth starts. This is also known as *point of commercialization (of agri.) in FR model.* Here the economy is fully commercialized in the absence of disguised unemployment. Such commercialization took place at the cost of absorption of disguised unemployment in industrial sector.

The amount and time to re-allocate labor will depend upon:

(i) The rate of growth of industrial capital which depends upon the growth of profits in industrial sector and growth of surplus generated within the agri. sector.
(ii) The nature and bias of technical progress in industry.
(iii) The rate of growth of population. It means that the rate of labor transfer must be in excess of the rate of growth of population.
The three phases of labor transfer are summarized as:
In phase I: MPL = 0 and there exists the surplus labor equal to AD.
In pnase II: CIW > MPL > 0 and there exists the open and disguised unemployment equal to AK.

In phase III: MPL > CIW and the economy is fully commercialized and disguised unemployment is exhausted. The supply of labor curve becomes steeper and both agri. and industrial sector compete with each other to get labor.

Thus we find that whereas Lewis had failed to offer a satisfactory explanation of this subsistence sector and ignored the real impact of population growth on the choice of capital intensity on the process of surplus labor absorption. Moreover, FR model emphasized upon the simultaneous growth of agri. and industrial sectors. Thus FR model believes in 'Balanced Growth' in the take-off stage. It means that there should be a simultaneous investment in both agri sector and industrial sector. According to FR model in the beginning the surplus rises; such surplus will bo available as a capital in the take-offstage. Some part of this surplus will be used in agri. development, while some part will be reploughed in industrial development. As a result, both agri. and industrial sectors will grow under 'Balanced Growth' pattern.

Thus, three major points are highlighted in the FR mode:

(i) Growth of agri. is as important as the growth of industry.
(ii) There should be a balanced growth of agri and industrial sectors.
(iii) The rate of labor absorption must be higher than the rate of population growth to get out of the "Malthusian Nightmare".

FR model argued that surplus can be generated by the investment activities of the land lords and by the fiscal measures of the govt. However, leakages could exist because of the cost of transferring the labor from agri. sector to industrial sector in the form of transport cost and building of schools and hospitals, etc. Moreover, the transference may lead to increased per capita consumption of agri. output, and a gap may also emerge in case of rural wages and urban wages. Again, if the supply curve of- the labor is backward bending, the peasants may reduce their work effort as their incomes rise.

Criticism:

The FR model is considered to be an improvement over Lewis. This model presents a balanced growth of both the sectors of the economy, the most notable thing for the growth of UDCs. Despite this fact, this model has following shortcomings:

(i) Marginal Productivity of Labor in Phase I: The FR model is of the view that MFL = 0 in the first phase of growth, and the transfer of labor from agri. would not reduce output in the agri. sector in phase I. But the economists like Berry and Soligo are of the view that agri. output in phase I of FR model will not remain constant and may fell under different systems of land tenure, i.e., the peasant proprietorship and share cropping etc.

(ii) Marginal Productivity of Labor is Not Zero: Prof. Jorgenson who has also presented a model of 'dual economy' has object FR model's contention of zero MP in phase I. He says whether MPL will be zero is an empirical issue. During the seasons of sowing and harvesting the MPL > 0. Jorgenson concluded on the basis of Japanese data even for the pre I world war period the supply of labor was not unlimited. Then how MPL can be zero.

(iii) Ignoring The Role of Capital: The FR model concentrated upon land and labor as the determinants of output, ignoring the role of capital. But Profs. Brown, Byres, Frankel, Griffen, Ghatak and Ingersent are of the view that in the UDCs there has occurred what is

known as 'Green Revolution' in agri. which has promoted the greater use of capital and technology on lands. Consequently, there has been a greater increase in the agri. productivity and agri. incomes.

(iv) Open Economy: FR model ignored the role of foreign trade as it assumed a closed economy model. In the 2nd phase when agri. product decreases the TOT goes against industrial sector. This would occur in the presence of closed economy. But if the model is made open such would not happen as the goods could be imported in the presence of then-scarcity. This was especially observed in case of Japan which imported cheap farm products to improve her TOT (terms of trade).

(v) Supply of Land in Long Run: FR model assumed that in the process of economic development the supply of land remained fixed. But it is not true. The supply of land can be increased in case of long run.

(vi) Commercialization Of Agri. And Inflation: According to FR model when 3rd phase starts the agri. sector becomes commercialized. But it is criticized by saying that this phase does not start so easily The shifting of labor to industrial sector will create labor shortage in agri. sector. This will create shortage of food stuff leading to increase their prices. In this way, the inflation will generate which may obstruct the process of development.

(vii) Low Productivity in Agri Sector: According to Jorgenson it has been observed that there has been a very slow rise in the productivity of agri. sector. Consequently, the surplus will hardly be created in agri. sector. Accordingly, agri. sector will not contribute to development Thus the growth requires that the surplus must be generated and it should persist.
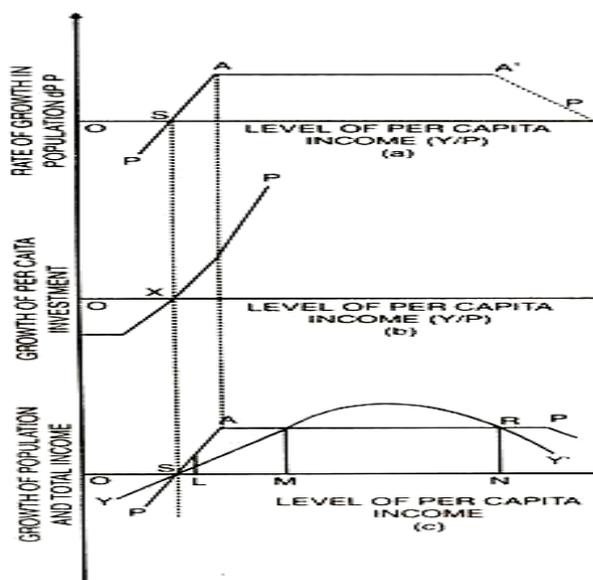

Fig. 1

In low level equilibrium trap, any small increase in per capita income is not able to sustain itself or lead to further increase in per capita income. In fig. 1 (c), at point L, the rate of growth of population is higher than the rate of growth in the total income. Consequently, per capita income will fall to previous low equilibrium level OS, which is the point of stable equilibrium. All this happens towards left of M because here the growth in population is greater than rate of growth in total income.

Thus, the economy will be caught in the low level equilibrium. According to Prof. Nelson, this low level equilibrium trap will be stronger more quickly, the rate of population growth responds to a given rise in per capita income and more slowly the rate of growth in total income responds to an increase in investment. It is only possible when the level of per capita income is increased by a discontinuous jump beyond the level of per capita income i.e. more than SM.

In short, a country can hope to come out of low level equilibrium trap because the rate of growth of total incomes exceeds the rate of growth of population. Again, beyond point 'R', further action is required by the active role of Government to raise the level of income above the growth of population. For instance, if BM is taken as 3%, then Nelson says that if a country has to break the shackles of low equilibrium trap, its rate of growth must be higher than 3% per annum.

Factors Escaping Low Level Equilibrium Trap:

The following factors are suggested to escape from the low level equilibrium trap:

1. There should be favourable socio political environment in the country.

2. Capital and income should be enhanced by obtaining funds from abroad/international institutions.

3. Improved techniques should be used to utilize existing resources.

4. The requisite methods should be adopted to change distribution of income.

5. Social structure can be changed by laying stress on thrift and entrepreneurship so that there must be ample opportunities, incentives to limit the size of family.

6. Solid investment programme should be introduced by the Government.

7. Efforts should be made to increase production with modern and latest techniques of production.

To conclude the discussion, if the growth rate of income is increased more than growth rate of population, then only low level of equilibrium trap can be escaped. Once this is achieved above a certain per capita income level, the continuous growth process will take place without any further government action until a high level of per capita income is attained.

3.5 Dixit and Marglin model

The Dual economy models has been extended to include dynamic behaviours. These models are fairly complex s they deal with dynamic optimization problem (see Dixit 1968; marglin 1976) . here we summarize their main features only.

In the lewis and FR models, the supply curve of labour is assumed to be perfectly elastic at a given real wage rate W which is fixed either by the subsistence level or by institutional consideration. At full employment APL <W. given the paucity of capital. Marglin (1976) has shown that in an economy with the features described by Lewis and Fei and Ranis, over a finite planning horizon, a dynamic optimal employment policy maximizes neither output nor surplus, but is in between and the rule to purse a dynamic investment policy is that the demand price of investment should be greater than the marginal utility of consumption. The rule in the neoclassical theory is that the demand price of investment should be equal to the marginal utility equal to per capita consumption,i.e. investment is allowed to take place-at the cost consumption. As phase II ends after a given time, per capita consumption is allowed to rise as the economy enters the neoclassical era. However Dixit does not pay much attention either to the agricultural sector or to the terms of trade between agriculture and Industry marketed surplus. There are political and institutional constraints which can affect the solutions (Marglin1976).

Questions

1. Definition of Vicious circle of Poverty
2. Explain the "big push" theory
3. Evaluate the Balanced and Unbalanced Growth
4. Explain the Critical Minimum Effort Thesis
5. Define Dualism Theories
6. Explain Stages of Fei-Ranis Model
7. What are the Factors Escaping Low Level Equilibrium Trap

Sectoral Aspects of Development

Agriculture occupies a very important place in the economic life our country. It is the backbone of our economic system. Agriculture has been the major source of livelihood in the Indian economy. India is primarily an agricultural country. The fortunes of the economy are, even now, dependent on the course of agricultural production. The importance of agriculture in the national economy can be best explained by considering the role of agriculture under the following heads.

4.1 Role of Agriculture in Economic Development:

The agriculture sector is the backbone of an economy which provides the basic ingredients to mankind and now raw material for industrialization. Therefore, the role of agriculture for the development of an economy may be stated as below:

1. **Contribution to National Income:**

The lessons drawn from the economic history of many advanced countries tell us that agricultural prosperity contributed considerably in fostering economic advancement. It is correctly observed that, "The leading industrialized countries of today were once predominantly agricultural while the developing economies still have the dominance of agriculture and it largely contributes to the national income. In India, still 28% of national income comes from this sector.

2. **Source of Food Supply:**

Agriculture is the basic source of food supply of all the countries of the world—whether underdeveloped, developing or even developed. Due to heavy pressure of population in underdeveloped and developing countries and its rapid increase, the demand for food is increasing at a fast rate. If agriculture fails to meet the rising demand of food products, it is found to affect adversely the growth rate of the economy. Raising supply of food by agricultural sector has, therefore, great importance for economic growth of a country.

Increase in demand for food in an economy is determined by the following equation:

$$D = P + 2g$$

Here,

D stands for Annual Rate of Growth in demand for food.

P stands for Population Growth Rate.

g stands for Rate of Increase in per Capita Income.

2 stand for Income Elasticity of Demand for Agricultural Products.

3. Pre-Requisite for Raw Material:

Agricultural advancement is necessary for improving the supply of raw materials for the agro-based industries especially in developing countries. The shortage of agricultural goods has its impact upon on industrial production and a consequent increase in the general price level. It will impede the growth of the country's economy. The flour mills, rice shellers, oil & dal mills, bread, meat, milk products sugar factories, wineries, jute mills, textile mills and numerous other industries are based on agricultural products.

4. Provision of Surplus:

The progress in agricultural sector provides surplus for increasing the exports of agricultural products. In the earlier stages of development, an increase in the exports earning is more desirable because of the greater strains on the foreign exchange situation needed for the financing of imports of basic and essential capital goods.

Johnson and Mellor are of the opinion, "In view of the urgent need for enlarged foreign exchange earnings and the lack of alternative opportunities, substantial expansion of agricultural export production is frequently a rational policy even though the world supply—demand situation for a commodity is unfavorable."

5. Shift of Manpower:

Initially, agriculture absorbs a large quantity of labour force. In India still about 62% labour is absorbed in this sector. Agricultural progress permits the shift of manpower from agricultural to non-agricultural sector. In the initial stages, the diversion of labour from agricultural to non-agricultural sector is more important from the point of view of economic development as it eases the burden of surplus labour force over the limited land. Thus, the release of surplus manpower from the agricultural sector is necessary for the progress of agricultural sector and for expanding the non-agricultural sector.

6. Creation of Infrastructure:

The development of agriculture requires roads, market yards, storage, transportation railways, postal services and many others for an infrastructure creating demand for industrial products and the development of commercial sector.

7. Relief from Shortage of Capital:

The development of agricultural sector has minimized the burden of several developed countries who were facing the shortage of foreign capital. If foreign capital is available with the 'strings' attached to it, it will create another significant problem. Agriculture sector requires less capital for its development thus it minimizes growth problem of foreign capital.

8. Helpful to Reduce Inequality:

In a country which is predominantly agricultural and overpopulated, there is greater inequality of income between the rural and urban areas of the country. To reduce this inequality

of income, it is necessary to accord higher priority to agriculture. The prosperity of agriculture would raise the income of the majority of the rural population and thus the disparity in income may be reduced to a certain extent.

9. Based on Democratic Notions:

If the agricultural sector does not grow at a faster rate, it may result in the growing discontentment amongst the masses which is never healthy for the smooth running of democratic governments. For economic development, it is necessary to minimize political as well as social tensions. In case the majority of the people have to be kindled with the hopes of prosperity, this can be attained with the help of agricultural progress. Thus development of agriculture sector is also relevant on political and social grounds.

10. Create Effective Demand:

The development of agricultural sector would tend to increase the purchasing power of agriculturists which will help the growth of the non-agricultural sector of the country. It will provide a market for increased production. In underdeveloped countries, it is well known that the majority of people depend upon agriculture and it is they who must be able to afford to consume the goods produced.

Therefore, it will be helpful in stimulating the growth of the non- agricultural sector. Similarly improvement in the productivity of cash crops may pave the way for the promotion of exchange economy which may help the growth of non-agricultural sector. Purchase of industrial products such as pesticides, farm machinery etc. also provide boost to industrial dead out.

11. Helpful in Phasing out Economic Depression:

During depression, industrial production can be stopped or reduced but agricultural production continues as it produces basic necessities of life. Thus it continues to create effective demand even during adverse conditions of the economy.

12. Source of Foreign Exchange for the Country:

Most of the developing countries of the world are exporters of primary products. These products contribute 60 to 70 per cent of their total export earning. Thus, the capacity to import capital goods and machinery for industrial development depends crucially on the export earning of the agriculture sector. If exports of agricultural goods fail to increase at a sufficiently high rate, these countries are forced to incur heavy deficit in the balance of payments resulting in a serious foreign exchange problem.

However, primary goods face declining prices in international market and the prospects of increasing export earnings through them are limited. Due to this, large developing countries like India (having potentialities of industrial development) are trying to diversify their production structure and promote the exports of manufactured goods even though this requires the adoption of protective measures in the initial period of planning.

13. Contribution to Capital Formation:

Underdeveloped and developing countries need huge amount of capital for its economic development. In the initial stages of economic development, it is agriculture that constitutes a significant source of capital formation.

Agriculture sector provides funds for capital formation in many ways as:

(i) Agricultural taxation,

(ii) Export of agricultural products,

(iii) Collection of agricultural products at low prices by the government and selling it at higher prices. This method is adopted by Russia and China,

(iv) Labour in disguised unemployment, largely confined to agriculture, is viewed as a source of investible surplus,

(v) Transfer of labour and capital from farm to non-farm activities etc.

14. Employment Opportunities for Rural People:

Agriculture provides employment opportunities for rural people on a large scale in underdeveloped and developing countries. It is an important source of livelihood. Generally, landless workers and marginal farmers are engaged in non-agricultural jobs like handicrafts, furniture, textiles, leather, metal work, processing industries, and in other service sectors. These rural units fulfill merely local demands. In India about 70.6% of total labour force depends upon agriculture.

15. Improving Rural Welfare:

It is time that rural economy depends on agriculture and allied occupations in an underdeveloped country. The rising agricultural surplus caused by increasing agricultural production and productivity tends to improve social welfare, particularly in rural areas. The living standard of rural masses rises and they start consuming nutritious diet including eggs, milk, ghee and fruits. They lead a comfortable life having all modern amenities—a better house, motor-cycle, radio, television and use of better clothes.

16. Extension of Market for Industrial Output:

As a result of agricultural progress, there will be extension of market for industrial products. Increase in agricultural productivity leads to increase in the income of rural population which is turn leads to more demand for industrial products, thus development of industrial sector.

According to Dr. Bright Singh, "Increase in agricultural production and the rise in the per-capita income of the rural community, together with the industrialisation and urbanisation,

lead to an increased demand in industrial production." In this way, agricultural sector helps promote economic growth by securing as a supplement to industrial sector.

Conclusion:

From the above cited explanation we conclude that agricultural development is a must for the economic development of a country. Even developed countries lay emphasis on agricultural development. According to Muir, "Agricultural progress is essential to provide food for growing non-agricultural labour force, raw materials for industrial production and saving and tax revenue to support development of the rest of the economy, to earn foreign exchange and to provide a growing market for domestic manufactures."

4.2 Efficiency and Productivity

Productivity

At its very core, productivity shows you the rate at which products are being developed or a task is being completed. When you are measuring productivity things get a little more complex than that. You have to take into account whether it's physical or office work, if the job requires a certain quality factor or the impact a specific industry's requirements may have on its workers. Nonetheless, productivity is an integral part of any successful company.

Efficiency

Efficiency is all about the comparison between what is really being produced or performed with what can be produced taking into account the same amount of resources, such as: money, time and labour. In simpler terms, efficiency measures whether there is any waste in your company. Depending on the industry you work in, efficiency may be more desirable than productivity, but usually their importance is proportionate.

Difference between Efficiency and Productivity

Efficiency is the ability to do something or produce something without wasting materials, time or energy. It is the quality or degree of being efficient. Productivity is the rate at which goods are produced or the work is completed. Efficiency and productivity are two important concepts in economics. Both concepts pertain to improving production in any company engaged in manufacturing, agriculture or the service sectors of the economy. This chapter helps to highlight the difference between the two words.

Productivity is the ratio of output to input in production. It is a measure of efficiency in production. Productivity refers to when something is produced, how much is produced, and in how much time. Quality and wastage are not important factors, but the quantity is. It focuses only on production. Economic well-being is a characteristic of production. It aims directly or indirectly to satisfy the human needs. The degree to which the needs are satisfied is the measure of economic growth. The satisfaction of needs comes from the commodities which are produced. The need also increases when the quality and price ratio improves, that too at a lesser cost.

By improving the quality and price of the product, the production is increased. The economic well-being increases due to the growth of income as the production increases. The most important forms of production are market production, public production and production in households. Market production is the prime source of economic well-being and therefore very important for the economy. Productivity in this economic system is the most important feature and an essential source of income.

Productivity measures may be examined across the whole economy or viewed industry by industry to examine the trends in labor growth, wage levels and technological improvement. Productivity gains are very important to the economy because they allow us to accomplish more with less. Capital and labor are both scarce resources, so maximizing their impact is always a central concern of modern business. Productivity enhancements come from technology advances, such as computers and the internet, supply chain and logistics improvements, and increased skill levels within the workforce. Productivity is measured and tracked by many economists as a clue for predicting future levels of GDP growth.

Effectiveness is described as the time, effort or cost well used to the task. According to Wikipedia, it is often used for the specific purpose of relaying the capability of a specific application of effort, which is used to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or effort. It is a measurable concept, which is determined by the ratio of output to input. As a result, it is expressed in a percentage of what ideally could be expected, as in 100% for ideal cases.

Effectiveness is all about doing things right. It is based on the principle that the selection of objects for a process is just as important as the quality of that process. It avoids mistakes and errors. It is based on thinking about the present, and not in the future which may result in no innovation. Efficiency is all about focusing on the process and the importance is given to the 'resources' of doing things. Efficiency is considered as the performance indicator of any organization. Productivity measures the output against the inputs required while efficiency measures the output against the expected standard output.

Comparison between Efficiency and Productivity:

	Efficiency	**Productivity**
Definition	It is the ability to do something or produce something without wasting materials, time or energy.	It is the rate at which goods are produced or the work is completed.
Measurement	It is the measure of waste in a system.	It is the measure of output produced by one unit of input.
Production	It is how much one produces in a given amount of time with resources.	It the amount of time one spends on productive tasks.
Depends on	It depends on the quality.	It just depends on production.

What is Sustainable Agriculture?

The goal of sustainable agriculture is to meet society's food and textile needs in the present without compromising the ability of future generations to meet their own needs. Practitioners of sustainable agriculture seek to integrate three main objectives into their work: a healthy environment, economic profitability, and social and economic equity. Every person involved in the food system—growers, food processors, distributors, retailers, consumers, and waste managers—can play a role in ensuring a sustainable agricultural system

Methods to promote soil health, minimize water use, and lower pollution levels on the farm. Consumers and retailers concerned with sustainability can look for "values-based" foods that are grown using methods promoting farm worker wellbeing, that are environmentally friendly, or that strengthen the local economy. And researchers in sustainable agriculture often cross disciplinary lines with their work: combining biology, economics, engineering, chemistry, community development, and many others. However, sustainable agriculture is more than a collection of practices. It is also process of negotiation: a push and pull between the sometimes competing interests of an individual farmer or of people in a community as they work to solve complex problems about how we grow our food and fiber.

4.3 The Role of Technology in Sustainable Agriculture

The notion that agriculture, as a global practice, has been exploiting resources faster than they could be renewed has been a topic of discussion and debate for decades, perhaps centuries. Symptoms of imbalance have been seen in the form of pollution, soil erosion/loss, wildlife population decline/shifts, and general alteration of a "natural" flora/fauna as a result of human intervention. Indeed, agricultural practices are undeniably "unnatural", regardless of whether the production is a one square meter vegetable garden in Tokyo or a one million hectare rubber tree plantation in Malaysia. Of course, an equally unnatural and parallel phenomenon has been the exponential growth in human population, with associated demands for both food and shelter, which have often exceeded the "natural" carrying capacity of land. Based upon the premise that human population growth will not be constrained as a result of food shortages due to overriding social values, this article makes three assertions regarding the role technology in sustainable agriculture:

➢ Technology has/will increase agricultural productivity
➢ Technology development has-been/will-be sustainable
➢ Technology is, therefore, the basis for Sustainable Agriculture

Food is subject to the economic principles of scarcity. Unlike the artificial value of scarce items such as gold, an adequate supply of food is paramount to population survival and skill diversification, making agriculture a first level priority. Technology has enabled human civilization to leave the "Hunter / Gatherer" paradigm of existence and concentrate labor and land to the sole purpose of food production on an ever-increasing scale. The concept of "scientific agriculture" dates to publications by Liebig in 1840 and Johnston in 1842, which speculated about the role of chemistry in agriculture (Pesek, 1993). The concepts of inheritance and Mendelian genetics were soon to follow in 1865 and subsequently stimulated the biological basis for modern agriculture. Soon, science-based institutions in Europe and North America eagerly expanded the application of biological and chemical sciences to agriculture, spawning new technologies and approaches. These early applications of technology have not only increased food production in real terms, but have dramatically reduced the number of individuals directly involved in food production/processing – enabling the diversification of society to address social issues not directly related to "survival", but generally seen to increase the quality of life.

To deny the role that biological and chemical technology have played, continue to play, and will play in the future development of agriculture is to deny natural history itself. The indiscriminate or inappropriate use of chemical and biological technology, however, can clearly produce negative consequences to the ecosystem and threaten the long-term viability of the enterprise. The central issue of sustainability, therefore, is preservation of nonrenewable resources.

Food production, habitat preservation, resource conservation, and farm business management are not mutually exclusive objectives. Credible arguments have been advanced to suggest that production of food via high-yield agriculture techniques can meet the nutrition requirements of the global population (Avery, 1995). The balance can be achieved through planning land use – with a considerate analysis of what parcels of land to employ for high-yield agriculture while retaining marginal or poor land for non-agricultural activities or wildlife habitat preserves (Anonymous, 1999). Studies to quantify the impact on production of reducing or limiting inputs to agriculture have suggested that yields/hectare would decrease from 35% to 80% depending upon the crop (Smith et al.). Without a concurrent decrease in demand, the amount of land that must be utilized would increase dramatically. In fact, global land in production today, which is roughly the size of South America, would need to be the size of South America and North America if the high yield benefits of technology were not employed (Richards, 1990). If the motivation of sustainability is optimization of production and resource conservation objectives, then progress can clearly be achieved.

Sustainability in agriculture relates to the capacity of an agro ecosystem to predictably maintain production through time. A key concept of sustainability, therefore, is stability under a given set of environmental and economic circumstances that can only be managed on a site-specific basis. If the perspective of sustainability is one of bias against the use of biological and chemical technology, and espouses a totally natural ecosystem, then agriculture as a practice is already excluded. If, on the other hand, the perspective of sustainability is one of preservation of non-renewable resources within the scope of the agricultural enterprise, then the objective is not only achievable, but good business practice and good environmental management.

To a large extent, the rate of technology development and the degree of innovation in future technologies will greatly influence the stability, and certainly the productivity, of agriculture (Hutchins and Gehring, 1993). Technology, in the classical sense, includes the development and use of nutrients, pest control products, crop cultivars, and farm equipment; but it also includes the vision of genetically modified crops providing greater nutritional efficiency (more calories per yield, or more yield), manipulation of natural pest control agents, and use of farm management techniques that focus on whole-farm productivity over time, not just annual production per hectare. Consider the basic premise of biotechnology: the least expensive and most renewable source of energy on Earth is the sun and the most abundant and predictable mechanism to convert the energy from the sun to useable energy is photosynthesis -- biotechnology has enabled methods to direct abundant natural energy to new more efficient or unique food products. The imagination is literally the limit to the opportunities. Short term objectives will of course focus on yield, quality, and input reduction. Long term, however, the genetically-created "transmissions" will focus on creating super-nutritious feed for animals, plants that out produce the subtractive influence of pests (making "tolerance" a key pest management tactic), physiological adaptation to out-compete adjacent species (e.g., weeds),

drought stress tolerance, and overall improvement in the rate of photosynthesis (leading to any number of industrial applications).

The development and use of agricultural technology is not, however, limited to genetic wizardry. Indeed, the use of computational technology, combined with geographical location devices and remote sensing advancements, promise to radically change the way all crops will be managed. Commonly referred to as "Precision Agriculture", the underlying theme is integration of information to create management knowledge as a means to address site-specific production goals. Uncertainty with the environment will always be a key issue with agriculture, but this too will be managed as environmental modeling, combined with risk management algorithms, will lead to the optimal use of genetics on specific soils within known weather profiles. And, breakthroughs will continue to be seen in the "classical" technologies that have exponentially increased world food production since the advent of "scientific agriculture" in the late 1800's. In addition to advances in productivity, technology will be used to remediate land that has been overused or misused through poor agricultural practices

The concept of Best Management Practices will continue to be a key focus, regardless of the current state of technological offerings. Strategies, such as Integrated Pest Management (IPM) consider the site-specific circumstances, but also the values and business considerations of the agricultural producers. IPM has been essential in describing the role and rationale for responsibly managing pests, pointing scientists and practitioners alike to identify future needs in biological information, and placing pest control in perspective with production goals. To this end, the concept of pest Economic-injury Levels has been central to dismiss the notion that pests must be controlled at all cost in favor of break-even analysis (i.e., Gain Threshold; Stone and Pedigo, 1972).

Sustainability is indeed an issue of survival, but is far broader than the concept of habitat destruction and soil erosion. Sustainability includes the goal of food production, welfare of the food producers, and preservation of nonrenewable resources. To that end, technology of all types has been and will be the enabling man-made component that will link these two overriding objectives. Indeed, history confirms that technology has been essential to agricultural productivity/stability, current breakthroughs in technology confirm that the discovery and development of new technologies is a sustainable endeavor, and common sense directs us to the conclusion that technology will enable Sustainable Agriculture.

4.4 Globalization and Agriculture Growth

Globalisation is the term used to describe the recent impact of innovations in communications and transport systems on trade and the growing interdependence of countries due to economic development and economic output. The nations have to reduce the high levels of protection between trading blocks of countries and to adopt policies to liberalise their

economies in order to increase their volume of trade, including trade in agricultural products. It has been proved that, for many countries, increased economic liberalisation and openness leads to growth. It is also recognised, however, that for some countries and for some communities within countries the transition from a protected, centrally controlled economy may bring with it serious, negative, short and medium term consequences.

These measures have resulted in benefits countries including the stimulation of private sector trading networks needed in a modern economy. A combination of the impact of structural adjustment programmes and partial reform of the rules governing international trade has reduced the prices of primary commodities exported countries and caused an increase in imports of agricultural products from more competitive producers, some of which remain highly subsidised in their country of origin.

Measures need to be adopted by a very wide range of agencies in both the public and private sectors. These range from a major effort to increase the understanding of issues in multilateral trade negotiations, urgent efforts to devise strategies to reduce economic dependence on primary commodities and major reforms of agricultural development and research strategies. We highlight the main issues that need to be addressed and to list important questions that need to be asked of policy-makers throughout the agricultural industry. The conclusions of this study are that decisionmakers should give urgent consideration to the following suggestions:-

1. Strengthening negotiating capacity in trade talks

Consideration should be given to establishing national and regional teams of experts with the necessary authority to analyse the interests of their stakeholder groups and to establish appropriate negotiating positions. The negotiators need to be directly linked the to policy makers and to the line Ministries of Trade, Agriculture and Finance, such that informed decisions can be made rapidly and effectively.

2. Over-supply of primary product exports

The plunge in prices has been caused by systemic over-production stimulated by components of structural adjustment programmes. Through small-scale production systems (small scale farmers) are unable to create new jobs or re-invest into alternative market sectors. Countries and individual farmers, who rely on cash crop production for revenue, are obliged to continue to grow and sell these commodities, no matter how low prices fall.

3. Trade protection

Greater efforts should be made to increase control of porous borders to discourage unwanted imports and to collect tax revenue. The dumping of heavily subsidised agricultural

commodities from developed countries should be actively opposed where such imports disrupt local farming economies. These efforts need to be pursued seriously Efforts should also be made to analyse the impact of imports of food aid and food monetisation schemes on domestic and regional farming. Such imports should be controlled with the objective of meeting relief needs whilst avoiding the undermining of local and regional production.

4. Production of Added-value products

The prices of primary agricultural commodities will continue to fall in the foreseeable future. Unless the mix of industrial activity is changed and economic growth will not occur.

5. Establishing an Agricultural Market Analysis Unit

This unit would be concerned with co-ordinating and developing policy on the development of market-orientated strategy in agriculture and setting policy guidelines for agricultural research.

6. Market Education Programme

A National Market Education Programme should be established targeted, primarily, the farmers, traders and agricultural product processors. Education, Trade, farmers' and traders' associations and other private sector actors and with extension services. The programme needs to set targets for training farmers to understand how competitive markets work, to take advantage of market information and to inform them of the difficulties and opportunities associated with market conditions.

7. Market Information Services/Commodity Exchange

Farmers find themselves in a weak bargaining position with traders which results in lower-than-market farm-gate prices, high transaction costs and wastage. Market Information Services need to be established at local, national and regional level to gather, process and disseminate market information in the appropriate language of intended recipients. Such services need to be fully co-ordinated with each other and involve full participation of stakeholders.

8. Agricultural research and extension and services

Research and extension services need to continue with their vital role in controlling plant and animal disease and pests, discovering and distributing new varieties, training farmers to improve their technical abilities The farmers need to ensure that the quality and packaging of those products meet the requirements of customers both on the domestic and export market. Research and extension services have a vital role to play in this effort and must be prepared to reform quickly to meet the challenges of globalisation.

9. Goods that can be compete with locally made products.

when they are rich in all the raw materials needed to make these products and have low labour costs

10. Market activity legalities

In some countries, road tolls and taxes are arbitrarily applied and often restrict trade and increase transaction costs of the end product.

4.5 Pattern of Industrialization in developing Countries

A whole creative side of India civilization and vibrant economy of Ancient and Medieval India had shrunk under the foreign rule. Down to the eve of British rule India had rich and prosperous economy due to its flourishing agricultural and manufacturing industries.

Indian industries not only met all local wants but also enabled India to export finished products which had a world-wide market. Indian exports consisted chiefly of manufactures like cotton and silk fabrics, muslins, calicoes, artistic ware, silk and woolen cloth.

The industrial pattern in India on the eve of planning 1950 was marked by:

(i) Low capital intensity:
It was the result of two factors first, the general level of wages in India was low, and, second, the small size of the home market in view of the low per capita income and the limited use of mass production (or high capital intensity) techniques resulted in low capital per worker employed.

(ii) Lop-sided pattern of industry:
The peculiarity of the industrial pattern of India was the high concentration of employment either in small factories and household enterprises, i.e., the lowest size- group or that there was a high concentration of employment in large factories, i.e., the highest size group. The medium sized factories did not develop in India.

The existence of this lop-sided industrial pattern was due to the colonial nature of our economy. The foreign firms and those owned by big business and industrial magnates were of a very large size coming at the top of the pyramid, and at the bottom were a very large number of indigenous small sized firms. The lop-sidedness of the industrial pattern was reflected in the absence of the middle entrepreneurs running medium sized firms.

(iii) Composition of manufacturing output:

Reflects the preponderance of consumer goods industries vis-a-vis producer goods industries. In 1953, the ratio of consumer goods to produce goods worked out to be 62: 38.

According to the criteria suggested by Haffmann India seems to have entered the second stage of industrial development. But even then, there is no doubt that the capital-goods, sector is under-developed and there is a need for the expansion of this sector so as to ensure a rapid rate of growth to make economy self-reliant and ultimately faster the pace of industrialisation in the country.

With the initiation of the Indian five year plans in 1951, it was imperative that the perspective should change in favour of industrial development of India as well simultaneous development of agriculture to constitute the complementary to each other as far as development of economy is concerned. Development of agro-industries, village industries and small scale enterprises would form an essential part of in industrial development process.

Industrial Growth Pattern in India (4 Phases)

The industrial growth pattern in India can be divided into four phases as explained below:

1. First Phase (1951-65): Strong Industrial Base:

The first phase of industrial growth consists of the first three plan periods which had build a strong industrial base in India. During this phase, huge investments were made in major industries like iron and steel, heavy engineering and machine building industries. The annual compound growth rate of industrial production during the first three plan periods moved between 5.7 per cent to 9.0 percent. The capital goods industries had registered its annual average compound growth rate between 9.8 per cent to 19.6 per cent during this period. Again the annual rate of growth of basic industries moved between 4.7 per cent to 12.1 per cent over the same period. Thus, a strong industrial base was laid during the first phase covering the first three plan periods.

2. Second Phase (1965-80): Deceleration and Retrogression:

The second phase of industrial growth covers the period of three Ad-hoc Annual Plans, Fourth Plan and Fifth Plan. The annual compound growth rate in industrial production declined from 9.0 per cent during the Third Plan to only 4,1 per cent covering the period of 1965 to 1976.

In 1976-77, the annual rate of growth of industrial output was 6.1 per cent. In 1979-80, a negative annual growth rate of (—) 1.6 per cent was recorded in respect of industrial outputs as the index of industrial production in this year (Base 1970 = 100) has declined to 148.2 as compared to 150.7 in 1978-79.

The industrial sector faced a structural retrogression during the second phase. The capital goods industries registered its annual average growth rate of only 2.6 per cent during the second phase Fifth Plan recorded the annual growth rate of 5.7 per cent which was far below as compared to that of first three five year plans. For, basic industries, the annual growth rate during the second phase was far below as compared to that of Third Plan. Thus basic industries were engaged in the production of ferrous metal groups, construction materials, mechanical engineering industries etc.

Causes of Deceleration and Retrogression:

The causes of deceleration and structural retrogression during the second phase are;

a. The wars of 1962, 1965 and 1971. During this period investment was made into unproductive uses. Successive droughts of 1965-67 and 1971-73, and oil crisis of 1973 was also responsible for supply constraints.

b. Considerable slackening of real investment;

c. Unequal distribution of income in favour of the rich followed by stagnation in demand for consumer goods;

d. Unsatisfactory performance of the agricultural sector;

e. Policy constraints and bureaucratic obstacles on industrial growth;

f. Conflicts in the dominant coalition between proprietary classes, capitalist class and the class representing rich agricultural farmers.

3. Third Phase: Industrial Recovery in Eighties (1981 to 1991):

The third phase of industrial growth covers the period of eighties consisting of both Sixth and Seventh Plan. This period of eighties experienced industrial recovery. During the period 1981-85, the average annual rate of growth of industrial production was accelerated to 7.0 per cent which further increased to 8.6 per cent during 1985-90. In 1990-91 also, the annual rate of industrial growth was registered at 9.0 per cent. The growth rate for consumer durable goods increased to 16.9 percent in 1985-89. In 1981-90, there was a set back as the segment recorded only 1.7 per cent growth rate and then the same rate again shot up to 14.8 per cent in 1990-91.

The basic goods industries maintained the annual average growth rate of 8.8 and 8.9 per cent during 1980-85 and 1985-89 respectively. But gradually declined to 5.4 per cent and 3.8 per cent in 1989-90 and 1990-91 respectively. The capital goods industries recorded 6.3 per cent annual rate of growth during 1980-85 which experienced increase in its growth rate of 13.0 per cent in 1985-89 and then significantly 24.0 percent in 1989-90. The growth rate of capital goods was 17.4 per cent in 1990-91.

Thus during this third phase, there is a clear shift in the pattern of industrialisation in the country. Looking at the growth of different product group in the manufacturing sector, chemicals, petrochemicals and allied industries recorded a faster rate as compared to others. During this period, the production of chemicals and chemical product industries, expanded at an annual average rate of 11.19 per cent as compared to that of only 5.47 per cent in machine building sector. Moreover, during this period, iron and steel, basic metal and alloys and metal products recorded only 5.15 percent 4.94 per cent and 3.95 per cent. It shows a clear shift in the growth pattern of the industrial sector during eighties (Third Phase) as compared to two earlier phases.

Causes of Industrial Recovery:

The main factors which were responsible for the industrial recovery during eighties are described as under:

(i) Introduction of new industrial policy and liberal fiscal period.

(ii) Higher contribution of agricultural sector in some of the regions in the country which helped in raising the demand for industrial inputs used for agricultural production.

(iii)Revival of investment in the infrastructure sectors and its effects in raising the degree of efficiency of the industrial sector.

4. Fourth Phase: Industrial Retrogression followed by an Upturn and Downturn Nineties (1991-92 to 1997-98):

The fourth phase of industrial growth covers the early part of nineties, i.e., from 1991-92 to 1997-98. This short period experienced a sharp industrial retrogression followed by an immediate upturn in the industrial growth of the country.

During 1991-92, the country had a bitter experience of negative growth rate of (—) 0.10 per cent as compared to that of 8.5 per cent in 1990-91. This is the clear evidence of sharp industrial retrogression in the country. But after that in 1995-96 the country experienced an industrial upturn trend as annual growth rate during this year stood at 11,7 per cent, During the year 1996-97 industrial output has increased by 7.1 per cent and further 8.6 per cent in 1997-98.

The industrial growth rates by use-based industrial classification again showed downward trend from April to Feb. 1997 to 7.2 and 10.2 per cent in April to Feb. 1998. The growth rate of consumer non- durables decreased to 4.2 per cent and 2.4 per cent during April-Feb. 1996-97 and 1997-98 respectively. The growth rate of capital goods industry declined to 7.2 per cent in 1996-97 and to 1.8 per cent in 1997-98. During the same period, the general growth rate of industrial production declined from 7.7 per cent in 1996-97 to only 4.7 per cent in 1997-98.

Causes of Industrial Slow down:

The factors responsible for industrial slow down in the fourth phase are summarized as below:

a) Decline in the growth of export to 4.6 per cent in the first eight months between April and November 1997.

b) The impact of the tight money policy followed in 1995-96 when the monetary expansion was about 13.7 per cent;

c) Significant build up industrial capacity in the first phase of liberalization;

d) In some cases the rate of demand growth was overestimated.

Signs of Sustained Industrial Recovery in 1999-2000:

The acceleration of growth rates in various sectors of the economy underline the significance of industrial recovery in the current year and cyclical downturn.

However, following are some of the major indicators of industrial recovery in recent years:

(i) Overall industrial output of the country i.e. 6.2 per cent in April-December 1999 as compared to that of only 3.7 per cent in April-December 1998.

(ii) The position of electricity generation remained much better in 1999-2000.

(iii)Manufacturing segment of industrial sector has grown by 6.7 per cent in April to December 1998.

(iv) As per use based classification, basic goods, intermediate goods and consumer goods, are having higher growth in 1999- 2000.

(v) Non-metallic mineral products, machinery and equipment, wool, leather, paper and basic chemicals are some of the industries growing at more than 10 percent during 1999-2000.

(vi) Industries like electricity, crude oil, coal, steel and cement having a weight of 26.7 per cent in overall IIP, grew at 8.2 per cent in April-December 1999.

(vii)   Better corporate performance in 1999-2000 compared to previous year.

Industrial Slowdown since 2001:

In recent years, the country is experiencing a serious phase of industrial slowdown during 2000-01 and in 2001- 02. The overall industrial growth during April- December 2001-02 at 2.3 per cent, is substantially lower than the 5.8 per cent achieved during the corresponding period of 2000- 01. In fact, the growth rate of the industrial sector during the first nine months of 2001-02 is considered as the lowest during the last ten years. Industrial slowdown was recorded in all broad sectors such as manufacturing, electricity and mining an all end use based groups such as capital goods, intermediate goods, consumer goods both durables and non-durables. However, the reasons for slowdown in industrial growth during this period is due to a number of structural and cyclical factors.

The other reasons are explained below:

1. The adjustment process is industry in response to increased competition in the form of Mergers and Acquisitions is taking longer time than expected.

2. Infrastructural bottlenecks and high costs.

3. Unreliable supply of services in transport, communications and power sector.

4. Low levels of productivity due to low economies of scale, out-dated technology and restricted labour laws'.

5. Lower speculative demand for sectors like automobiles and real estate due to expectation of lower prices and reduction of taxes and duties in the short term period.

6. High interest rates.

By the first decade of the 20th Century, a series of changes affected the pattern of industrialisation.

(i) As the Swadeshi Movement gathered momentum in India, the nationalists mobilised people to boycott foreign cloth and other goods. Industrial groups organised themselves to protect their collective interests pressurising the government to increase tariff protection and grant other concessions.

(ii) From 1906, export of Indianyarn to China declined. So Indian industrialists shifted their interest from yarn to cloth production leading to considerable production of cotton piece goods.

(iii) The beginning of First World War created a new situation. Since British mills were busy in producing war materials to meet their own war needs, export of goods to India declined. This gave an opportunity to Indian industries to thrive. Indian mills now had a vast home market to supply.

(iv) As the war continued, Indian factories were called upon to supply war needs, such as jute bags, cloth for army uniform, tents, leather boots, horse and mule saddles, etc. New factories were set up and old factories ran double shift.

(v) After the war, industries in Britain got a severe setback. In India however local industrialists gradually consolidated their position substituting foreign manufactures and capturing home market. Handicraft production also expanded in the 20th century.

4.6 Choice of Techniques

If labour is more abundant and capital is scarcer in developing countries than in developed countries, we might expect to observe the use of more labour-intensive techniques of production in the industrial sector of developing countries, reflecting a lower price of labour relative to capital.

Choice of Techniques of Production in Developing Countries

A choice between alternative techniques of production is a major problem in the planning for developing countries. This is because a particular choice of technique of production affects not only the magnitude of employment but also the rate of economic growth. Several alternative techniques of production are available to produce a commodity and these differ with regard to the amount of capital being used with a unit of labour for production. In other words, the various techniques differ with regard to capital-intensity which is generally measured by the magnitude of capital-labour (K/L) ratio. Thus, the higher the capital-intensity, the more quantity of capital as compared to labour will be used to produce a given level of output.

Factor Price Ratios and Choice of Technique:

In economic theory based on the perfect competition model where the factor prices are given and constant for a firm and factor proportions are variable, the choice of a technique or capital-labour combination is easily made by a firm which aims to minimise cost for a given level of output through equating relative prices of factors to their relative marginal products. Consider Fig. 51.1, where curve q is an iso-quant which represents a given level of output.
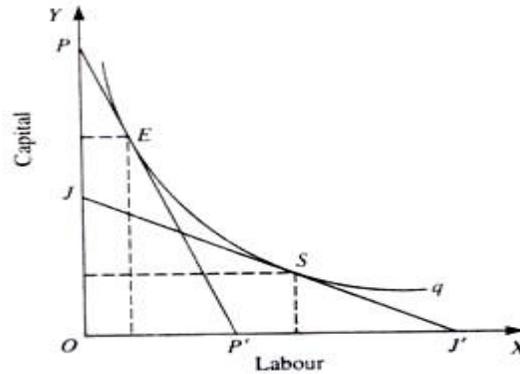
Fig. 51.1. *Factor Prices and Choice of Techniques*

The slope of line PP' measures the relative prices of capital and labour. The firm will be minimizing cost by choosing capital intensity represented by the point E at isoquant q. At E the price line PP' is tangent to the isoquant q. The slope of the isoquant q at point E measures the ratio of marginal products of capital and labour which is equal to the slope of the price line representing factor price ratio. However, if a country has abundant labour and shortage of capital, in the absence of any price distortions, labour will be relatively cheaper than capital and price line representing this will be less steep, say it is J J'. As will be seen from Fig. 51.1 the new price line JJ' is tangent to the isoquant q at point S.

Accordingly, the capital-intensity chosen by a cost minimizing firm will be given by the point S. This technique of production is more labour-intensive than the technique corresponding to point E. However, it is worth mentioning that in a labour-surplus economy, labour-intensive technique may not be actually chosen by a cost-minimizing firm because of the existence of distortions of factor prices from their true scarcity values.

Choice of Techniques: Maximum Reinvestible Surplus Criterion:
In the planning for developing countries, the choice of techniques is not to be decided from the point of view of private profit maximisation or private cost minimisation. In it the choice of capital intensity has to be decided keeping in view the problem of mass unemployment and the need for rapid economic growth to raise levels of living of the people. The problem is made difficult because the achievements of the twin objectives of reducing unemployment and promoting rapid economic growth through a choice of technique clash with each other at least in the short run. For the optimum choice of technique of production or capital intensity two alternative criteria have been put forward. They are the maximum output and maximum reinvestible surplus criteria.

To explain these criteria let us take a single product model in which two factors, capital and labour, are used to produce a commodity. We further assume that there is a given amount of capital but the form it takes varies depending on the technique it embodies. With a given amount of capital, output of the commodity becomes a function of labour. We represent this production function and explain the two alternative criteria with the help of Sen's diagram. In this Fig. 51.2 on the X-axis, labour input is measured and on the Y-axis (upward from the origin) output is measured and also on the Y-axis (downward from the origin) amount of capital is measured. OK is the given amount of capital available which takes different form according to different degree of capital intensity.

The line OW measures the wage bill, given a wage rate equal to the slope of the wage line OW. It should be noted that with increase in labour employed, given the stock of capital OK, capital-labour ratio falls (or labour-capital ratio increases). Thus, as we use more labour input, capital intensity will vary along the line OX. It should be further noted that given the wage rate as more labour is used total wage bill will be increasing. Thus with OL_1 labour employed L_1S is the wage bill and with OL_2 labour employed L_2J is the total wage bill.

With capital stock equal to OK, output is a function of labour which is given by the production function curve Q. In drawing this production function we have assumed that as more labour is used with a given capital stock there occurs diminishing returns to labour and ltimately with increasing labour-intensity, total output declines, so that a certain labour-capital ratio
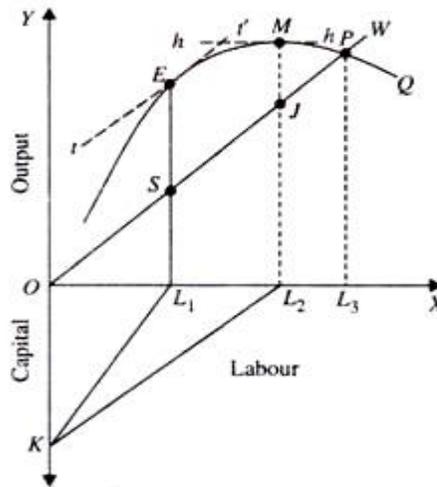

Fig. 51.2. *Maximum Reinvestible Surplus and Choice of Techniques*

corresponds to maximum output.

We are now in a position to explain the choice of technique on the basis of maximum output and maximum reinvestible surplus criteria. If the planner wants to choose capital-intensity (i.e., technique of production) to maximise output, then he will choose point L_2 where output is maximum (at OL_2 marginal product of labour is equal to zero).
With the given capital stock OK, capital-intensity chosen will be equal to the slope of the line L_2K i.e., OK/OL_2. With this choice of capital-intensity, OL_2 labour is employed. If maximisation of employment in the present is desired, then, obviously, capital-intensity OK/OL_2 is the optimum choice.

However, maximisation of present employment may not yield a satisfactory rate of growth. The surplus of output over total wage bill at OL_1 level of employment is MJ which is not the largest. If the maximum of surplus over wage bill is required, then the capital-intensity (or in other words, employment of labour with the given capital stock) at which the wage rate equals the marginal product of labour should be chosen.

From Fig. 51.2 it will be noticed that at OL_1 use of labour input or capital-intensity represented by L_1, the marginal product of labour (measured by the slope of the production function curve Q at point E) equals the wage rate (as measured by the slope of the wage line OW).

The surplus of output over the wage bill at capital-intensity at L_1 (which is equal to OK/OL_1) is ES which is the largest under the given circumstances. At L_1, the capital-intensity is

higher but employment smaller than with capital-intensity at L_2. Thus, the largest surplus ES is obtained with a higher capital-intensity and lower labour employment at the present.

If it is assumed, as is done by the exponents of maximum reinvestible surplus criterion that the whole surplus is reinvested and the whole wages are consumed, then this larger surplus on being reinvested would yield a higher rate of economic growth.

On the other hand, with lower capital-intensity at L_2, though the level of present employment is larger, surplus MJ is smaller which when reinvested would yield a lower rate of growth. With a higher capital- intensity and higher rate of growth, the rate of growth of employment will be higher, though the level of present employment will be less.

On the contrary, with a lower capital-intensity the surplus is smaller and consequently rate of growth of output and employment will be smaller, though the present level of employment will be large.

Thus the choice of capital-intensity implies the choice between the higher levels of present employment and output on the one hand and the higher rates of growth of employment and output on the other. Thus, it is argued if you are interested in maximising the current level of employment (and production) choose a lower capital-intensive technique such as the one represented by L_2.

On the other hand, if you want a higher rate of growth of employment and output choose a higher capital-intensive technique such as the one represented by L_1. Thus we find that there is a conflict between maximising present employment (or consumption) and maximising employment or consumption at some future date.

Amartya Sen's Time Series Criterion and Choice of Technique:

To resolve the above conflict or dilemma, Prof. Sen in his famous work 'Choice of Techniques' has proposed what is called Time Series Criterion. According to it, choice of technique depends upon the time horizon of output or employment generation, the time preference and social welfare function.

To make an optimum choice of technique, alternative time series of employment and output following the adoption of different techniques have to be obtained. This is illustrated in Fig. 51.3. Let the vertical axis measure labour-employment and output of consumer goods and the horizontal axis measure time.

The more steep curve AK represents growth of output or employment over time with using capital-intensive technique K whereas the less steep curve BL shows the growth of output and employment over time with adopting labour -intensive technique of production L.
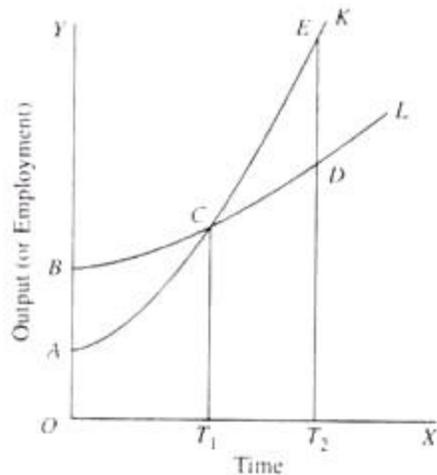
Fig. 51.3. *Amartya Sen's Criterion of Choice of Technique*

Till time T_1, labour-intensive technique generates more output and employment as compared with the capital-intensive technique. But, since the growth of output or employment is greater in case of capital-intensive technique due to its yielding larger surplus and reinvestment, beyond time T_1 the output or employment is greater in case of capital-intensive technique K.

And on account of higher growth of output and employment the capital-intensive technique fully compensates for the initial loss of output (or employment) by the time T_2. Note that the area CED equals the area ABC in Fig. 51.3).

After time T_2, the society would have higher levels of output and employment by choosing capital- intensive technique. Thus though the choice of labour-intensive technique yields higher levels of output and employment in the present it yields lower rate of growth due to smaller reinvestible surplus.

On the basis of this time series criterion, Amartya Sen argues that if social welfare function of a society is such that it is prepared to wait up to time T_2, (say thirty years) output and employment sacrificed at present could be fully compensated and after T_2, the society would enjoy higher levels of consumption and employment by choosing capital-intensive technique. However, if social welfare function is such that society prefers present output (consumption) and employment to future consumption and employment, then it may choose labour-intensive technique.

Conflict between Maximising Employment and Maximizing Production:

When new projects for investment are planned, there is likely to be grater scope for varying the amount of labour employment. For example, a given amount of resources may be invested in either handlooms or automatic looms which employ quite different amounts of labour.

It may, however, be noted that a given amount of new investment in labour-intensive and capital-intensive techniques may result in different levels of output; labour intensive techniques may yield less output as compared with capital-intensive techniques.

Thus, while the labour-intensive techniques are characterised by higher labour-output ratios, it is not necessary that all such techniques have lower capital-output ratio. For instance, it is worthwhile to note that Amartya Sen has shown that the labour-intensive technique of Ambar Charkha has higher capital-output ratios than the factory methods.

Dhar and Lydall have also found that some labour-intensive small-scale industries have higher capital-output ratios. Hence, a conflict between output and employment arises. However, the decision whether output should be sacrificed or employment will depend upon the social welfare function.

Given the extent of unemployment and under-employment and the glaring disparities of income we feel that some output is worth sacrificing for more employment. Provision of employment is by far the most important way of raising the people above the poverty line and of ensuring widespread sharing in the fruits of economic development.

In addition, employment gives individual a sense of participation in socially gainful activity and prevents the feeling of being not wanted which has a great demoralising effect. Indeed, as has been remarked by Barbra Ward, "of all the evils worklessness is the worst."

It should however be noted that nil labour-intensive techniques do not have higher capital-output ratio and therefore in their case conflict does not arise between maximizing employment and maximizing production. In fact, many labour-intensive techniques and small-scale industries, capital-output ratio is lower than the corresponding large-scale industries. Hence cases for encouraging such industries in developing countries like India.

Conflict between Maximising Current Employment and Maximising Rate of Growth of Production and Employment:
Conflict which generally arises relates to the maximisation of current employment and maximisation of rate of growth of production and employment. As seen above, from Sen's analysis of choice of techniques, maximisation of output-employment in the current period will not lead to the higher rate of economic growth of both output and employment. This question is of particular importance in respect of (a) allocation of resources for investment between capital goods and consumer goods and (b) the choice between labour-intensive and capital-intensive techniques.

Maximising rate of growth of production now at the cost of present employment makes it possible to use extra output produced for generating more employment in the future. It is worth noting that more output (i.e., more reinvestible surplus) is useful not only for its own sake but enables the planners to generate more employment opportunities in the future. Thus, a conflict (and therefore inter-temporal trade off) arises between more employment now and more employment tomorrow.

Let us explain how conflict arises in the two cases mentioned above. Allocation of more resources to the production of investment goods by sacrificing some employment in the present (that is, if extra output is in the form of capital goods such as machines etc.) will enable us to provide employment to more men in the future. Similarly, if extra production is in the form of

more wage goods – liquid capital as they are sometimes called—enables the planners to create more jobs in the future as the availability of wage goods limits the opportunities for creation of employment opportunities.

On the contrary, raising employment now means sacrificing not only some production in the current period but also lowering the rate of growth of employment. Thus with the allocation of resources to the consumer goods industries ensuring more employment now, level of employment at some future date would be lower than would have been possible if more allocation of resources to capital goods industries in the present was preferred.

Turning to the conflict between current employment and the rate of growth of employment arising out of the choice of techniques of production, it has been shown by Sen and others that the choice of labour-intensive techniques, though maximizes employment in the current period, will reduce the share of profits (or investible surplus) as compared to wages. And the reduction in profits will adversely affect the rate of savings and investment and therefore the growth of output and employment. On the country, if capital-intensive techniques are chosen, they may yield less employment (and output) in the present but they will yield more surplus or profits as compared to wages.

Therefore, the choice of capital-intensive techniques will ensure higher rate of growth and therefore more employment in the future. Here, the conflict or trade-off involved does not arise between current output and current employment. Instead, there is intertemporal trade-off, that is, more employment now or more employment tomorrow. It means that some more unemployment in the present may be tolerated for the sake of generating more investible surpluses (profits) so that higher growth rate is achieved and more employment opportunities are provided in the future. But the above argument regarding capital-intensive techniques yielding more employment in the future is based on the crucial assumption that a major part of profits is re-invested and most of wages are consumed.

Besides, account should also be taken of the fact that increase in consumption of the poor and unemployed will generate demand for basic wage goods which are produced with much more labour-intensive techniques as compared to those used in the production of goods demanded by the rich. Thus only a part of any increased income going to the rich will be saved and the part that will be spent would generate less employment than a similar amount of spending by the poor. In view of these, the use of capital-intensive techniques will not necessarily promote more rapid growth of employment and output.

Appropriate or Intermediate Technology:
As has been stated above, the growth of organised or large-scale industries with modern capital-intensive technology yields only meagre employment opportunities. Therefore, in order to create adequate employment opportunities through industrial growth, there is a need for developing and adopting an 'intermediate technology' which requires less capital per work-place without loss of efficiency. Besides, to prevent excessive urbanisation and concentration and to arrest the tendency for mass migration into the urban areas, there is need for adopting a strategy for rural industrialisation, based on small-scale manufacturing using intermediate technology dispersed throughout the countryside to increase rural employment and income.

Dr. E.F. Schumacher, the advocate of the adoption of intermediate technology, rightly says, "It is surely an astonishing error to assume that the technology developed in the West is necessarily appropriate to the developing countries. Granted that their technological backwardness is an important reason for their poverty: granted too, that their traditional methods of production, in their present condition of decay, lack essential viability: it by no means follows that the technology of the richest countries is necessarily suitable for the advancement of the poor.

It must never be forgotten that modern technology is the product of the countries which are 'long' in capital and 'short' in labour, and that its main purpose, abundantly demonstrated by the trend towards automation, is to substitute machines for men. How could this technology fit the conditions of countries which suffer from a surplus of labour and a shortage of machines?" He further remarks. "That technology devised primarily for the purpose of saving labour should be inappropriate in a country troubled with a vast labour surplus could hardly be called surprising."

It is worth noting here that research in India, after making proper cost and price calculations, has already discovered intermediate technologies for producing some thirty types of such goods as agricultural implements, processed foods and consumer goods which are actually cheaper and more efficient than those produced by the advanced machinery. It should be further noted that the evolving of intermediate technologies for various industries does not imply discovery of altogether new principles of science and engineering. What is required is the application of the basic principles of modern science and engineering to evolve the production techniques which conform to the factor endowments of the labour-surplus economies.

These appropriate or intermediate technologies may be obtained by scaling down the advanced techniques by adapting them so as to make them more labour-intensive, or by scaling up handicrafts techniques with the introduction of new tools and simple machines and thus improving economic efficiency of these techniques while maintaining their labour-intensity. In this process of adaptation product design itself will also have to be modified and standardised. Further, entirely new intermediate technologies have also to be evolved from the applications of the basic principles of modern science and engineering so as to suit the labour-surplus conditions of developing countries. For that, a good deal of research and development is required to be undertaken.

It may be noted again that Japan's remarkable adaptability has been reflected not only in agricultural techniques but also in the extent to which it has organised its new industries efficiently on a cottage industry basis. Here, as in agriculture, Japan's production methods are especially well-suited to the conditions of labour-abundant economies. Lastly, it may be noted that recently, four East Asian Countries, namely, South Korea, Taiwan, Hong-Kong and Singapore which have achieved remarkably higher growth rates and are therefore called Asian Tigers followed labour intensive path of economic growth. That is, they used relatively much more labour in there industrial development than India.

Techniques of Production and Technology

The problem of choosing an appropriate technique of production or technology arises when the LDCs have already decided on a particular project. Choosing between the alternative methods of production is one of the major problems that confront development planning. If labour (L) is more abundant and capital (K) scarcer in LDCs we might expect to see the use of more labour intensive techniques of production in the modern industrial sector. Figure 1 compares the techniques of production that should be found in LDCs with that found in DCs. Assuming the same production function in the two sets of countries represented by the isoquant labelled YY, the lower price of labour relative to capital is given by the isocost ab and the higher relative price given by ed. D Labour The two isocost lines give the relative prices of labour to capital in LDCs and DCs, respectively.
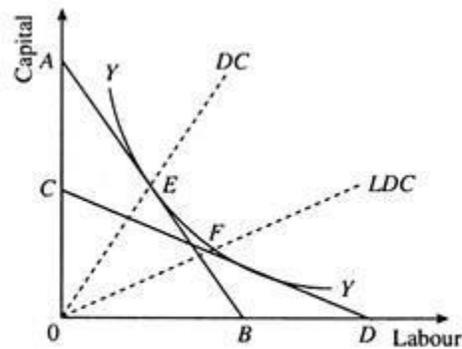

Fig. 1: Limited technological choice in practice

In the developed countries K/L ratio is given by the ray from the origin labelled DC and that for the LDCs is given by the one labelled the same. ADC and LDC differs in technique of production mainly in the aggregate sense as large sectors of an LDC use very little capital such as subsistence farming and petty service activities. In the modern sector, however, techniques are more capital-intensive-1 in an LDC than what would be predicted on the basis of factor endowments. The judgments passed on the basis of the latter would advocate a more capital-intensive-1 technique to be **"appropriate"** for a capital-rich developed economy and that an capital-intensive technique would be more appropriate for a LDC. So, why is this**"inappropriate"** technique applied to most LDCs?

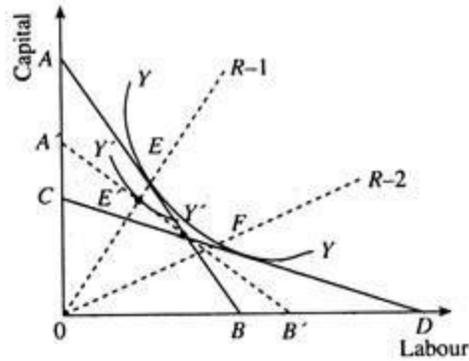**There are several reasons that are discussed below:**

Fig. 2: Change in Factor Porportion

(a) Factor Price Distortion:

In a labour surplus economy L is the abundant factor and K is the scarce factor, and we expect the former to be cheaper than the other, but in a lot of LDCs this is not the case. The wage rate is bid up and the interest rates are kept deliberately low. Such a price ratio does not reflect the relative factor endowments of a LDC and what has occurred is factor-price distortion. In Fig. 2 a DC would follow the path R—1 of high capital intensity and a LDC should normally follow R-2 with low capital-labour ratio. Suppose the price of labour in an LDC is bid up and the rate of interest is lowered, the distorted isocost line is A'B' which meets a new isoquant Y'Y' on the path R-1 indicating capital-intensive production in a labour-surplus economy. The rationale behind this **"inappropriate"**technology is the profit motive of the cost-conscious profit-making private enterprises.

(b) Efficiency Wage:

An important factor behind the use of capital-intensive technology (KIT) in an LDC is the high efficiency wage though labour may be abundant and its money wage may be lower than in a DC but is not necessarily **"cheaper"** or less costly to employ because MP_L may be lower too. The efficiency wage = nominal wage/ AP_L may differ very little between LDCs and DCs. This discourages private entrepreneur from increasing employment, instilling a tendency to save and use KIT. In Fig. 3 the production function for an LDCs is labelled Y_2. Even though labour is cheaper in a LDC, slope of isocost' line for LDC (AB) is less than the slope of isocost for DC (CD), the most profitable KJL ratio will be-the same for both countries and lie along the path OE'. In an LDC it is an efficiency wage that matters and not the money wage.
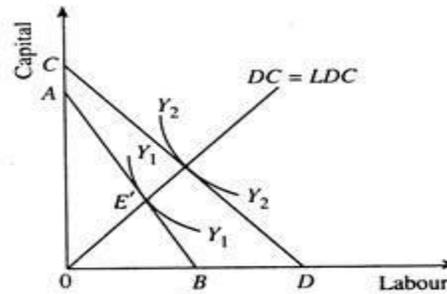
Fig. 3: The same technique in spite of
wage differences

(c) Limited Factor Substitutability:

For a large number of commodities that may not be a spectrum of techniques to choose from. The production function may not be a smooth one as shown in Fig. 1 and a country cannot move from E to F in accordance with differences in relative factor endowments the production function can take the L-shaped form (called Leontief production function which assumes no factor substitutability), and AT and L have to be combined in fixed proportion to get a certain level of output. Thus, the coefficients of production become fixed in such areas of production dictated by a given technology. This naturally makes the choice of technique invariable in favour of say, when the price of labour is higher than the price of capital and accounts for the K-intensive choice of technique in an LDC. Note that here we are talking about profitable techniques. LDC might be able to utilise more Labour Intensive Technology (LIT) but then the output would not be saleable profitably.

(d) Capital an—A Substitute for Skill:

Capital intensity in LDCs can also be explained by a skill constraint. Typically, LIT requires a great deal of skilled labour compared to KITs which require a preponderance of semiskilled labour to undertake routine repetitive tasks. In developing countries short of skilled manpower, capital may substitute for skills and constitute a rational response on part of the decision makers, whoever they may be.

(e) Import of Technology:

There is an absence of large spectrum of techniques of production. Perhaps the overriding factor which accounts for the relative capital-intensity of the developing countries is that many, if not most of the techniques are imported from abroad which, naturally, have a heavy bias in the L-saving direction. The techniques could be imported by the indigenous firms or as increasingly seems to be the case, by large foreign multinational corporations which invest in LDCs and bring their technology with them.

In this case, the technology might be inappropriate not because there is not a spectrum of techniques but because the technology available is circumscribed by the global profit maximising motives of the companies investing in LDCs. The L- saving bias of the technology is to be explained by the L-saving bias of the technological progress in the advanced countries where labour is relatively scarce and expensive.

(f) Need for Infrastructure:

Choice in favour of a KIT may be sometimes stated by the goals of economic development. A developing economy in its initial stages requires a strong infrastructure consisting of power, transport, irrigation projects etc. that are dependent on KIT in order to build up the base of the economy. Similarly, a view to maximise long run rate of growth by maximising investment rate calls for generating maximum reinvest able surplus which is possible in more KITs than in labour intensive ones. The state may concentrate on some heavy industries and the capital goods sectors that "creates large reinvest able surplus, external economies and builds up infrastructure of an economy. Such a state relies on KIT for production.

The points (a) – (f) help in explaining why a labour surplus LDC often utilizes K1 methods of production in their modern sector. One of the major problems of development planning is that of choosing between alternative techniques of production. The number of alternatives that are open to a developing country is quite often large and the amount of capital per unit of labour (i.e., capital-intensity) varies widely from technique to technique. We also note that different techniques often simplify quite different strategies of development with very different effects on the performance of the economy. To be specific, choice of technique is related to the objective of planned economic development.

In this context we can identify two different objectives:
1. Maximisation of current output or current consumption,
2. Maximisation of the rate of growth of output.

In fact, a conflict can arise between these two objectives from the point of view of choice of capital intensity. In what follows we present Amartya Sen's model to show the nature of conflict involved in the different objectives of economic development.
First we make some basic assumptions as regards the type of economy under consideration. The economy is over populated in the sense that there exists a reserved army of labour.

Moreover, the economy is divided into two sectors:
(a) Modern Sector
(b) A Primitive Rural Sector.

The modern sector is subdivided into two departments—Department 1 producing only capital goods and Department 2 producing consumer goods by using both labour and capital. Moreover, it is assumed that the means of production in the modern sector are owned by the state. However rural sector is run by the family based private enterprises.

There are two classical assumptions made in the model:
1. The real wage is fixed in terms of consumer goods and the wage bill is entirely consumed.
2. The surplus is entirely reinvest able. Moreover it is assumed that there is no technological progress. Here the choice of technique refers to the choice of capital intensity in the modern sector. The following diagrammatic illustration explains the potential conflict between employment maximisation and growth maximisation.

In Fig. 4 there are three axes—OY' representing investable surplus which in fact represents output produced in Department 1. OX representing the employment in Department 2.
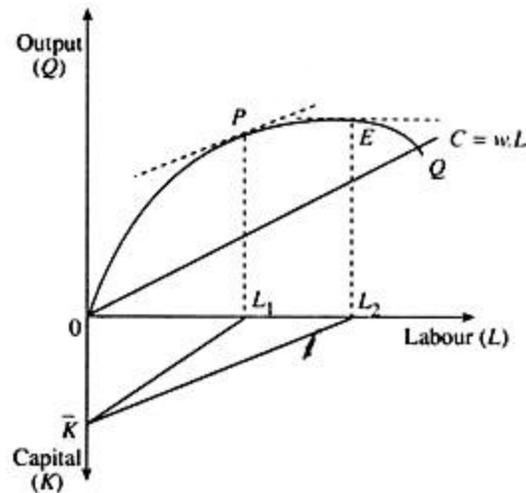

Fig. 4: Choice of Techniques

Let us start with a given amount of investable surplus OK. The production function exhibits diminishing marginal product of L such that with increasing capital intensity, the productivity of labour in Department 2 rises wL represents the wage bill, corresponding to different levels of employment in Department 2. Since real wage is a constant, wL is a straight line. Point E represents the maximum output and the capital intensity is represented by tan $\sum KL_2O$.

On the other hand P is the point of maximum surplus of consumption of goods over its consumption as the slope of the curve OQ at that point equal to slope of wL, i.e., real wage rate is equal to MP_L a condition for profit maximisation. Assuming that the entire saving comes from profit-income and it is entirely reinvested we immediately get that higher capital-output ratio,

i.e., more intensive method of production generates higher profit share, higher saving rate and, thus, higher rate of growth. Clearly, maximisation of employment requires labour intensive technique while maximisation of future growth potential necessities capital intensive technique.

The following simple algebraic formulation explains this conflict. Let the production function be:

Q-aL- bL^2 … (1)

where notations have their conventional meanings and the saving function as:

S= aL-bL^2 – wL … (2)

The level of employment which maximises saving is obtained by differentiating equation (2) w. r. t. L and setting equal to zero which gives

$dS/dL = a-2Lb-w = 0$

Therefore, the level of employment which maximises saving is $L_1 = (a + w)/2b$

The level of employment which maximises output is obtained by differentiating equation (1) w. r. t. L and setting equal to zero which gives

$dQ/dL = \alpha - 2bL = 0$

or, $L_2 = a/2b$

The maximisation of output corresponds to the rate of turnover and the SMP criterion. On the other hand, surplus maximisation corresponds to the rate of surplus criterion (or MRTS criterion).

An interesting possibility is represented in diagram 5

In this case E lies below the wage line. This means that maximisation of output will involve negative surplus. Point P gives maximum output consistent with the condition that the output covers the wage bill i.e., wL = Q. It is thus possible that maximisation of current output (and hence current consumption) may lead to contradiction through capital decumulation.

The moral e of the above exercise is to show clearly that there is basic conflict between maximising current consumption or maximising future consumption through higher investment. Let PP' be the PPF form an LDC as shown in Fig. 6. If all the resources are allocated to the production of investment goods, OP of capital goods would be produced.
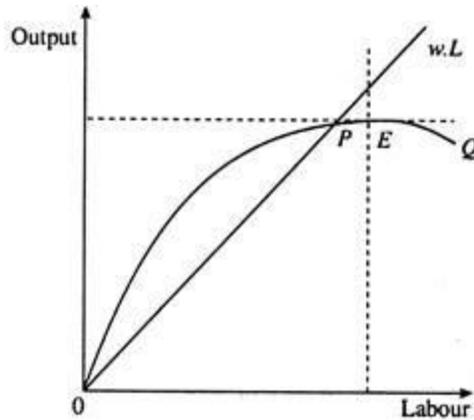
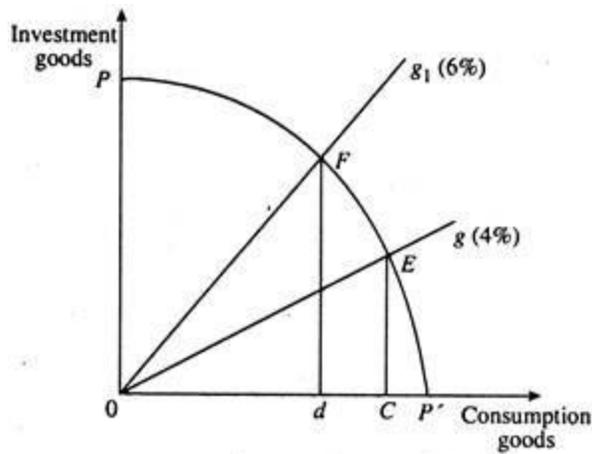Fig. 5: The Possibility of Capital Decumulation

Fig. 6: Alternative Growth Rates

On the other hand, if all the resources are spent on the production consumer goods, OP' of consumer goods would be produced. Obviously, the society would choose to produce some combination of both the goods. However, lines Og and Og_1 represent different growth rates (say 4% and 6%) respectively. Let us assume that the economy is growing along Og. But, if a higher growth rate (Og_1) is regarded as desirable, it requires a reduction in consumption goods by wL, which would allow resources to be realised for the production of more investment goods to take the economy to F, given a rise in the production of investment goods, growth rate will be higher, i.e., 6% instead of 4%. But present consumption must be sacrificed to obtain the high growth path, though the choice of a higher growth path at present will ensure higher consumption, in the future as well.

As one of the solutions to the dilemma Amartya Sen had proposed that since the choice of technique comes to depend on the time-horizon of the output generation, the time-preference and the social welfare function the best way of looking at the problem would be to derive

alternative time series of real income flow corresponding to each technique. Let us consider Fig. 7.
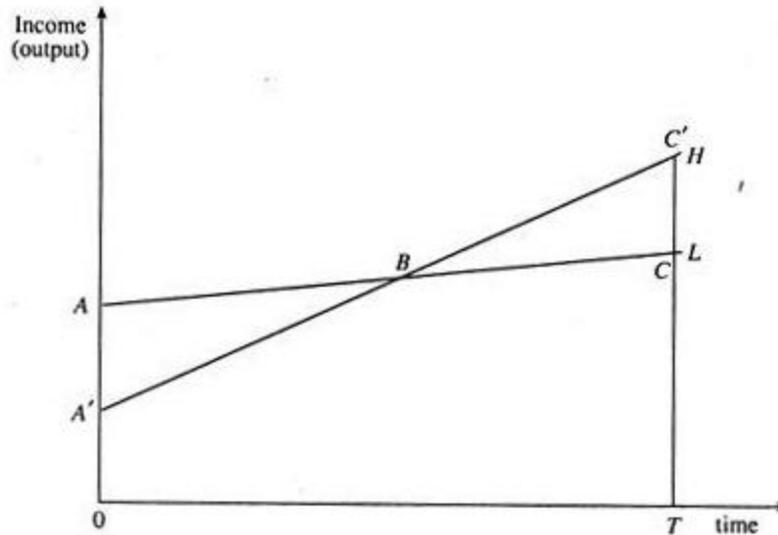

Fig. 7: Income path over time

Let us consider an LDC having H and L as two of its available options, where H is relatively capital intensive. Let us consider the growth rates r and r' associated with L and H respectively. Then the time paths of consumption are exponentially given as

$C(t) = A_0.e^{rt} \ldots (L)$

$C(t) = A_1.e^{r't} \ldots (H)$

Let us first fix a time horizon and examine whether the loss of immediate output incurred by the more capital intensive technique is more than compensated by the extra output from it later before the period of consideration is over.

Let U denote the time horizon under consideration. We may actually consider a period of recovery (T) defined as the period of time in which the total output with the more capital intensive technique is just equal to that with the less intensive technique. Let the vertical axis measure the growth of output and the horizontal axis measure the time.

Output can be produced by either technique H or by technique L. Technique H produces less output now than technique L but after B the rate of growth of output of technique H is such as to compensate for the initial loss of output by the year T. It is assumed that the area AA'B = BCC'. If U < T technique L is preferable and if U > T technique K should be chosen, the point of indifference being given by U = T. If we assume U = 1, the society is interested in maximisation of current output. If U = D, the society wants to achieve a higher rate of growth.

The defect of this approach lies in its arbitrariness. We have to assume that until the end of the period U, each unit of income is equally valuable and there is no preference over time. But

beyond that point no income is of any value at all. This brings in the time factor rather suddenly and with extreme severity.

But such arbitrariness is difficult to avoid due to the very nature of the problem and the approach of the period of recovery may have considerable operational value. In any case by choosing the non-extreme values of it can be made less arbitrary than the approach of SMP criterion or that the criterion of reinvestment.

It is impossible to arrive at a realistic criterion for tackling this question which will be considered to be fully satisfactory intellectually. The objective of the exercise one has to remember is not perfection but minimisation of imperfection. The period of recovery approach can be properly understood only when this is recognised.

Some Observations on Relation between Wage Rate and Choice of Capital-Intensity:

Let us make certain observations on the relation between wage rate and the choice of capital intensity.

Firstly, it is important to remember that the production function is not continuous, so we cannot assume that as soon as the wage-rate falls by a little, we move over to a slightly less capital-intensive technique as no such technical alternative may be available. Thanks to such technological discontinuity, in the case of some industries the same technique may be preferred in widely different economies, a fact which has often been observed.

We have not yet ventured upon the problem of wage differentials. The wage rate may vary from technique to technique, depending upon productivity, skill and soon involve a higher wage level than the same industries in the rural area. In comparing the surplus rates of alternative techniques this consideration should be introduced. This point does not need much elaboration.

What may be somewhat more complicated is the probability of rise of wages over time. This not only affects the choice of techniques in the future, but also, in the case of durable plants, the choice of techniques is present.

When the pool of unemployed labour force is limited, this is an important factor to be borne in mind while choosing between techniques. Further, the rise in the level of real wages may not be independent of our decision about technology, because the speed of expansion of employment will vary from technique to technique. This possibility has also to be taken into account.

Finally, a few words on the role of wage rate as such: In a complete planned economy, the scope of direct manipulation of wage rate is also considerable. When the wage rate can be manipulated, the conflict (given a reserved army of labour) between the maximisation of im-mediate output and that of growth rate involved in technological choice disappears.

We choose the technique which maximises the level of immediate output given the investment and choose whatever saving rate we want by manipulating the wage rate. When the wage rate is completely under control, the level of employment need not have any influence on the rate of consumption.

Thus, there is no argument with these assumptions, from deviating from the maximisation of total output of consumer good given the investment in the field. In practice, however, even in a completely planned economy, the wage rate is never fully within our control. Governed by customs, trade unions pressures, immobility and incentives the wage rate is not entirely a policy variable.

The planning authority may, of course, exert some influence on the precise level of it but this is not strong enough to make the consumption creating effect of extra employment entirely irrelevant. And, therefore, the conflict between the maximisation of immediate output and that of the rate of growth is indeed not imaginary.

Conflict between Output and Employment:

In spite of relatively impressive rates of individual output growth in many LDCs, the rate of employment growth has lagged significantly behind. In a number of cases it has been stagnate. In what follows we will examine why rapid industrial output growth has failed to generate corresponding rapid rates of employment growths.

Basically the answer lie in the growth of labour productivity. By definition the rate of growth in output (0 minus the rate of growth in labour productivity (Q/L) approximately equals the rate of growth of employment (L) i.e.,

$$dQ/Q - d(Q/L)/Q/L = dL/L$$

It follows that if labour productivity is growing at 8% while employment is growing by only 3%, the difference is due to the rise in labour productivity. The phenomenon of rising labour productivity associated with highest capital-labour ratio can be explained (at least theoretically better) with the aid of a variable proportions neoclassical model.

Recall that this model of savings, capital accumulation and economic development—the latter term defined simply as maximum output growth purports to demonstrate the higher capital-output ratios (i.e., more capital intensive production methods) will generate larger profit shares, higher savings ratios and, thus, higher rates of growth.

The optimal savings rate i.e., the one which leads to output growth can be generated only by relatively capital intensive methods of production. Maximum output and maximum employment growth are, therefore, seen as conflicting objectives.

In general, increases in labour productivity are desirable. But what is really desirable are increases in total factor productivity, output per unit of all resources. The productivity of labour can increase for a variety of reasons, some good and some not so good.

Improved education, better training and better management are all desirable reasons for increased productivity. But increases as results of substitution of capital for labour in production process or as a result of the importation of sophisticated and expensive labour saving machinery and equipment (e.g., tractors, powerfully automated textile machinery, heavy construction equipment) may be less satisfactory in heavily populated nations. Not only can such capital accumulation waste valuable domestic financial resources and foreign exchange, but it can also curtail the growth of new employment opportunities.

Moreover, the importation of inappropriate and expensive labour saving capital equipment may, in fact, reduce total factor productivity and thereby increase average costs of production even though average labour cost falls, the average total costs of production may rise because of the under-utilised productive capacity that often results when expensive mechanical equipment designed for large scale production in developed countries is imported into LDCs where the local market is too small for its efficient utilisation.

It is far from self-evident that higher levels of employment must necessarily be achieved at the expense of output growth. Just as there is widespread disagreement with the conventional wisdom of the 1950s and 1960s which assumed that income growth and more equitable distributions of income are mutually exclusive objectives, so too many economists have now come around to view that an employment-oriented (and, therefore, indirectly poverty-oriented, development strategy is also likely to be one which accelerates rather than retards overall economic progress.

This is especially true with regard to the growth and development of rural and small scale urban sector. More employment means more income to the poor which, in turn, implies a greater demand for locally produced basic consumption goods. Since these products tend to be more labour intensive than many of those produced by large scale industry, it follows that more jobs and higher incomes can become self-reinforcing phenomena.

They ultimately lead to high growth rates of both output and aggregate employment. But, in order to achieve this dual objective, a complementary policy of removing factor price distortions and promoting labour intensity technologies of production may be required.

4.6 (a) Small scale Vs Large scale production

Small scale production refers to the production of a commodity with a small plant size firm. It requires less amount of capital and is labor intensive in nature. The investment in machinery is lower when compared to large scale units.

When more units of a good or a service can be produced on a larger scale, with less input costs per unit of output produced, economies of scale (ES) are said to be achieved. Alternatively, this means that as a company grows and production units increase, a company will have a better chance to decrease its costs

Scale of Production

The term, "Scale of production" refers to the size of the production unit of a firm or business. Depending on the size of production, it can be classified into large scale and small scale production.

What is Large Scale Production?

The term, "Large scale production" refers to the **production of a commodity on a large scale with a large sized firm**. It **requires huge investments** in plant and machinery. Large scale production can be carried out if the market size is large and expanding.

Large scale firms are characterized by <u>mechanization</u>, division of labor and production and sale of goods in large quantities. They cater to a large market. The industrial revolution laid the foundation of the factory system. The factory system which extensively used machinery and adopted division of labor made large scale production possible.

What are the Motives for large scale production?

The following are some of the motives of large scale production.

1. Desire for economy.
2. Desire for increase in sales.
3. Desire for a large customer base.
4. Desire for large profits.
5. Desire to become a global company.
6. Desire for economic power.
7. Desire for continuous growth and expansion.
8. Desire to increase demand.
9. Desire to overcome competition.
10. Desire to achieve monopoly status.
11. Desire for achieving long term profitability.

Advantages and Disadvantages of Small-Scale Production!

Advantage of Small-Scale production:

As against the large-scale producer, the small producer has advantages of his own.

(i)   Close Supervision:

The small producer can himself supervise the minutest details of the business. Nobody will be allowed to spoil machinery or waste materials. The master's eye is everywhere. There can be no fraud or idleness anywhere.

(ii) Economical Management:

It is unnecessary to engage large staff. Verbal messages will take the place of written orders which are generally half understood. No elaborate accounts need be kept. All this means a great saving.

(iii) Personal Attention to Customers:

The small businessman sends away his customers perfectly satisfied. He personally attends to their orders and at once removes difficulties and misunderstandings. Personal contact is pleasant and profitable.

(iv) Personal Touch with the Employees:

The employer is in constant touch with his employees. He can promptly attend to their difficulties or grievances and remove them without delay. Peaceful relations can be thus easily maintained, and strikes and lock-out avoided. This makes the business smooth and prosperous.

(v) Greater Adaptability:

If conditions of trade change, the small producer can change his front. He is in a position to take quick decisions. He has to consult nobody except himself.

(vi) Independence:

The small-scale producer is happy that he is independent. He will not like to work as a subordinate in a big business. This sense of independence is a great incentive for hard work.

(vii) Nature of Demand:

The small producer has an advantage over the large producer when the demand is either small or is constantly changing. He has thus a sphere of his own where he has advantage over the large-scale producer.

(viii) Nature of Industry:

There are some industries where the personal factor is very important, e.g., tailoring. It is quite advantageous to run such business on a small scale.

Conclusion:

It is due to advantages like the above that the small-scale businesses have survived and are able to compete with big businesses even in modern times. These advantages make production economical and help the small business to survive and compete.

Disadvantages of Small-scale Production:

The small-scale production cannot reap those economies which are available to a big concern.

(i) Less Scope for Machinery:

There is less scope for the use of modern machinery and labour-saving devices. The cost per unit, therefore, of the small-scale producer is generally higher.

(ii) Less Scope for Division of Labour:

There is little scope for division of labour. The advantages of division of labour are, therefore, lost to the small producer. He cannot put the right man in the right place. Goods are not, therefore, made by experts. They are, thus, inferior in quality and higher in cost.

(iii) Disadvantages in Purchases and Sales

The small-scale producer is at a disadvantage both in the purchase of raw materials and other accessories and in the sale of his finished goods. This also raises his cost of production and marketing.

(iv) No Research and Experimentation:

A small businessman cannot afford to spend large sums of money on research and experiments. He cannot, therefore, discover new processes or new materials. He treads the beaten path and is soon overtaken by rivals.

(v) Higher Overhead Costs:

Cost of rent, interest, advertisement, etc., per unit of the output is higher. A small-scale producer has, therefore, higher overhead charges.

(vi) Inability to Face Misfortunes:

With his limited resources the small- scale producer cannot meet bad times. The business may, therefore, collapse at the slightest touch of adversity. A small business is financially weak.

(vii) High Cost of Credit:

A small-scale producer cannot secure cheap- credit because the credit of a small business is not generally as high as that of a big business. Since he has to pay high rate of interest, his cost of production is higher.

(viii) By-products Wasted:

By-products have to be thrown away as so much waste. A small-scale producer cannot have the equipment to make an economical use of the by-products. This also raises his cost of production.

Advantages and Disadvantages of Large-Scale Production

Advantage of Large-Scale Production:

The modern factory system, with its extensive use of machinery and division of labour, is responsible for large-scale production.

The following are its chief advantages:
(i) Economy of Specialized and Up-to-date Machinery:

There is a large scope for the use of machinery which results in lower costs. A large producer can install an up-to-date and expensive machinery. He can also have his own repairing arrangement. Specialized machinery can be employed for each job. The result is that production is very economical. A small producer with a small market cannot keep the machinery continuously working. Keeping it idle is uneconomical. A large producer can work it continuously and reap the resulting economies.

(ii) Economy of Labour:

In a big concern, there is ample scope for division of labour. Specialized labour produces a larger output and of better quality. It is only in a large business that every person can be put on the job that he can best perform. The large-scale producer thus gets the best out of every person he employs.

(iii) Economies of Bulk buying and selling:

While purchasing raw material and other accessories, a big business can secure specially favorable terms on account of its large custom. Whine selling its goods, it can attract customers by producing a greater variety and by ensuring prompt execution of orders. Even a small rate of profit results in larger sales and higher net profits in a large-scale business.

(iv) Economies of Overhead Charges:

The expenses of administration and distribution per unit of production in a big business are much less. Interest, the pay bill, and other overhead charges are the same whether production is large or small. Thus, the same amount of expenditure being distributed over a larger output results in a lower cost per unit.

(v) Economy in Rent:

A large-scale producer makes a saving in rent too. If the same factory is made to produce a large quantity of goods, the same amount of rent is divided over a large output. This means that the cost per unit in respect of rent comes to a much smaller amount.

(vi) Experiments and Research:

A large concern can afford to spend liberally on research and experiments. It is well known that, in the long run, these expenses more than repay. Successful research may lead to the discovery of a cheaper process. This may bring a large profit. Only a large-scale business can incur such expenditure.

(vii) Advertisement and Salesmanship:

A big concern can afford to spend large amounts of money on advertisement and salesmanship. Ultimately they do bear fruit. Also, the amount of money spent on advertisement per unit comes to a low figure when production is on a large scale. The salesman can make a careful study of individual markets and thus acquire a hold on new markets or strengthen it on the old ones. Thus a large-scale producer has a greater competitive strength.

(viii) Utilization of By-products:

A big business will not have to throw away any of its by-products or waste products. It will be able to make an economical use of them. A small sugar factory has to throw away the molasses, whereas a big concern can turn it into power-alcohol. By utilising by-products, it can lower the cost of production.

(ix) Facing Adversity:

A big business can show better resistance in times of adversity. It has much larger resources. Losses can be easily borne. A small concern will simply collapse under such a strain.

(x) Cheap Credit:

A large business can secure credit facilities at cheap rates. Its credit in the money market is high and the banks are only too willing to give advances. Low cost of credit reduces cost of

production. These are some of the advantages that a large-scale business has over a small-scale business. It can produce better goods at lower cost. But let us see the other side.

Disadvantages of Large-scale Production:

Large-scale production is not without its disadvantages.

Some of these disadvantages are:

(i) Less Supervision:

A large-scale producer cannot pay full attention to every detail. Costs often rise on account of the dishonesty of employees or waste of material by them. This is due to the lack of supervision. Owing to laxity of control, costs of production will go up.

(ii) Individual Tastes Ignored:

Large-scale production is a mass production or standardised production. Goods of uniform quality are turned out irrespective of the requirements of individual customers. Individual tastes are not, therefore, satisfied. This results in a loss of customers.

(iii) Absence of Personal Element:

A large scale business is generally managed by paid employees. The owner is usually absent. The sympathy and personal touch, which ought to exist between the master and the men, are missing, Frequent misunderstandings lead to strikes and lockouts. This is positively harmful to the business.

(iv) Possibility of Depression:

Large-scale production may result in overproduction. Production may exceed demand and cause depression and unemployment. It is not always easy or profitable to dispose of a large output.

(v) Dependence on Foreign Markets:

A large-scale producer has generally to depend on foreign markets. The foreign markets may be cut off by war or some other upheaval. This makes the business risky.

(vi) Cut-throat Competition:

Large-scale producers must fight for markets. There is wasteful competition which does no good to society or to businessmen. Many promising businesses are ruined.

(vii) International Complications and War:

When the large-scale producers operate on an international scale, their interests clash either on the score of markets or of materials. These complications sometimes lead to armed conflicts. Many modern wars arose on account of scramble for materials and markets.

(viii) Less Adaptability:

A large-scale producing unit finds it very difficult to switch on from one type of production to another. In a depression, small-scale firms move away from declining trades to flourishing ones easily. In this way they are able to avoid losses. This adaptability is lacking in a big business.

4.7 Infrastructure and its importance

First we should know what constitutes infrastructure. It is variously termed as social overhead capital or economic overhead Broadly speaking, the natural of these installations is that they do not produce commodities directly. They are of a facilitative structure that aids general economic activities. Such investment may be broadly divided into two types. This first type includes those investments promotion health, skills education and other qualities of population. These are investment on human capital formation. The latter include the public utilities in the form of roads, railways, water supply, electric power etc. This lesson discusses in detail the significance of education and health and provides a brief not on the other public utilities.

Before going into the particular divisions as mentioned above, we can refer to some of the characteristics and contributions of infrastructure. Firstly, an infrastructure is characterized by certain indivisibilities. It is for instance indivisible in time Further its equipment has high minimum durability. Installations of lesser durability are either technically impossible or these are much less efficient. Also it has a long gestation period. Another characteristic of infrastructure is that it has a high capital-output ratio.

Next, a few principal contributions of infra-structure may be mentioned here. The infrastructure in the form of public utilities enables better, the functioning of a modern economy as producer of goods and services for consumption and investment. The investments made on health and education, facilitate adding to the capacity of population in the performance of their economic activities.

The way infrastructure facilities economic development is obvious. Many writers have highlighted this. Rostow, for example, while mentioning independent variables for development, includes the construction of social overhead capital as one of the pre-conditions for an accelerated growth. Myrdal regards the construction of infrastructure as necessary for

development. Rosentein-Rodan says that the most important products of the social overhead capital are the investment opportunities created by it in other industries.

Among the several items of infrastructure of an economy, first we can take up Education and Health for a detailed discussion in this lesson.

ROLE OF EDUCATION ECONOMIC DEVELOPMENT

To study Education and Health as key variables in the context of development, forms part of several modern studies on "Human Capital Formation".

The role of human capital in the process of economic development is now a well established fact. Investment in human capital implies, on the job training, migration of individuals and families. Study programmes for adults. Among these, education is by far the most important item. We propose to explain the importance of investment of the particular item in the context of an LDC. We cell such investment, educational capital formation.

Human resources constitute the ultimate basis for wealth of nations. While capital and natural resources are passive factors of production, human beings are the active agents who accumulate capital, exploit natural resources, build social, economic and political organizations, and carry forward national development. Clearly, a country which is unable to develop the skills and knowledge of its people and to utilize them effectively in the national economy will be unable to develop anything else.

We first explain the paramount importance of expenditure on education in an LDC.

In a newly liberated less developed country, paucity of physical capital is generally viewed as most important bottleneck and hence first impulses are used to remove inadequacy of physical capital. It is possible that over-enthusiasm in having greater amounts of capital goods, may result in refusal to educational capital its due place. This is corollary to the shortage of investible resources. There exists a complementary relation between physical capital and education capital and hence formation of physical capital should be accompanied by educational capital formation. Here in lies the importance of capital allocation of resources between the two.

We should note that there must be a critical minimum ratio between them, which if not attained will result in wastage and less then optimal rate of growth of income. Further it could be observed that the relative contribution of educational capital in the process of economic development in a number of countries has been much greater than that of physical capital. Clearly the lessons of history of economic development through planning should integrate strategies of formation of physical as well as educational capital on the basis of rules of optimal allocation.

Now we can refer to some studies made with reference to the contribution of education in the context of development. This will help appreciate the significance of educational capital, in enhancing the GNP, of an economy. These studies spell out in detail the benefits of education already referred to by way of providing empirical substance to the existing theories.

Several empirical studies have been made in developed countries. Particularly in the U.S.A. They have gone into the sources of growth analyzing the contribution made by various factors, such as physical capital, man hours, education etc. they have clearly shown that education or the development of human capital is a significant source of economic growth. So low has estimated that for United States between 1909 and 1949, 87.5 percent of the of the growth in output per man hour could be attributed to the residual factor which represent the effect of the technological chance and of the improvement in the quality of labour mainly as a consequence of education.

Denison has separated and measured the contributions of various elements of their residual factor. According to his estimates that over the period 1929-57, education could explain about 23 percent of the growth of real national income and 42 percent of the growth of real national income per person employed.

The contribution of education to economic growth has also been measured using the rate of return approach using this method Gary. S. Backer measured income differential arising from the cost of expenditure incurred on acquiring a college education in the United States. He showed that the rate of return on education in the U.S.A. for urban white population were 12.5 percent in 1940 and 10 percent in 1950. Renshaw also adopted this approach and estimated that the average return on university education ranged between 5 and 10 percent for the period 1900 to 1950 in the U.S.A.

We should observe have that estimates of rate of return on investment in education are based upon private rates of returns to individuals receiving education. However, by assuming that differences in earnings in a market economy reflect differences in productivity the rate of return on investment in education is taken to be the effects of education on the output of the country.

Another approach to measure the contribution of education is based upon the analysis of the relationship between expenditure on education and income. Using this approach Schultz studies the relationship between expenditure on education and consumer's income and also the relationship between expenditure on education and physical formation for United States during the period 1900 to 1956. He found that when measured in constant dollars the resources allocated to education rose about three and a half times. A) relative to consumes income in dollars b) relative to the gross formation of physical capital in dollars. This implies that the "income elasticity" of the demand for education was about 3.5. Over the period or in other works, education considered as an investment could be regarded as 3.5. Times more attractive than investment in physical capital. It may, however, he noted that these estimated of Schultz only indirectly reflect the contribution of education to economic growth.

In our analysis above we have explained that education is regarded as investment and like investment in physical capital, it raise productivity of labour and thus contributes to growth of national income. The increased earnings or higher wages made by more educated workers have been considered as benefits not only to the private individuals but to the society as a whole. Because, higher earnings presumably reflect higher productivity, increased output in real as well as in monetary terms. Now we can look into the consumption benefits. Education yields consumption benefits for the individual as he may enjoy more education, and derive increased satisfaction from his present and future personal life. The welfare of the society depends on the welfare of its individual members so the society as a whole also gains in welfare as a result of the increased consumption benefits of individual from more education. In economic theory, to measure the marginal value of a product or service to a consumer, we consider how much he has paid for it, thus the relative prices of various products reflect the marginal values of different products and the amount consumed of various products multiplied by their prices would indicate the consumption benefits derived by the individuals. The same could be applied to education also. It may, however, be pointed that prices in fee market economy are influenced by a given income distribution and the presence of monopolies and imperfection in the market structure and therefore they do not reflect the true marginal social values of different goods. Thus measuring the consumption benefits of education becomes difficult. However it has yet to be found out given its policy relevance. We should bear in mind that economic development is not merely concerned with the growth of output but also with the increase in consumption and welfare of the society.

Apart from the investment and constipation benefits there are a few other external benefits. Firstly education makes our social and political life more healthy and meaningful. Secondly, it has its positive impact on technological change in the economy. Higher education stimulates research and thereby raises productivity.

Education has its influence on structure and pattern of economic development as well as on the distribution of income and removal of poverty. Some recent studies in poor countries have revealed that education, given the present educational system has tended to increase the inequalities in income distribution, rather than distributing them. This is owing to certain special difficulties encountered by the poorer sections of the community. For instance, the private costs, particularly, the opportunity costs of primary education for the children belonging to the poor families are higher than for students belonging to the rich families.

But byway of adopting suitable change in the educational system, this problem could be overcome in the less developed countries Education must be restructured in such a way that rural development receives the highest priority in these nations. Education, as it obtains today, is mostly urban-based and hence is ill suited to the requirements of agricultural and rural development. A relevant and meaningful education in a poor primary oriented country should be able to raise the productivity of the rural poor in agricultural work. Further education should induce in the people the desire to go for a small family, which will not only raise their standard of living, but also help the general economic development by checking the growth of population.

Also education should be capable of bringing about improvement in their health and nutrition. Thus, an educational policy, well conceived and implemented with a fair degree of efficiency, will go a long way in effecting development.

Health and Economic Development

Irving fisher says that the true wealth of the Nation is in the health of the individuals. Economists assume an average economic man who is "healthy and is in full command of his body and mind".

Sickness is not a normal factor in the functioning and growth of the economy. But the LDCs present a different picture. Even at birth there is only 80 percent chance for the survival on infants. They are prone to all attendant sickness of childhood. They go through adult hood in the midst of endemic and contagious diseases and only to live up to 50 years on an average. Hence the individual is not any more one who is in full command of his body and mind. In fact half of the population of the developing world numbering one billion is suffering from some disease or other due to deficient diet. Four hundred million of them are children. Therefore, an average economic main in LDCs is characterized by lack of health, which affects his attitude towards work, initiative, creativity, bearing ability, energy and capacity for heavy or sustained work or thought. Productivity of an individual is by and large a function of his physical health status, that decides an important part of his welfare. Personal incomes do not always reflect individuals welfare. In the real income of the individual, health is an important component. But this factor can be quantified. It is this difficulty of quantification that makes the relation between health and economic development quite complex. Economics has contribute to the understanding of the problem, the underfed sick man, their economic dete-minants and economic consequences. But we should note here the paradox. The traditional theory of consumption does not emphasis the enormous need based demand of the malnourished and underfed. Instead it caters to the want based demand of the superficial economic man with homogeneity as his characteristic.

This assumption has a serious drawback Young children are not homogenous to adults in view of these realities, some recent works have attempted to reorient the approach to human capital in the light of health as well. Health is both a consumption and an investment. As an end in itself being responsible for a good part of human welfare, health is consumption. As a key component of the human capital which determines the level and duration of one's market and non-market activities, health is an investment. In this respect it can be related to some measurable components of earnings and non-monetary incomes.

Health standards as important determinants of the longevity of human life differ from country to country. The average life expectancy at birth in less developed countries is 49 years and in advanced countries it is 75 years. This is entirely due to the difference in health conditions between the two areas. Life expectancy has an important bearing on the productivity rate and hence on the dynamics of growth.

A composite indicator of national well-being has been recently worked out by the overseas development council in Washington and is called PQLI: the physical quality of life index. This has important policy significance. This index is calculated by taking into consideration the level of nutrition, the standard of medical care, the nature of income distribution, comparative levels of education and the extent of employment opportunities. High PQLI is found associated with high per capital incomes. The case of Sri Lanks can be cited as a notable exception to this rule. With a per capita GNP of $ 11.770 obviously a fairly high quality of life can be secured even with low per capital income by adopting appropriate social welfare policy ensuring basic needs of the people. These fact suggest that more high per capita income in itself is no guarantee of satisfactory levels of literacy, life expectancy and in fact mortality.

A.C. Pigou, strong advocate of state intervention for transferences from the rich to the poor, upholds that resources transferred to "poor in the form of medical care and appropriate food are likely to prevent large loss of capacity". To get good results the "transference must be adequate and the medical attendance or supervision must not be abandoned at too early a state". This is a sound caution to policy makers to out for sustained programme to yield enduring results. He pleads for transference in the form of training and nature to the normal children of the poor. "Here is immense scope for profitable investment. It is when their children are young that poor families are lest able to provide adequately for them. Properly arranged, help for these children may do much towards building in the most plastic period of life, strong bodies and minds trained at least in general intelligence and perhaps also in some form of technical skill. As with the sick, so too with the children the case expended on them must be adequately prolonged".

Social justice apart, economic consequences of a nation's children prone to malnutrition and diseases provide economic justifications that are more than adequate. These justifications come broadly under three categories (1) Children's health and nutrition is a "Public Good" and an externality to the rest of the society. Malnutrition and ill health are results of distorted, non pare to optimal allocation of country's economic resource (2) good health in children leads to resource savings in future, (3) healthy children increase future productivity. In short the public good approach, resource saving approach and human capital formation are sound economic basis for massive children. Health programmes that must be given high priority.

Strategy for Health Promotion

The arguments presented in the foregoing paragraphs, suggest the economic significance of health promotion in the context of development. There is, of late greater awareness' than ever before, at the global level to promote health programmes. The world health organization too is propagating the philosophy of "Health for all". The 30th world Health Assembly has resolved that the main social target of Government and of WHO should be the attainment by all citizens of the world by the year 2000. A.D. of a level of health that will permit them to lead a socially and economically productive life. For achieving this, the problems of health should be understood in all its dimensions. Firstly the problems may be spelt out.

1. Substantial disease burden in the population contributed by high prevalence of communicable, nutritional and other diseases. Among these, malaria, tuberculosis, leprosy, cholera, malnutrition, under nutrition etc. are the most important.

2. Environmental, demographic and socioeconomic determinants of the disease burden. Of these, the most important factors are poverty, unemployment, low level of education population growth pressures attributable to high growth rates, certain beliefs and habits, lack of basic amenities such as safe drinking water and sanitation to vast numbers of people.

3. Inadequate infrastructure of health services and appropriate health service systems: this is coupled with other important constraints such as paucity of adequately trained manpower inappropriate technologies, constraints in managerial process at all levels, gross inadequacy of financial resources for health development resulting at least partly from national policies.

It is obvious that the factors in the three categories are closely inter-related. In fact, they contribute in a kind of vicious cycle leading to perpetuation of the existing constraints.

National and regional strategies for the attainment of Health for all objectives must be addressed to the entire range of causes in each of these dimensions.

Such a strategic framework must encompass the following principal strategies.

a) Strategies for the Development of health and Socio-economic policies including improved capability for planning. Since health development can only be conceived as an integral part of socioeconomic development at the national level, this will ecompass appropriate socioeconomic policy.

b) Support strategies for ensuring community participation appropriate change in the community Health Behaviour and organization of communities for their own development, this is a complex area which involves many socio anthropological economic, socio psychological and socio cultural factors. Therefore appropriate actions are necessary to bring about full-fieldged community participation.

c) Strategies for Utilization of Appropriate Technology for Health strategies would be required for the development and utilization of appropriate technology for health. These will include not only hardware but such software as communication process.

d) Strategies for Development of Managerial process at various levels: The entire success of primary health care depends on appropriate application of managerial processes at all levels of development. This is true from the top decision, making level of the operational grassroots level.

e) Strategies for the development and mobilization of material Manpower and Financial Resources.

f) Strategies for ensuring inter and intrasectoral collaboration: Because health is both input and output of overall development, all development sectors have to participate in its betterment. Thus, priorities between different components of development will be rationally determined. Within the health sector itself, collaboration and coordination must be ensured at all levels and between the programmes.

g) Strategies for Ensuring Delivery of at least a minimum package of essential service to all people: Minimal these include education concerning prevailing health problems and the methods of preventing and controlling them Promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; material and child health care including family planning, immunization against the major infectious diseases: prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and orovision of essential drugs. Strategies will be directed to promote and assist efforts for provision of this minimum package.

h) Strategies for appropriate research in Health and Health-related systems.

i) Strategies for maximizing Technical cooperation among developing countries.

j) Strategies for development of appropriate Mechanisms for Evaluation and Monitoring progress in Health Development.

Having looked into the aspects of education and health at length we can move on the public utilities for a brief discussion. Mainly three aspects namely irrigation, transport and power deserve mention.

There are four major uses of irrigation (1) It helps to increase production and productivity through double and multiple cropping (2) it corrects the imbalances and stabilizes the water situation for the country. Where there is excess water it is stored through reservoirs and the later is used by drought affected areas. 3) Irrigation release land for non-crop uses. More production through irrigation would imply lesser use of land. This would make available more land than at present for such purposes as animal husbandry, for estry and horticulture (4) Lastly it helps small and marginal farmers can the helped a lot by making it possible for them to practice in ensive agriculture with assured water supply. Small farming can be most modern and yield large return only if the basic input i.e., water is available.

The economic benefits of Transport are:

1. It serves final consumers by taking products to them.

2. It facilitates production by moving raw materials, tools, machines etc; to places of production.

3. It is a key agency for the promotion of planned development. In terms of the use of resources as per priorities of plans, transport helps in linking and do retailing of different parts of the economy.

There are also non-economic benefits of transport.

1. There are social benefits. It brings together people from different regions and places. This helps tone down the rigours of social evils such as caste, untochability etc.

2. The economy benefits politically also. Transport helps people in their political integration.

3. There is also the cultural benefit that arises out of contracts among the people. The people belonging to different races, religious and languages learn to live together. This makes more generous and humane in approach. Coming to Fuel and power, we find that they are the key elements in the modernization al also expansion of the economy. It is required both for commercial uses such as, transport, agricultural purpose, industrial purposes etc. and also for nor-economical uses such as domestic lighting, heating, cooking, refrigeration, etc. the demands on both these counts are rising fast and hence the importance of fuel and power from a development perspective. Of late, all the developing countries are assigning a heightened importance to the public utilities like irrigation-structures. Transport and Power generation. Many studies going into the cost-benefit aspects of these public utilities have also come by

REVISION POINTS

(a) Social overhead capital (b) Physical and human infrastructure (c) Health and Economic development (d) Role of Irrigation, power and transport.

QUESTIONS

(a) Briefly the role of physical infrastructure and development.

(b) Briefly the role of Human infrastructure and development.

(c) List the strategy for health promotion.

4.8 Information Technology

Information - Information is the act of informing or the conditions of being informed, the communication of knowledge, and knowledge derived from study, experience, or instruction.

Technology- Technology is the application of science, especially to Industrial or commercial objectives. We may hear terms such as information age, information society, and knowledge workers and wonder what they all mean. What these and other such terms refer to is one aspect or another of the increased role that information technology is playing in our lives and career.

What is Information Technology?

The phrase information technology (IT) refers to the creation, gathering, processing, storage, and delivery of information and the processes and devices as tools that makes all the

possible. Think of these processes and devices as tools that makes our life and career better or more efficient. The tasks that are handled using information technology continue to increase almost on a daily basis. For example, a few years ago, cinematography and photography didn't use computers at any point in the process. Now, computers are in -cameras, processing nibbles and the editing room. No matter what field of study we major in, or where we are employed, we will be sure to find information technology at work.

Growth and Performance of Information Technology Industry in India

Growth and Performance of Information Technology Industry in India: The information technology industry has emerged as one of the fastest growing industries in India. As a proportion of Gross Domestic Product, the information technology industry revenue has grown from 1.2 percent in 1998 to an estimated 5.5 percent in 2008. India's domestic market is estimated to grow by 20 percent growth in 2008-09. Hardware segment is estimated to grow by 17 percent to be Rs. 541 billion, information technology services segment is estimated to grow by 20 percent to be Rs. 380 billion. Whereas software products and BPO segment is estimated to grow by 15 percent to be Rs. 103.3 billion. Export growth is expected at 16-17 percent in 2008-09. According to the latest findings of NASSCOM, the aggregate revenues of the sector are expected to reach USD 60 billion in 2008-09. Industry will continue to net hire and focus on value creation, provide direct employment to 2.23 million and indirect job creation estimated to eight million employees. Indian information technology sector is developing as the biggest source of revenue and employment generator.

The growth of information technology industry will also develop the other industries of the economy. This industry has a number of customers in India, as well as also in abroad. The USA (60 percent) and the UK (19 percent) remain the largest, information technology export markets in 2008. The industry footprint is steadily expanding to other geographies - with exports to continental Europe in particular is growing at a CAGR of more than 51 percent over 2004-2008 (www.nasscom.org.)

Table: 1 India's GDP and Information Technology Industry Growth

Years	GDP Growth (USD Billion)	IT Growth (USD Billion)	%age share of IT Industry in GDP
1997-98	411.570	5.0	1.2
1998-99	440.597	6.0	1.4
1999-00	461.914	8.2	1.8
2000-01	473.050	12.1	2.6
2001-02	494.997	13.4	2.7

2002-03	573.167	16.1	2.8
2003-04	669.442	21.5	3.2
2004-05	783.141	28.2	3.6
2005-06	877.224	37.4	4.3
2006-07	1098.945	47.8	4.3
2007-08	1232.946	64.0	5.2

Source: www.adb.org, and www.nasscom.org

Table: 2 IT sector in share of Indian GDP

Year	GDP growth in (%)	Indian growth(in %)	IT output rates (in USB)	IT sector in share of Indias GDP level and (US$Bn)
2011	6.6	16	76.3	6.4
2012	5.5	12	81.8	7.5
2013	6.5	10	95.7	8
2014	7.2	9	106.3	8.1
2015	7.9	17	132	9.5
2016	7.1	-	143	9.3

Questions

1. What is Information Technology?
2. Explain in the Technology?
3. Growth and Performance of Information Technology Industry in India?

DevelopmentPlanning

A development plan is an aspect of town and country planning in the United Kingdom comprising a set of documents that set out the local authority's policies and proposals for the development and use of land in their area.

DEFINITION OF DEVELOPMENT PLANNING

Development planning happens in many different contexts so to define it succinctly is tricky. Basically development planning refers to the strategic measurable goals that a person, organization or community plans to meet within a certain amount of time. Usually the development plan includes time-based benchmarks. It generally also includes the criteria that will be used to evaluate whether or not the goals were actually met.

5.1 Meaning of Economic Planning

When **planning** for **economic development**, the goal is to create and maintain a strong, vibrant local economy. The **economic development** plan provides a comprehensive overview of the economy, sets policy direction for **economic** growth, and identifies strategies, programs, and projects to improve the economy.

What is Economic Planning?

The fundamental purpose of economic life is the satisfaction of human wants which are basically unlimited. All the economic activities of any modern society are directed towards satisfying human needs with limited (scarce) resources.

The limitation of resources forces society to make choice and allocation. Economic resources are scarce in relation to the demands for their alternative uses. The primary economic problem is the allocation of scarce resources to satisfy human wants in an manner that brings maximum satisfaction.

And economic planning, writes B.C. Tandon, "means arrangement of resources which are scarce in relation to the needs for their alternative uses in such a way that the satisfaction yielded by them is maintained at an optimum level. It thus involves the element of choice between scarce means of achieving a pre-determined end. It is a carefully thought out rational arrangement of economic resources". L. Robbins says: "To plan is to act with a purpose, to choose, and choice is the essence of economic activity".

The term 'planning' in such a context has been defined differently by the different writers like W.A. Lewis, Jan Tinbergin, RagnarNurkse and others. Briefly speaking, economic planning is a conscious and carefully thought- out process, initiated by the state for the efficient utilisation of the country's available resources to realise some basic objectives.

In the words of H. D. Dikinson, **"Economic planning is the making of major economic decisions— by the conscious decision of a determinate authority, on the basis of a comprehensive survey of a country's existing and potential resources and a careful study of the needs of the people."** On the basis of the available resources and the needs of the people, development plans for a definite period are prepared beforehand by the central planning authority. And then the economic activities of the country are directed towards the implemen-tation of the plans.

Essentials of a Good Plan:
The following are some of the essential elements of a good plan:
1. An economic plan is based upon the initial resources of the country, presupposing a careful inventory of present and future availability of manpower and domestic resources.
2. It sets up feasible targets or goals for the terminal date.
3. It sets out the feasible policies that permit achievement of the terminal (end-period) goals from the initial resources taking into account the intermediate economic resources that can be imported from abroad (through loans or gifts) and that can be produced at home out of the initial resources by the mechanism of domestic investment.

Basic Features:
The basic objective of planning is to exercise control over the private sector of an economy. Controls are exercised over economic resources which are scarce. When the economic resources of the country are rationally arranged with a predetermined purpose, it is called economic planning. It usually refers to planning by the State.

Economic planning has some essential features:
a) There must be a centralised planning authority for preparing the plans and suggesting the means for their implementation.
b) Before framing the plan, the planning authority should undertake an accurate survey of the available resources (both existing and potential) and the essential needs of the country.
c) An economic plan must have some definite aims and objectives.

d) The plan should lay down a series of targets on the different lines of production such as agricultural, industrial, etc.

e) It should make a proper allocation of the proposed outlay into the different heads of development.

f) An economic plan must have a definite time limit, usually 5 years (as in our country).

g) There must be mutual consistency between the targets of the production of the different sectors.

According to Prof. Oscar Lange, "The problem of an underdeveloped country is not merely one of assuring sufficient productive investment but also of directing that productive investment in such channels as will provide for the most rapid growth of productive power of national economy".The investment criterion implies pick and choose policy. The aggregate volume of investment to be undertaken becomes, meaningful when expressed in terms of concrete investment projects. The programming aspect of investment planning is an important problem of planning in underdeveloped countries.

In underdeveloped countries the investible resources are very much limited according to their increasing needs. Therefore, the planners have to decide regarding the distribution of resources between industry and agriculture, capital goods and consumer goods industries, public sector and private sector. The flow of investment resources in these different sector is influenced by political, social and economic factors.Allocation of investment resources becomes a difficult task due to the existence of a number of development objectives. These objectives may be conflicting in the short run and hence there are no simple criteria for fixing up the investment priorities.

According to Meier and Baldwin, it is difficult to establish a satisfactory criterion for best allocation of investment because alternative investment criterion will affect total output differently, a certain investment criterion may be more relevant for maximizing output over a different time period.Moreover, the allocation of investment will affect not only total output but also the supply and distribution of the labour forces, social and cultural conditions, growth and quality of the population, tastes and technological progress.

5.2 Meaning of Investment Criteria

According to Meier, "Investment criteria refers to the problem of determining the best utilisation of investment resources to minimize capital intensity, to maximize social marginal productivity of capital and employment absorption."

Objectives of Factor Allocation of Investment:

The primary objective of a developing economy is to secure a greater and faster increase in its income from its available resources.

Therefore, the objectives of investment criteria are summarized below:

(i) Equal distribution of income and wealth.

(ii) Balanced and rapid growth of the economy.

(iii) To raise the gross and national product and per capita income.

(iv) Proper allocation of existing resources.

(v) Efforts to correct the balance of payment.

vi) All-round development of the country.

(vii) To keep watch the interest of the future generation.

Types of Investment Criteria:

1. Social Marginal Productivity Criteria:

This theory was put forward by Hollis B. Chenery. Social Marginal Productivity of Investment may be defined as the return to the private investor plus the net contribution of the investment to the national product. According to this criterion, the projects must be ranked according to their social value, determine the marginal project from the total funds and exclude all lower- ranking projects.

In order to measure social marginal product (SMP) Chenery used the following method:

Let the welfare function be $U = f(Y, B, D,....)$ ...(1)

Where Y = effect on income,

B, effect on balance of payments,

D = effect on distribution of income, and

U = index of social welfare.

Then increment in U corresponding to a given increment in investment can be written as:

$$\Delta U = \frac{\delta U}{\delta Y} \Delta Y + \frac{\delta U}{\delta B} \Delta B + \frac{\delta U}{\delta D} \Delta D + \quad ...(2)$$

This implies, the increase in SMP is the sum of the effects of a change in income, balance of payments portion, distribution of income etc. For simple explanation, all other variables are ignored excepting Y and B to express SMP.

Accordingly:

SMP = ΔU = ΔY + rΔB … (3)

      Mathematically, "r" represents an amount of increase in national income which would be equivalent to an improvement of one unit in the balance of payments under specified conditions. Therefore, r measures the average over-valuation of the domestic currency, at the existing rates of exchange. If r=0, balance of payments is in equilibrium, if r is positive (>0), the domestic currency is overvalued and if r is negative (<0) the domestic currency is undervalued. In underdeveloped countries r may be appreciably greater than zero because of the relative inelasticity of imports and exports.

This follows:

$$SMP = \frac{X+E-M_i}{K} - \frac{L+M_d+O}{K} + \frac{1}{K}(\alpha B_1 + B_2) \qquad \dots (4)$$

(or)

$$SMP = \frac{V}{K} - \frac{C}{K} + \frac{B_r}{K}$$

Where all variables (except B_1 and K) are annual flows:
SMP = Average annual increment in national income from marginal unit of investment in a given productive use;

K = Increment to Capital (Investment),
X = Increased market value of output,
E = Added value of output due to external economies,
M_1 = Cost of imported materials.
V = Social value added domestically, i.e., $V = X+E-M_i$
L = Labour cost,
M_i = Cost of domestic materials,
O = Cost of overheads,
C = Total cost of domestic factors = $L + M_d + O$.
B_r = Total balance of payments effect = $\alpha B_1 + B_2$
α = current amortization and interest rate on current borrowings,
B_1 = Effect of investment on balance of payments.
B_2 = Effect of operation on balance of payments.

Thus, the social marginal product is divided into three elements, viz.:
(a) Value added in the domestic economy for unit of investment;
(b) Total operating costs per unit of investment; and
(c) Balance of payments premium per unit of investment.
Equation (5) can be expressed as
SMP = (V/K) (V-C/V) + B_r/K ….(6)

SMP is thus the product of the percentage margin of social value over cost (V-C/V) and the rate of capital turnover plus the balance of payments premium. This form of equation shows that a decrease in the rate of capital turnover may be offset by a proportionate increase in the value margin and vice-versa.

2. Capital Turnover Criterion or Capital Intensity Criterion:

J.J. Polak and N.S. Buchanan have propounded this criterion. This criterion is based on capital-output ratio, i.e., K/Y of a project. In those countries where capital is scarce, funds should be invested in those projects which have the lowest capital intensity. This criterion is also used in its reverse form and then it is called capital—turnover criterion. According to this criterion, those projects should be selected which have a high rate of capital turnover or low capital output ratio.

Since capital is scarce in underdeveloped countries, those projects should be chosen which yield maximum output per unit of capital invested, i.e., where the capital—turnover is the highest. Quick yielding projects with low capital intensity are also desirable because they make it possible for the scarce capital resources to be released soon for investment in other projects. Such projects also generate more employment which may be very desirable in the context of underdeveloped countries.

3. Reinvestment Criteria or Criteria of Investment for Accelerated Growth:

Walter Galenson and Harvey Leibenstein introduced the concept of marginal per capita reinvestment quotient criterion for investment in the underdeveloped countries. The rate of investment per unit of capital invested is given by

$$r = p - ew/ c \quad \ldots(1)$$

Where p=output per machine; e=number of workers for machine; w = real wage rate; c = cost per machine and r = rate of reinvestment per unit of capital.

This model explains the employment provided by any combination of men and machines through the following equation:

$$E_{1+1} = E_1 \left(1 + \frac{p - ew}{c}\right)^t \quad \ldots(2)$$

Where E = Total employment

It is assumed that I = P—W … (3),

i.e., the total amount invested in any period is the difference between the total gross value added (P=Np) and the real compensation paid to labour (Ew) Then:

I = P—Ew …(4)
I = NP—Ew …(5)
$I = N_p — eNw = N(p— ew)$ …(6)
Net investment I = cost per machine (c) multiplied AN, the increase in number of machines,
Is given by $(\Delta N/N)$ and is equal to the rate of reinvestment for unit of capital i.e.,

$r = \Delta N/N = P — ew/c$ …(9)

This criterion is thus designed to take into account the influence of choice of projects on the rate of capital accumulation. If we assume that all profits are reinvested while all wages are consumed, this reinvestment quotient is nothing but the rate of profit. This reinvestment quotient is likely to be higher in capital intensive than in labour intensive projects.

4. Time Series Criterion:

This criterion was put forward by Prof. A.K. Sen. According to him, time factor is an important factor in the choice of techniques. If the capital output ratio and the rate of savings, the time path of two techniques can be drawn. It can be found out which of the techniques yields the highest returns over time horizon.For that, a time horizon is fixed up and returns for both the projects for different years are calculated. On the basis of this we can find out a period of recovery for any pair of techniques. In choosing the technique we compare this period of recovery with the period we are ready to take into account.

Suppose that there are two projects H and L and time horizon is ten years at the end of which total returns in each case are 100 million.

Period in year	Project 1 Capital Intensive (H)Return in lakhs	Project II Labour Intensive (L)Return in lakhs
1	2.5	6.5
2	4.0	7.0
3	6.0	8.5
4	9.5	9.0
5	10.5	10.0
6	11.5	11.0
7	12.5	12.5
8	13.5	12.0
9	14.0	12.5
10	15.5	13.0
	100	100

The returns of the H project are less in comparison to project L over the first six years while in the remaining four years the returns of H rise more than the project L. Since the total returns are the same for both the projects, the overall position is one of indifference.The point to be noted is that whether the initial loss in output by adopting a capital intensive projects recovered within the period of ten years or not. The time taken by the capital intensive technique to overcome its initial deficiency in output over the labour intensive technique is called the period of recovery.

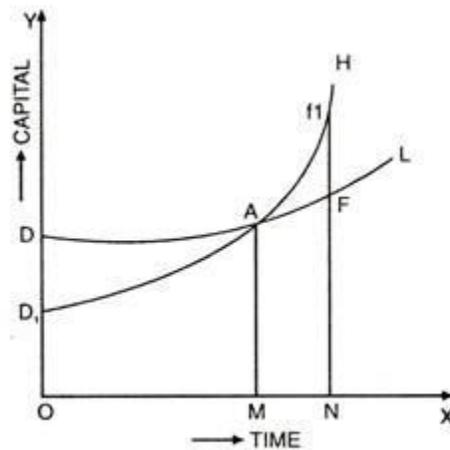**This is explained with the help of diagram given below:**

Fig. I

In diagram I, H and L curves show the flow of real output during a given time horizon with two techniques. The period ON is the period of recovery which makes the area DAD_1 = area FAf_1.

Thus for any pair of techniques a period of recovery can be found. In the selection of techniques the period of recovery should be compared with the period we already taken into account. If it is found that period of recovery is longer i.e. if within the time horizon the loss in output by adopting technique H is not recovered by excess of output we should choose technique L and vice-versa.If there is some conflict between present and future, the choice will depend on the time discounted use.

5. Balance of Payments Criterion:

The balance of payments effect of investment projects is important in case of underdeveloped countries. According to this criterion the allocation of investment should be done to minimize the adverse effect on balance of payments. Balance of payments difficulties of underdeveloped countries are due to the fact that they are heavily dependent on foreign countries for their capital equipment.

They also require foreign exchange for import of materials for keeping this equipment into operation.Buchanan had called this type of imports as the direct drain on foreign exchange. The rise in income due to investment and industrialisation leads to imports of consumer's goods. These are called circulation drain on foreign exchange. On the basis of the effect on the balance of payment.

Polak divides investment into three categories:

I.   Investment, yielding goods which add to the exports of a country or replacing goods formerly imported. The next effect of such an investment will be to create export surplus.

II. Investment, replacing goods previously sold in the country or exported from the country; the effect of this sort of investment on balance of payments will be neutral.

III. Investment, which would result in addition of goods to those sold in the country and in excess at demand. Such an investment will have a negative effect on the balance of payments.

IV. The first two types of investment should be preferred because they will have a favourable effect on balance of payments. The third type maybe avoided. Thus according to this criterion investment projects with least bad effects on the balance of payments must be chosen.

5.3 Linear Programming

Linear Programming is a mathematical device developed by the mathematician George Dantzig in 1947 for planning the diversified activities of the US Air force connected with the problem of supplies to force. Linear or mathematical programming, also known as activity analysis, has been further developed in its application to the economics theory of firm, managerial economics and finally to development planning.

Meaning

It is a mathematical technique for the analysis of optimum decisions, subject to certain constraints in the form of linear inequalities. Mathematically speaking, it applies to those problems subject to a system of linear inequalities stated in terms of certain variables .the problem of maximisation are also called optimization problems. if x and y, the two variables, are the function of z. The value of z is maximized when any movement from that point result in an increased value of z. the value of z is minimized when even a small movement results in an increased value of z. when cost and price per unit

change with the size of output, the problem is non-linear and if they do not change with output the problem is linear. Linear programming may thus be given output or the optimum combination of factors to produce by given plant and equipment. the techniques to produce a commodity. The technique involved in linear programming is similar to the adopted in input-output analysis for the industry.

Condition and Generalizations

The application of limner programming technique to any problem rests on certain condition and generalization .Firstly, there is a definite objective. It may be the maximization of profits or national income or employment or the minimization of costs. It is known as the objection function or the criterion function. If a quantity is maximized, its negative quantity is minimized. Every maximization problem has its dual problem, that of minimization. The original problem is the primal problem which always has its dual. If the prim problem pertains to maximization, the dual involves minimization and vice versa.

Secondly, there should be alternative production processes for achieving the objective. Tomcat of process or activity is the most important in linear programming. A process is a `specific method of performing an economic task'. It is `some physical operation, e.g., consuming something, storing something, selling something, throwing something away, as well as manufacturing something in a particular manner. 'The technique of linear programming enables the planning authority to choose the most efficient and economic process in attaining the objective.

Thirdly, there must be certain constraints of restraints of the problem. They are the limitation or restrictions pertaining to certain conditions of the problem, ad to what cannot be done and what has to be done. They are also known as inequalities. They may be limitation of resources such as land, labor or capital.

Fourthly, there are choice variables, the various productive processes or activities so as to maximize or minimize the objective function and to satisfy all the restraints.

Lastly, there are the feasible solutions. Given the income of the consumer and the prices of goods, Fusible solutions of two goods for the consumer are all combinations that lie on and to the left of the budget line. Whereas, on an is cost line, they are the combination that lie on and to the right of it. We may put it differently that a feasible solution is one which sacrifices all the restraints. The optimal solution is the best of the feasible solutions. If a feasible solution maximizes or procedure for finding out the optimal solution out of the possible highly mathematical and technical procedure involved in linear programming. However, the main aim of linear programming is to find out optimal solutions and study their characteristics.

Assumptions

The linear programming analysis is based upon the following assumptions:

a. The decision –making body is faced with certain constraints or resources restrictions. They may be credit, raw material and space constraints on its activities. The type of constraints in fact depend upon the nature of problem. Mostly, they are fixed factors in the production process.

b. It assumes a limited number of alternative portions.

c. It assumers linear relations among the different variables which implies constant proportionality between input6 and output within a process.

d. (iv)Input-output prices and coefficients are given and constant. They are known with certainty

e. (v) The assumption of additively also underlies linear programming techniques which means that the total resources used by all firms must equal the sum of resources used by each individual firm.

f. (vi) Linear programming techniques further assume continuity and divisibility in products and factors.

g. (vii) Institutional factors are also assumed to be constant.

Lustily, for programming a certain period is assumed. For convenience and more accurate results, the period is generally short, through longer periods are not ruled out.

Programming technique - Its Application in planning

In plan formulation the planners have to decide whether to use labor- intensive or capital-intensive technique of production. Depending on its outlay. They will choose that technique which maximizes output.

Let us suppose that it is planned to produce a commodity Z. Using X and Y input, its objective is to maximize output. It has two alternative production processes, C (capital intensive) and L (labour–intensive). The constraint is a given cost outlay Mp as shown in the figure. All other assumption (noted above) relating to the linear programming technique are applicable. The problem is explained in terms of Fig. 54.1.

Units of input Y per period are measured along the vertical axis and units of input X per period are shown on the horizontal axis. If process C requires two units of input Y to every unit of input X. it will produce 50 units of commodity Z. if the input of X and Y are doubled to four units of Y and two units of X output is also doubled to 100 units of Z can be produced by doubling the inputs X and Y to six

units of X and two units of Y. These output scales are established along to labor –incentive process ray OL as represented by input combination c and d. If the point A and C at the 50 unit output level the corresponding isoquant is I$_1$bds. The cost outlay is constrain is represent by the is cost curve MP and it place a limit on the production capacity of the project. The project can produce with either of the two available techniques C and L within the area represent by triangle *Obd*. It is not possible for it to produce outside this "area of feasible solutions." The "optimal solution" witch maximize the output will occur at the point where the isoquant curve touches the isoquant with the higher output. In fig. 54.1 the isocost curve MP touches the isoquant I$_1$bds at point b on the process ray OC. It shows that the project will use the capital intensive technique C by using four units' four units of input Y and two units of input X and produce 100 units of commodity Z.

Now we take another planning problem. Suppose the planners undertake a project which aims at minimization of costs. Two types of goods X1 and X2 are to be production .let the planners attach weight of 3 and 8to units of these goods. let there be 2 units of resource X1 and 6 units of resource X$_2$,let The production of 1unit of X$_1$ use 1 unit of input C$_1$ and 2 units Of input C$_2$,Simiilarly,let the production of X$_2$ use 2 units of input C$_2$, the problem can now be sct in the linear programming form as:

Maximize 3x$_{1+}$8x$_2$ (R, i,e.,revenue)
Subject to the constrains

$$X_1+2X_2<2$$
and $$2X_1+8X_2<6$$

And none of these quantities is negative. The optimal solution is X$_1$ -2,X$_2$, and R=7
The dual problem is:
Let P$_1$
be imputed price of X$_1$ and P$_2$ be the imputed price of X$_2$.
Minimize 2P$_{1+}$6P$_2$(C, i.e., cost)
Subject to the constraints

$$P_1+2P_2>3$$

and $$2P_1+8P_2<8$$

and that more of these of these price is negative. the optimal solution is : P$_1$=I$_1$P$_{2=1/2}$ and C=7.

These are not shadow or dual price. But as all values have been imputed to the two resource, the maximum value of the objective function C must equal R. Hence C=R=7.

D line CD represents 2P$_{1+}$8P$_{2=8}$ the line AZD in the **figure no.** theoptimum solution is at point Z where the isocost (dotted line) RK passes through the point of intersection of AB and CD**.**

Limitations of Linear Programming

Linear programming has turned out be a highly useful tool of analyisis in development planning. But it has its limitations. As a matter of fact, actual planning problems cannot be solved directly by the technique of linear programming due to a number of restraints. First, it is not easy to define a specific objective function. Second, even if a specific objective function is laid down, it may not be so easy to find out the various ocial, institunal, financial, and other constraints which may be operative in P rusting the given objective. Third given a specifics objective and asset of constranints, it is possible that the constraints may not be directly expressible as linear inequalities. Fourth, even if the above problems are surmounted, a major problems is one estimating relevant values of the various constant coefficients that enter into a linear programming problem,i,e., population, price,etc.fifth, one of the defects of this technique is that it is based on the assumption of linear relations between inputs and outputs. This implies that inputs and output are additive, multiplication and divisible. But the relation between inputs and outputs are not always linear. In real life, most of the relations are non-linear. Sixth, this technique assumes perfect completion in product and factor markets. But perfect competition is that a reality. Seventh, the LP technique is based on the assumption of constant returns in the economy. In reality, there are either diminishing or increasing returns.

Linear programming models present trial and error solutions and it is difficult to find out really optimal solutions to the various economics problems.

Uses of Linear Programming in Planning

Linear programming as a tool of economics development is more realistic than the input, output approach. In input- output analysis only one method is adopted to produce a commodity. it does not take into consideration the bottlenecks(constraints)whicha development project to face in underdeveloped countries. But un any linear programming problem a definite objective   is set to maximize income or maximize costs. All possible process or techniques are taken into account for achieving the desired objective. This necessitates even the substitution of one factor for another till the most efficient and economical process is evolved. So projective and techniques which are too uneconomical to implement are not undertaken. In linear programming the entire process of calculation or selection of various techniques is mechanical,   based as it is on mathematical equations. Once the computer is fed with a plan, it provides an optimum solution.

But assuming certain constraints, linear programming as a tool of development planning is superior to the input-output technique. in underdeveloped countries, planning agencies are faced with such constraints lack of sufficient capital and machinery, growing population,etc. resources exist that cannot be used properly for want of cooperant factors. linear programming takes due note of these

constraints and help in evolving an optimum plan for attaining the objectives within a specified period of time.

In practice, however, the techniques of linear programming are being used very sparingly in solving only a limited number of economic problems in developing countries. In solving only a limited number of economics problems in developing countries. This is due to the lack of proper personnel for working out mathematical equations and for operating highly mechanical computers. Mostly linear programming techniques has been found to be extremely useful for sectoral planning in developing countries: for example, in selecting optimum alternatives in respect of location and technologies in industries, transport, and power or in farm management. This techniques s used to assign jobs to work force for maximum effectiveness and optimum results subject to constraints of wages and other costs not Similarly, purchasing are being solved through the LP technique in order to minimize costs and maximice profit , given the various constraints in the case of problem . However, for an extensive use of this technique for extensive use of this technique for development planning, developing economies will have to depend upon larger resources of trained personnel, and finance.

5.4Investment Criteria

In recent times, most of the poorer have set up development programmes in the belief that governmental intervention in the process of resource allocation will speed up the rate of economic growth. The procedures followed in formulating development programmes, require adoption of suitable investment criteria. There are various criteria suggested by different authors which range from simple rules of thumb such as those based on capital in density and balance of payments effects, to elaborate application of the principles of marginal productivity. In this lesson it is proposed to examine those criteria so as to arrive at some guide posts for allocating investable resources.

In developing countries these choices become especially complex for two reasons. First, due to uncertainty regarding the determinants of development, second due to market perfections, externalities and disequilibria prices make market criteria unrealistic or irrelevant.

Following Adam Smith, the classical economists advocated a liberal' theory of resource allocation. They believed that the unimpeded operation of the free market mechanism would result in efficient allocation of factors. But the market, as Roan points out, is an effective locative much anise only in the allocation of a given stock of consumers goods and of production from a given stock of consumer goods and of production from a given stock of equipment land and labour. The market is not so effective in bringing about the correct allocation of investment owing to imperfect for sight, external economics and complentaries, and in automatically ensuring equilibrium between aggregate demand and aggregate supply".

Realising this deficiency in the liberal theory of the classicists, the neo-classical school held that "the efficient allocation of investment resources is achieved by equating the social marginal productivity to its various uses". In developed countries perfect competition provides a standard of judging such a distribution of resources without necessity of measuring the marginal productivity. In underdeveloped areas, perfect competition cannot be used as a standard for measuring the marginal productivity. In underdeveloped areas, perfect competition cannot be used a standard for many sectors of the economy. Since both private value and

private cost may deviate far from social value and social cost, it is necessary to measure social productivity achieve more or less efficient distribution of investment resources.

This may be attributed to two structural characteristics of underdeveloped countries that effect resource allocation, as compared with the competitive economic system. The first is that "the system normally starts from a position of structural dis-equilibrium rather than of equilibrium". This is due to the ignorance of technological possibilities or of consumer's demand, widespread monopoly positions, expectation of inflation, inadequate social overhead facilities etc. As a result, the resources are far from optimally used this is reflected in shortages of investment funds, foreign exchange deficit, under employment and unemployment. Under these conditions, existing prices are not proper guides for resource allocation, either for government agencies or for private investors.

The second characteristics relates to "external economics" stemming from the fact that may types of economic activities are either non existent or performed in a primitive way in underdeveloped countries. Even if the existing price system were optimal investment in a modern plant in one sector would normally reduce the cost of production and hence affect the profit expectation of both the producers and importer. Investment in an underdeveloped economy cannot, therefore, be considered under 'ceteris paribus' Hence the need for investment criteria or guides for "rational allocation" of the limited resources.

The rate of turnover criterion

The simplest approach to any allocation is to concentrate on the scarcest resource. Since capital is scarce in under developed countries, it is reasonable to choose the technique that uses the least capital to produce a given output; Professor J.J. Polak was the first to evolve two criteria in this connection Discussing the investment criteria of countries reconstructing after the war, he suggested that investment for development should be chosen according to the "Rate of turnover" i.e. the ratio of output to capital, 'Given the magnitude of capital investment – it is desirable to maximize output and thus the rate of turnover". Professor Norman S.Buchanan voices the same view: If investment funds are limited, the wise policy, in the absence of special consideration would be to under take first those investment having a high value of annual product relative to the investment necessary to bring them into existence.

The minimum capital-output ratio criterion s valid only when (i) capital is the only scarce factor or neither inputs are relatively abundant: (ii)_ the same output is produced by each investment alternative: and (iii) production takes place under constant costs. This also requires a measurement of the total capital used in producing a given commodity including capital used in producing all materials and services purchased. This procedure assumes that market prices correctly reflect the use of capital in the rest of the economy.

But, as a general guide to policy, this criterion is imperfect, firstly, the rates of turnover being high, it will result in lesser output as the rate of depreciation will be great. Secondly, it ignores labour cost, when it is zero, a good case can be made for the criterion of maximum addition to net output from a given amount of capital investment. If on the other hand, employment of labour involves some cost to society that has to be taken into account.

Balance of Payments effect

The second criterion of polack concerns the balance of payments effect of the ultimate product. He lays down that "a sufficient portion of the investment must fall into those projects which yield additional export (or import displacing goods or services). This rule provides insurance against balance of payment difficulties after the period of capital formation. According to him balance of payments difficulties may arise due to the necessity of servicing obligation. Secondly, the operation of new industries will result in increased demand for

foreign goods. Hence Buchanan recommended that it is necessary to hold within narrow limits which will produce additional product, for the home market even domestic savings may be adequate to finance projects".

Alfred E Kahn accept the possibility of increased demand for imports directly as a result of investment programme. But he disagrees with the assumption that the marginal propensity to import was greater than zero. Those investments whose products by their very nature are not exportable involve no such inherent threat to balance of payments". He argued that it is possible for investment to yield additional product for domestic consumption and increase real national income without increasing money income available for (additional) imports". It is also possible that output offered for sale, may force down the general price level thus raising real income without disturbing money distributive hares. Low prices may even reduce imports and such investment will yield additional money as real incomes without increasing imports".

Non capital intensity criterion

The next criterion is the non capital intensive. The ratio of capital to labour. If production function is the same in all countries and if capital is scarce relative to labour. Comparative advantage in the latter can be identified by "low capital lobour", ratios, since most underdeveloped countries suffer from a larger number of partially or completely unemployed potential workers and a serious shortage of capital, stress is laid on the importance of selecting industries which make maximum use of abundant factor, labour and minimum use of scarce factor capital. According to the United Nations Report: In most underdeveloped countries, it is labour intensive rather than capital intensive industries that would appear likely to possess the greater relative comparative advantage even when the productivity of labour is somewhat lower than in the more advanced countries". Buchanan and Ellis also echo the same view. "Since the most persuasive feature of underdeveloped countries is the abundance of labour in contrast to the shortage of capital, a strong presumption exists that capital should be used sparingly relative to labour.

This approach is an improvement over the capital output ratio as it does not assume that labour has zero opportunity cost. But is ignores the existence of other factors of p production such as natural resources. If either labour or natural resource has a significant opportunity cost, then, as Cheery points out "the capital output measure must be replaced by the more general marginal productivity of capital criterion". The judge the comparative advantage by the capital labour ratio is to assume that this ratio will be the same for the same industry in all countries or that capital is equally substitutable for labour in producing all the commodities traded. Deviations from these assumptions, along with omission of other inputs and variations in efficiency by sector, will make the capital labour criterion a very crude approximation.

Marginal productivity criteria

A more comprehensive allocation criteria provided by Economic theory is the social marginal product of a given unit of resources in a given use Recognising this principle, the U.N. Expert's Report on "measures for the Economic Development of underdeveloped countries" states that maximum results can be obtained from a limited quantity of resources, if they are allocated among different uses in such a manner that a small additional does of them will result in the same yield in all the uses". This is an improvement over the factor intensity criteria in that it tries to measure the rate of return or the "national economic profitability" as Bryce would put it while the factor intensity criteria are correlated with the increased national income produced by a project.

The social marginal productivity criteria

The social marginal productivity (SMP) criterions was first put forward by A.E. Khan, Later Hollis B. Chenery improved upon it. It is based on the classical marginal productivity approach. As more and more capital is employed in any project in combination with given amounts of other inputs, its marginal product will

after a time start falling till the marginal productivity of capital in different used is equalized. The aim is to allocate limited investment resources in such a way as to maximize the national output.

This theory has to be viewed, as the economy as a whole and not to individual investment projects.

Chenery has evolved a for the quantitative measurement of the SMP concept, using which the various investment projects may be ranked according to their social value. This will help to assess their effect on national income, balance of payments and the const of domestic and import4d materials used therein. The selection of project depends on their rank, and their number on their cost and finds at the disposal.

Assuming the balance of payments to be equilibrium' the Chenery equation is:

$$SMP = X + \frac{E - M - O}{K}$$

Where X represents increased market value of the output. E the added value of output due to external net economies, L cost of labour. M cost of materials, O overhead costs including depreciation, and K is capital funds invested. The equation can be simplified as (V-C)/K where V the social value added domestically equals (X+E) and C the total cost of factors equals (L+M+O).

With regard to underdeveloped countries, there is a large difference between the actual and official value of the foreign currency in terms of the local currency. Chenery represents this difference by r.A. Zero r means equilibrium in the balance of payments a positive r represents a surplus and a negative r, a deficit in the balance of payments, of the country. According the refined formulation is

$$SMP = \frac{V-C+r(aB1+B2)}{K}$$

The other elements being the same. AB1 is the annual authorized impact on the balance of payments of servicing initial borrowings from abroad and B2 the annual effect of the projects operation on the balance of payments If. B is negative, it means an import and if it is positive it is as export, to simplify the formula still further r (aB1+B2) in represented by Br the combined balance of payments effect and the final formula is:

$$SMP = \frac{V-C}{K} + \frac{Br}{K}$$

With the help of this formula Chenery has calculated the SMP of a number of investment projects in Italy and Greece. According to him, the use of this formula in full may help in utilizing the funds better on major projects.

1. It is not possible to make the marginal productivity of epical exactly equal in all uses; for technical reasons.

2. The SMP criterion is concerned only with the present productivity of factors of different uses. The resource use is influenced by the demand and supply conditions. But in the long run they are themselves influenced by present investments. But in the long run they are themselves influenced by present investments. Similarly, cost conditions may also be changed over time with acquisition of greater knowledge and experience. This is difficult to calculate the productivity of resources when the time period is long.

3. The SMP criterion is vague and indefinite if it is attempted to make a correct assessment of the benefits and cost of different projects both in the present and future. Market prices are not a correct guide to resource allocation in underdeveloped countries. Liberalise the benefits accruing from social investments like

equation and public health services can at best be arbitrarily. There are also idle resources like the under employed and the unemployed manpower whose market value is not capable of measurement. Chenery himself admits that such imperfections in the market forces will "greatly reduce the social value of investment unless in an attempt is made to offset them".

4. One of the major defects of the SMP criterion is that it is concerned with once for all effect of investment on the national income and neglects the multiplies effect of present investment on future income.

5. Further, it does not consider the indirect effect of the present investment in population, saving and consumption in the future. It is possible that the present investment may increase the national income but may make the distribution of income unequal. Similarly, investment in some projects may raise the per capita consumption in the present as compared with other projects which may raise it over the long period.

Hagen's SMP Criterion

Everettee Hagen has presented a slightly modifies version of the SMP criterion. According to him, Investment allocation must be such that no use of capital yields a lower marginal discounted representative income than any excluded use". The refinement is in the use of the present value of future income as the index of gain. This criterion provides an objective standard for choosing between capital intensive and labour intensive investment. In addition to the social productivity test," in evaluating any projects" Hagen points out, "regard must be taken of the effects known loosely as external economies" resulting from changes which are more than marginal in magnitude.

The reinvestment criterion

Galenson and Leibenstein introduced the reinvestment criterion. It is also known as the rate of surplus criterion or the marginal per capita investment quotient. The latter term refers to the "net productivity per workers minimum consumption per worker". For Galenson and Leidenstein the maximization of per capita output in the future is more important than that in the present. This requires the rate of savings being maximized leading to the reinvestment of income. The reasoning is as follows; National Income is divided into wages and profits, the former are spent on consumption and the latter are saved for the purpose of investment. The larger the volume of profits, the higher will be the rate of savings, as a result, the larger will be the amount of capital available per head and the higher will be the growth rate of output which will lead to increased output per head in the future. In the early phase of development a "critical minimum effort" is required on the part of underdeveloped countries to increase the proportion of profits to national income and to restrict consumption per head. This would lead to larger savings and larger reinvestible surplus. Given the quality and quantity of labour force, is the capital labour ratio that determines per capita output Galenson and Lcibenstein use the following formula to determine the rate of investible surplus(r)

$$R \qquad \frac{P - e\,w}{c}$$

where P is the product per machine, e the number of men per machine, w real wage rate, and C the cost of machine, a can be increased by raising P and reducing e. w. in proportion to c.

CHOICE OF TEFCHNIQUE

The problem on hand is to enhance the ratio of capital to labour, the per capita output potential and the per capita investible surplus. For achieving this, the theory advocate capital intensive techniques even in those countries where capital is scarce and labour abundant. Production processes having a high ratio of capital to labour will enable a large share of income going into profits and a small share into wages. Thus a larger proportion of the initial income being available for investment is facilitated. Further, in the course of industrialization, urbanization is promoted affecting several economic and social factors, including population growth.

Further, capital intensive production processes imply a long life of capital. So it will not cost much for the replacement of worn-out capital good, and hence a larger proportion of investment resources is available for future capital formation. Another important argument in favour of such techniques is that their labour capacity will be very high in the long run.

There are, however, certain objections to this criterion:

1. the reinvestment quotient assumes that consumption remains constant overtime. But this is unrealistin. A.K. Sen has pointed out that with additional employment the total consumption of the community is likely to increase and unless the increase in output as a result of additional employment is greater than the increase in consumption resulting from it, the volume of investible surplus will fall. This will adversely effect the growth rate of the economy.

2. The assumption that whatever is received as wages is spent on consumption and whatever is not paid to labour is reinvested is not tenable. Because there are likely to be leakages in the wages stream and profit stem flowing into consumption and investment channels respectively. When the real total output increase workers might feel better off than before even at the same wage rate and may save something. Also the theory does not take into consideration the capital depreciation which will certainly reduce the quantum of the reinvestible surplus.

3. It goes against the principle of marginal productivity of capital. As the amount of capital is increased in successive doses, after a point its productivity starts declining. This implies, a fall in output per capita and in the reinvestment quotient.

4. The views that highly capital intensive processes have a large reinvestment potential may not hold good always. A haughty capital intensive industry like the iron steel will takes several years to yield output. On the other hand, modern small enterprises possess a high reinvestment coefficient.

5. The concentration upon large scale capital intensive industries is best with a number of practical difficulties in underdeveloped countries. For want of skilled labour and entrepreneurial ability, the efficient management of large undertakings suffers. Further, due to the non availability of sufficient capital for small enterprises, consumer goods industries are unable to develop, thereby causing inflationary pressures in the economy.

6. The reinvestment criterion is incomplete for it does not take into consideration the impact of balance of payment of investments. In an underdeveloped economy there is an acute scarcity of capital goods which have to be imported and they, worsen the already right balance of payment position.

7. Otto Eckestein is of the view that instead of depending on the reinvestment criterion for planned investment it may be better to use fiscal measures to attain an income distribution which will yield sufficient savings for the purpose of reinvestment.

8. The investment criterion neglects the importance of consumption, rather it advocates its curtailment. But current consumption may be more important that future consumption and the reinvestible surplus may have to be reduced in the interest of the community. Neglecting the consumer goods sector in favour of the capital goods sector, would mean several adverse consequences both for economy and for the Government. The scarcity of essential commodities will lead to inflation and social unrest in an underdeveloped economy.

9. The use of the reinvestment criterion perpetuates the problem of unequal distribution.

10. This criterion does not consider those cases of development planning in which the present income is valued more than the future income, to provide for the expansion of the capital goods sector and is which a lower growth rate of income in the immediate future is to be preferred.

All though, there are deficiencies, the reinvestment criterion is found useful as a first approximation towards accelerating the rate of income growth in an underdeveloped economy. It may be considered more realistic than the social marginal productivity crier ion, for it takes into consideration the effects of population growth on the rate of investment in the future.

Marginal Growth Contribution

The conflict between kahnChenerySmP approach and Galenson and Leibenstein reinvestment approach has finally been reconciled by Eckstein. First he assumes, with the former that the social objective is to maximize the present value of the future consumption stream. With a zero discount rate, this objective approximates the long term income objective of Galenson and Leibenstein, which with a high discount of future consumption, it leads to the maximization of income in the short term, Second Eckstern assumes with the latter that there is a different savings (reinvestment) coefficient associated with each project, but that allows for any savings rate out of wages and profits. From these assumption, he derives a measure of the "marginal growth contribution" of a given project consisting of two parts: 1) an efficiency term consisting of the present value of the consumption stream; and a growth term, consisting of the additional consumption to be achieved by reinvestment of savings.

The relative importance of the two terms depends largely on the rate of discount that is applied to future consumption. Even with a low rate of discount, the significance of the second term depends on the extend or variation in the fraction of income saved among different projects if the savings ratio is not related to the form of income generated then as Bator points out there is no conflict between maximizing income in the short run and in the longer run. This formula provides for all possible intermediate assumptions between the two extreme views on the determinant of savings.

Time Series Criterion

The present criterion associated with the name of A.K.Sen, seeks to maximize output within a given period of time. When there are alternative techniques available, it is possible to find out which of them yields the highest returns over the time horizon suppose there are two projects, using two different techniques, say capital intensive and labour intensive respectively. Let the time horizon be a particular period (say 10 years) at the end of which there obtains the same level of output (say one million units) in both. But in the initial phase, say up to six years, the project II (labour intensive type) gives a higher output than the Project I (Capital intensive type) but later the performance of project I turns greater than performance of project II and in four years it is able to over come its initial deficiency. The time taken by the capital intensive project for this, is called by Sen, "the period of recovery".

Thus for any pair of techniques a period of recovery may be found out. In choosing between the techniques, the period of recovery should be compared with the period we are ready to take into account. If the period of recovery is longer, that is if within the time horizon, the loss in output, by adopting technique I is not

recovered by the excess of output, we should choose technique II. If otherwise, technique I is chosen. It is illustrated in the diagram given.
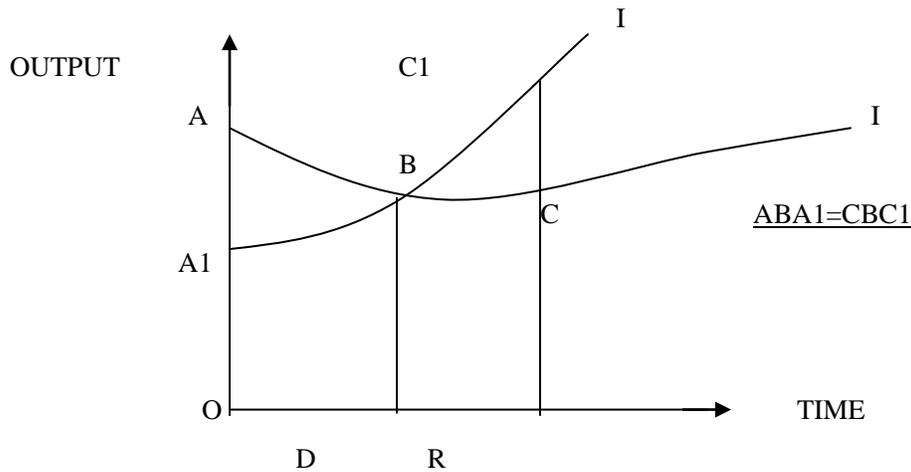

FIG. TIME SERIFS CRITERION

In the diagram, I and II curves shows the flow of real output during a given time horizen with the two techniques. Techniques I gives lesser out but in the beginning but a higher rate of growth than technique II. Upto the time period D technique II gives more output over technique I at the point of time R, technique I make up this deficiency, when it gives CBC, more output over technique II The period OR is the period of recovery which makes the area ABA1 area CBC1.

This theory has certain limitations

1. The taking up of a particular time horizon is arbitrary.

2. It is difficult to expect the same time series during all periods to come for a variety of reasons.

3. The time series is a function of a number of factors such as the level of technology, wage rate, propensity to consume, etc., Hence it is likely that the forecast does not work out in practice.

4. It may also be said that this theory does not introduce any new idea; if the period of recovery is short, this criterion becomes the rate of turnover criterion and if it is very long it corresponds to the reinvestment criterion.

The above theoretical discussion of various investment criteria leads us to derive some working principles as guide posts for allocating resources in the underdeveloped countries. When the problem of factor allocations is approached in terms of general equilibrium, it resolves into two important basic questions. What are the industries to be selected? And what is the level of technique to be adopted?

The basic consideration in electing industries for development is the development of "external economies" to which Allen Young drew attention as early as 1925 and ResenteinRodan in 1993. Investment should be directed to growing points in the economy such as Social Overheads, from where the claim of reaction starts and gradually spreads dynamic change to the remaining areas of the economy". This external economy logic underlies most of the multipurpose river valley projects in India.

Secondly, with regard to the choice of industries. Brown has suggested that "in view of the initial scarcity of capital relative to labour industry. With the low capital intensity producing consumer goods must be

promoted to begin with the succeeded by construction of industries of the labour intensive type, which again ought to be followed by capital intensive construction".

Thirdly, the choice in the initial stages has to be infavour of industries or methods which are 'skill light' i.e. those in which the major part of the work is of the routine type or in which the automatic machinery reduced the demand for skill.

Fourthly, industries chosen should be 'import light, i.e. they should use a relatively low proportion of imported equipment and materials as compared with the total amount of capital used. A low import intensity of the capital strict. Are of the new industries will reduce the need for foreign capital or exchange earnings, obviate balance of payments difficulties later and will currently retain within the country a large part of whatever induced effects may materialize.

Fifthly, in an economy with a higher inflationary potential and a need for a rapid rise in the living standards, the industries chosen should be of "quick investment" type, i.e. those in which the time lag between investment and flow of consumable goods is relatively short, the anti-inflationary requirements and the requirements for development, all often in conflict and a compromise can be found in industries which have a high 'fruition-coefficient' or a high ratio between planned output and investment and also a short frution lag.

The problems of the investment criteria for the economy as a whole are not the same as the problem of choice criterion between alternative techniques of production in a particular industry. Where a choice has to be made between a labour intensive and capital intensive technique in a particular industry, the problem is one of the relative costs and productivities. But a choice in favour of highly productive techniques cannot be made all around in a capital deficient country.

Apart form these economic criteria, non-economic factors should also be considered in the choice of projects. Hagen suggests three principles: (1) the effect of investment in specific fields on the social acceptability of the development programme, (ii) the extent to which it fosters emotional derives towards the functions necessary for economic development; and (iii) The effect of alternative projects on the sociological stability of the people. To sum up, it is necessary that socio-economic stability must be considered as an end in itself.

4. REVISION POINTS

(a) Marginal productivity criterion, (b) Non-capital intensity criterion (c) Balance of payment effect (d) Rate of turnover criterion.

5. INTEXT QUESTIONS

(a) Explain the rate of turn over criterion, (b) briefly the social marginal productivity criterion, (c) Explain the time series criterion, (d) What is choice of technique.

6. SUMMARY

The role of turnover criterion was evolved by J.J. polka. He says that investment for development should be chosen according to the "Role of turnover", i.e. the ration of output to capital. IN the Balance of payment effect polock says that a sufficient portion of the investment must fall into those projects which yield additional export.

In the social marginal productivity criterion which H.B. Chenery improved upon says that as more capital is employed in any project in combination with given amount of other inputs, its marginal product will fall after a period of time. However this also suffers from a number of limitations.

A.K. Sen is associated with time series criterion. He says that investment can be made in capital intensive or labour intensive technology but theorise that the rate of return will be high in labour intensive technology in the initial stage but over a period of time the return stagnates. Where as in the capital intensive technology, the return will be less in the initial stage but over a period of time the rate of return increased faster than the labour intensive technology.

5.5Cost Benefit Analysis

Definition: It can be explained as a procedure for estimating all costs involved and possible profits to be derived from a business opportunity or proposal.

Description: It takes into account both quantitative and qualitative factors for analysis of the value for money for a particular project or investment opportunity. Benefits to costs ratio and other indicators are used to conduct such analyses.The objective is to ascertain the soundness of any investment opportunity and provide a basis for making comparisons with other such proposals. All positives and negatives of the project are first quantified in monetary terms and then adjusted for their time-value to obtain correct estimates for conduct of cost-benefit analysis. Most economists also account for opportunity costs of the investment in the project to get the costs involved.

5.6 Shadow Prices

Meaning of Shadow Prices:

Shadow prices reflect true values for factors and products for the calculation or estimations of prices in social cost-benefit analysis. J. Tinbergen defines them, **"Shadow prices are prices indicating the intrinsic or true value of a factor or product in the sense of equilibrium prices. These prices may be different for different time periods as well as geographically separate areas and various occupations (in the case of labour). They may deviate from market prices."**

According to E.J. Mishan, "A shadow or accounting price…. is the price the economist attributes to a good or factor on the argument that it is more appropriate for the purposes of economic calculation than its existing price if any."

Need and Determination of Shadow Prices:

In developing countries for project evaluation the distribution of factors on the basis of market prices is imperfect because there exist fundamental disequilibria which are reflected in mass underemployment at existing wage levels, in the deficiency of funds at existing interest rates and in the scarcity of foreign exchange at the prevalent exchange rate.In such a situation, the equilibrium level of wages would be much below the market wage, the equilibrium interest rates would

be higher than their market rates, and the equilibrium rate of exchange would be lower than its market rate.

In order to overcome these difficulties, J. Tinbergen, H.B. Chenery and K.S. Kretchemer have emphasized the use of shadow or accounting prices for the following reasons:

1. Imperfect Market Mechanism:

The price mechanism operates imperfectly in developing countries. Market prices do not correctly reflect relative scarcities, benefits, and costs. This is because perfect competition is entirely absent. Structural changes do not respond to price changes.Institutional factors distort the existence of equilibrium in the product, labour, capital and foreign exchange markets. Thus prices fail to reflect and transmit the direct and indirect influences on the supply side and the demand side.All such difficulties are overcome with the help of shadow prices. Fiscal, monetary and other policies also help in bringing the market prices of products labour, capital and foreign exchange in conformity with their shadow prices and thus make investment projects a success.

2. Wage Rates:

In developing countries, there exist fundamental disequilibria in the labour market which are reflected in mass underemployment and unemployment at existing wage rates. In such economies, wages are much lower in the non-organised agricultural sector.There is also surplus labour in rural areas whose marginal product is zero or negligible. But it cannot be assumed to be zero in calculating the cost of such labour on construction works. On the other hand, wages are much higher than the opportunity cost of labour in the industrial sector where labour is organised in strong trade unions.

Therefore, unadjusted market wages of labour cannot be used for calculating the cost of such labour on investment projects. In such a situation, the equilibrium level of wages would be much below the market wage in the rural sector.Economists suggest that the shadow price of such labour can be fixed anywhere above the zero marginal product of labour, and with the increase in the marginal product of labour, its shadow price can also be raised to the market level of wages.

3. Capital Costs:

In developing countries, funds for investment are deficient at prevailing interest rates. The main cause is the deficiency of savings. The majority of people are poor having low income levels, low rate of savings and hence low propensity to invest. Moreover, there is little relationship between the supply of capital and interest rates prevalent in the country.

There is also wide disparity between the prevailing interest rates in different regions and areas. In the capital market, the market rate of interest is much higher them the bank rate. Therefore, the equilibrium interest rate would be much higher than its market rate. If unadjusted market price of capital is used in calculating the cost of capital on investment projects, it would underestimate the real cost of such projects.To overcome this problem, the shadow rate of interest can be estimated on the basis of interest rates paid by private investors. But while so doing, it is essential to allow for a social rate of discount for calculating the social benefits and costs of an investment project where its net present value (NPV) is calculated as

$$NPV = \Sigma_t \, B_t\text{-}C_t / (1+i)_t$$

Where B_t is the expected gross benefit of the project at time t, C_t is expected gross cost of the project at time t, and i is the social discount rate at time t. The social discount rate is the government's borrowing rate on long-term securities. So it differs from the market rate of interest. If the social discount rate is higher, short- period projects with higher net benefits are preferred, and if it is low, long-period projects with lower benefits are chosen.

4. Exchange Rate:

There is acute scarcity of foreign exchange leads to balance of payments difficulties in developing countries. As a result, the current rate of foreign exchange is much lower than in the black market and the equilibrium exchange rate is lower than its market exchange rate.To solve this problem, an artificial equilibrium is achieved in the balance of payments by fixing a higher shadow exchange rate than the official exchange rate. For this, weight is attached to the cost of foreign exchanges in the project.

Suppose the shadow price of foreign exchange is 50% higher than its market value, the net effect of a project on the balance of payments should be given a weight of 0.5. This is equivalent to valuing foreign exchange costs and earnings at a price of 1.5. Tinbergen suggests the calculation of the shadow foreign exchange rate based on the 'black' and 'free' rates of exchange.

If the free (official) exchange rate is Rs.50 a dollar and the black rate is Rs.75 a dollar and the conversion of the official rate is four times as great as that at the black rate, then the shadow exchange rate would be the weighted average,

$$4 \times 50 + 1 \times 75/5 = Rs.55$$

Thus Rs.55 per dollar would be the shadow rate instead of the official rate of Rs.50.

5. Inflationary Pressures:

Developing countries suffer from inflationary pressures because the market mechanism operates imperfectly due to a number of socio-economic and administrative obstacles. Even otherwise, rise in prices are inevitable in the development process.So actual market prices do not reflect social benefits and costs. Some prices are fixed by the government. Others are free, but are influenced by restrictive trade practices or monopolies. Still others are influenced by quantitative controls.

When prices rise, there is overvaluation of domestic currency. The prices of imported goods for projects underestimate their real cost. Thus there is need for shadow prices in the case of investment projects in different sectors of the economy.A factor that is expected to be in short supply should have a shadow price higher than its market price, while a surplus factor should have a lower shadow price than its market price. Thus the shadow price is the price which would prevail if prices were equilibrium prices.

Limitations of Shadow Prices:

The following are the limitations in the determination of shadow prices:
1. The calculation of shadow prices pre-supposes the availability of data. But adequate data are not easily available in less developed countries.

2. In order to establish the intrinsic value of a factor or product requires the existence of full equilibrium in all markets. In an underdeveloped economy which is characterized by a number of fundamental disequilibria, the knowledge of full equilibrium conditions for the entire economy is not possible. Thus the notion of shadow prices corresponding to intrinsic values is arbitrary.

3. The assumption of full employment equilibrium in the whole economy makes the concept of shadow prices indeterminate. It requires a complete knowledge of demand and supply functions which are based on the existing socio-economic institutions in the economy. Thus shadow prices are difficult to ascertain under the existing institutional framework of underdeveloped countries.

4. Another problem arises with regard to the time dimension. The concept of shadow prices is static and timeless, because shadow prices are used to overcome the difficulties involved in project evaluation when factor prices change over time. All inputs and outputs are valued at fixed shadow prices in such cases. This is not realistic because investment projects relate to long periods. Hence the concept of shadow prices remains a static one.

5. Another practical difficulty relates to the use of shadow prices in the economy where the private enterprises buy inputs and sell outputs at market prices. The government, on the other hand, uses shadow prices for the evaluation of its projects but buys all inputs at market prices and sells outputs at competitive market prices where it does not possess a monopoly.

6. The determination of shadow prices is difficult in the case of projects with high capital-intensity and which are substitutes and complementary to each other. Suppose there are two projects in which the input of one is the output of the other and vice-versa.

In such cases, the determination of the shadow prices of the inputs of labour, capital and foreign exchange will not only be difficult but impossible because the decisions about the construction plans of the two projects cannot be the same.

Conclusion:

Prof. Myrdal in his "Asian Drama" regards shadow prices as "utterly unreal and other worldly in concept, particularly in underdeveloped countries like those in South Asia …. as it is recognised that they cannot be definitely ascertained."

Uses of Shadow Prices:

Despite the above limitations, the shadow prices possess the following uses:

1. In Project Evaluation:

　　　Shadow prices are a convenient tool for evaluating investment projects in different sectors of the economy. They are used for evaluating the effects of a project on the national income which are also known as external effects. This is done on the basis of costs-benefit analysis where both costs and benefits are calculated at shadow prices.

2. In Public Policy:

　　　The success for development planning depends upon the correct operation of public policy. Shadow prices are intrinsic prices on whose correct determination depends the success of a plan to a considerable extent. In developing countries, investment projects in the public sector cannot be profitable unless the prices of labour, capital and other inputs and foreign exchange rates are determined in shadow prices.Though very often shadow prices are rough estimates, yet the state should try to bring market prices close to the shadow prices of products and factors through monetary, fiscal and other measures for the success of the plans.

3. In Programming:

Shadow prices have much importance in programming. In the context of developing countries, programming means the optimum use of investment whereby there is no difficulty in the production process. But, in reality, the difficulties of supplies of factors, rise in market prices and the scarcity of foreign exchange are found in such economies. All such problems are overcome with the help of shadow prices.The use of fiscal, monetary and other policies by the state help in bringing the market prices of products, factors and foreign exchange in conformity with their shadow prices and thus make investment programming a success. Thus shadow prices are a useful and important devise for the success of project evaluation, public policy and investment programming.

Shadow Pricing in Cost-Benefit Analysis

A sound development plan entails a great deal of knowledge and skill about actual and potential projects. In a less developed economy, the allocation of factors on the basis of market prices is imperfect because there exists fundamental disequilibria in the economy. The prevalence in almost all developing countries of factor price distortions resulting in wage rates exceeding the social opportunity cost of labor and interest rates understating the social opportunity cost of capital results in the widespread phenomenon of unemployment and underemployment and the excessive capital intensity of industrial production technologies.

Opportunity cost implies the estimating value that focuses on establishing a value on alternative opportunities or resources that were used or lost by applying them in one way rather than another way. For example, if one spent an entire day getting a car repaired, the time spent for this imposition could be valued in terms of what the individual could have otherwise done with the time. Perhaps this essentially wasted time used for this task of taking the car to the garage, sitting and waiting, and returning home could have been used by a salesperson for making several calls. The missed sales opportunities can be calculated as opportunity cost.

If the Governments were to use unadjusted market prices for labor and capital in calculating the costs of alternative public investment projects, they would grossly underestimate the real costs of capital-intensive projects and tend to promote these at the expense of the socially less costly labor intensive projects. The existence of high levels of nominal and effective tariff protection in combination with import quotas and overvalued exchange rates discriminates against the agricultural sector and in favor, of the import-substituting manufacturing sector. In addition to reflecting-incorrectly the real terms of trade between agriculture and industry, such distorted domestic product, prices tend once again to favor upper income groups disproportionately in relation to society's lower income group.

The most appropriate method in apprising projects from the national point of view is the cost-benefit analysis. The analysis is the most scientific and useful criterion for project assessment. It helps the planning authority in making correct investment decisions to achieve optimum

resource allocation by maximizing the difference between the present value of benefits and cost of a project. It involves the enumeration, comparison, and evaluation of benefits and costs. A memorandum provided by the Federal Government for heads of executive departments and establishments defines cost-benefit analysis as ".A systematic quantitative method of assessing the desirability of Government projects or policies when it is important to take a long view of future effects and a broad view of possible side-effects". (http://www.whitehouse.gov/).

The objective function of cost-benefit analysis is to establish net social benefit. The function can be written as NSB=Benefit-Costs, where benefits and costs are measured in terms of shadow prices of inputs and outputs instead of in actual market prices. According to Streeten, "the call for the use of shadow prices in planning for development stems from the obvious fact that actual market prices do not reflect social benefits and social costs. Some are fixed by administrative fiat. Others are free, but influenced by restrictive practices or monopolies. Others again are influenced by quantitative controls. The shadow price is the price which would prevail if prices were equilibrium prices.…". Shadow prices indicate implicit or true values for factors or products. J. Timbergen defined shadow prices as "Shadow prices are prices indicating the intrinsic or true value of a factor or product in the sense of equilibrium prices. These prices may be different for different time periods as well as geo-graphically separate areas and various occupations. They may deviate from market prices".

Shadow pricing, is used when placing a value on program outcomes other than market price. Program outcomes that cannot be bought or sold, such as social value, can be ascribed a monetary value. Some effort may be required to construct good shadow prices, but frequently some items may have been sufficiently studied to provide accurate information-that can be used in program valuing by shadow pricing. For example, the cost of incarceration is about Rs 100 per person per day. When programs significantly reduce crime rates for participants as compared to non-participants, this shadow price can be used as a means of determining estimated savings to society. Reasonable and realistic application of shadow pricing is necessary in order to avoid overly optimistic or highly inflated estimates of program benefits.

Optimum allocation of scarce resource for production of goods and services in less developed economy is one of the important factors for having a successful development and planning. The use of market mechanism for determination of product and factor prices is not perfect and correct method because it leads to wrong allocation of resources.

5.7 Project Evaluation

Project evaluation is a systematic and objective assessment of an ongoing or completed **project**.1 The aim is to determine the relevance and level of achievement of **project** objectives, development effectiveness, efficiency, impact and sustainability

Evaluation involves the systematic collection of information about the activities, characteristic and outcomes of an activity or action, in order to determine its worth or merit (Dart et al, 1998). It is a major part of learning, and can provide a wealth of useful information on the outcomes of a project or action, and the dynamics of those who undertook the work. Through the identification of the highlights and lowlights of the project, evaluation draws conclusions which

can inform future decision making, and assist to define future projects and policies (Patton, 1997). It is important to be aware of the reasons for undertaking an evaluation before commencing, as this will define how the evaluation process should be designed, and what outcomes are expected as a result

Evaluation is an integral part of UNIDO's technical cooperation management system and of the organization's continuous improvement process. Evaluation is a tool for supporting the decision making process on project and programme implementation and for planning new technical cooperation activities. Evaluation is also an instrument for knowledge building through experience and lessons learned. Given the partnership between UNIDO and its counterparts in recipient countries as well as donors, evaluation also supports the decision-making processes followed by those partners.

These guidelines cover evaluation of Integrated Programmes and of stand-alone projects. They complement the guidelines on the formulation of integrated programmes

Timing

Evaluation can take place at any time in a project. However, the most appropriate timing will be governed by the nature of the project, and the reason for carrying out the evaluation. It will be most effective when it is built in as a fundamental part of your overall project, and should be considered while the project is being designed.

Undertaking Evaluation

There is no one way to carry out an evaluation, with strengths and weaknesses apparent in most approaches. A suitable approach should be developed in consultation with stakeholders such as the community, local government, relevant coastal management groups, State government or the funding body. It is important to ensure all relevant parties have an understanding of the evaluation process, and its anticipated outcomes.

Regardless of the method or approach, steps involved with any evaluation should include the following:

1. Design and plan the evaluation

• Clarify the specific purpose or intended outcomes of the evaluation. Why are you doing it? Will the evaluation be in the form of a report or a series of stories?

 • Determine the questions you want to answer.

• Identify stakeholders, such as the community, local government, coastal management groups, State government or funding body, and their requirements. They may provide you with important guidance, which could make the evaluation more relevant.

• Identify possible sources of data.

• Identify potential methods, approaches and techniques.

• Agree on the evaluation purpose and procedures including timeframes and indicators.

• Prepare any materials required, such as questionnaires. 2. Gather information

• This may be an ongoing requirement or staged at key points during the project.

2. Gather information

• This may be an ongoing requirement or staged at key points during the project.

3. Analyse the information

• This may involve preparing a report. Check that your conclusions respond to the outcomes which the evaluation was originally seeking.

4. Use the conclusions

• Once you have evaluated the worth or merit of your project tell others about what you have learned and achieved so they too can benefit from your experience. This can empower others to undertake similar projects and make their journey easier and more enjoyable.

Evaluation Methods

Once you have worked out the questions you would like the evaluation to answer, you need to consider what methods to use to collect relevant information or data. The table below provides a list of some available methods. Advice on the limitations of each method is included as well as some additional references. It is intended to inspire some ideas towards how to evaluate a project. You should seek further advice and read additional references before undertaking your project evaluation.

Asking people

(a) Structured interviews

Structured interviews require that all interviewees be asked the same questions, in the same order. Structured interviews can be conducted in person, and are also often used in surveys and opinion polls. Interview questions must be selected carefully as there is no room to change the questions once the process has commenced. The way questions are constructed can also introduce bias into responses, and expert advice should be sought if you wish to undertake a conclusive interview.

Questions are of two basic types: closed and open. Closed questions limit the respondent to a yes/no answer, or to indicating a rating or ranking on a scale presented to them. Open questions, on the other hand, invite the respondent to provide an opinion. Questionnaires may contain both types of question. Open question example: Through your involvement with the group and project how has your understanding of coastal plants increased?

Closed question example: Through your involvement with the group and project has your understanding of coastal plants increased:

A: significantly
B: slightly
C: not at all?
Useful further reading on structured interviews can be found in Foddy (1996) Constructing Questions.

Semi-structured interviews – In person Semi-structured interviews are informally guided. Some questions are predetermined and new questions are developed from the discussion. Questions are mainly open, providing an opportunity for the respondent to provide an opinion.

Semi-structured interviews are used to understand an interviewee's experiences and impressions. Open question example: How effective do you believe the group has been in addressing the original objectives of the project?

Patton (1990) Qualitative methods in Evaluation and Research provides further reading on semi-structured interviews. Questionnaires Questionnaires can be conducted in person, by telephone, or by mail. They are used to quickly obtain information from a wide variety of people.

Questionnaires are typically inexpensive, can be completed anonymously, and are easy to compare and analyse. It is possible to involve many people, although it may only appeal to a certain section of the community, and responses from certain sections of the community may be limited. Useful further reading can be found in De Vaus, D. (1995) Surveys in social research.

Participant observation Data is collected by listening, watching, and documenting what is seen and heard. Through asking questions, and by noting comments, behaviours and reactions, useful information is provided to the evaluation process. The participant observation method gathers accurate information about how a group and project operates in the field.

Objectives of Project evaluation

1. Analyse the process of implementation, focusing on participation of the community
2. Analyse the impact or changes that have occurred within beneficiary households and the community
3. Identify problems and constraints that have been encountered

4. Identify important lessons to be learnt and make recommendations for the implementation of future projects

UNIDO and Evaluation

The UNIDO **Independent Evaluation Division** (ODG/EVQ/IEV) is responsible for conducting independent evaluations of UNIDO's major projects, programmes and technical cooperation activities. It also supports project managers and team leaders in conducting self-evaluations through design of methods. The UNIDO Evaluation Policy was adopted in 2006 and revised in 2015. The evaluation function supports learning, continuous improvement and accountability, and provides factual information about result and practices that feed into the programmatic and strategic decision-making processes. Evaluation is an assessment, as systematic and impartial as possible, of a programme, a project or a theme. Independent evaluations provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons learned into the decision-making processes at organization-wide, programme and project level. ODG/EVQ/IEV is guided by the UNIDO Evaluation Policy, which is aligned to the norms and standards for evaluation in the UN system.

Functions
- Undertake and manage independent evaluations to determine the relevance, efficiency, effectiveness, sustainability and impact of technical cooperation programmes and projects.
- Undertake and manage independent evaluations of global forum activities to determine their relevance and effectiveness.
- Monitor and track the implementation of recommendations by those in UNIDO who are responsible for the evaluated technical cooperation or global forum activity.
- Undertake strategic and thematic evaluations on cross-programmatic or institutional issues.
- Promote continuous improvement within the Organization through the application of evaluation findings, lessons learned and recommendations in policy and programme formulation and implementation, in close cooperation with the Bureau for Programme Design and Knowledge Management.
- Develop evaluation guidelines as well as methodological and training tools to support managers at UNIDO Headquarters and in the field with a view to ensuring that established quality standards are met in the whole technical cooperation cycle, with particular emphasis on evaluation and results management.
- Maintain dialogue with staff at Headquarters and in the field as well as stakeholders to strengthen the application of evaluation standards and ensure transparency and stakeholder participation in all stages of the evaluation process.
- Prepare reports on evaluation for submission to the policymaking organs.
- Maintain and develop partnerships with UN system organizations within the context of the United Nations Evaluation Group (UNEG) and with OECD-DAC on evaluation-related work

to ensure that UNIDO is fully abreast of developments in the evaluation field and able to implement good and best practices in evaluation.

- Support the implementation of a coherent and consistent system of results-based management in UNIDO.
- Support the mainstreaming of gender in technical cooperation, including development of indicators for monitoring.

Questions

1. Define of Development Planning
2. What are the various Types of Investment Criteria
3. Explain Linear Programming
4. What is meant by Choice of Technique
5. Write a short note on Cost Benefit Analysis
6. What are the limitations of shadow prices
7. Discuss Project Evaluation
8. Mention the UNIDOguidelines of project Evaluation