

DEVELOPMENT PLANNING AND PROJECT ANALYSIS I (Econ 4011)

MODULE

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Preface

*This module is aimed at serving the needs of students who take the course **Development Planning and Project Analysis I**, Econ 4011, offered to upper level undergraduate students of economics. The course materials are compiled by consulting the available literature offered by various renowned authorities in the field. Attempt has also been made to select and include the most appropriate topics that can serve the purpose of the course mentioned. It is also hoped that the “check your progress” and the end-of-chapter exercises add some flavor to your study by triggering some re-thinking. By and large, we hope that students will enjoy the reading and gain some benefit in terms of some increments in knowledge and skill.*

CHAPTER 1

DEVELOPMENT PLANNING: AN INTRODUCTION

1.1 Introduction

This chapter deals how the concern for development in a conscious, deliberate and organized manner evolved through time among the Less Developed Countries (also known as the Third World). Development planning has been practiced in various forms in many countries with different socio-economic setups and differing levels of economic development. So in this chapter, basic concepts in relation with development planning like motives of development planning, the objectives and problems of development planning as well as its brief history will be addressed.

Dear Distance learners, we hope you will enjoy the readings and exercises in this first chapter and in the subsequent chapters as well.

Learning Objectives:

After studying the contents in this chapter you should be able to:

- be familiar with the meaning of development planning

- Recognize how development planning evolved and shaped through time

 - Explain how and when the Less Developed countries started a deliberate effort to develop,

 - Explain the objectives of economic planning

 - Explain the need for development planning

- Identify short comings of development planning

- Explain the implications of various economic controls in a planned economy

Identify and analyze the problems associated with development plan exercises in developing countries

1.2. Historical Background of economic Planning, Projection, plans, and forecasting

The idea of planning has a long history and goes back to the time of Pluto [the first person who talked about organized planning]. It was later developed, shaped and molded by prominent thinkers and writers both in the western and eastern economies. However, economic planning in its modern form is comparatively new. It is the 20th century phenomena.

1.2.1 Planning in Eastern Europe

The paradox resulted from capitalism understood by various thinkers and writers during the end of 19th century. Therefore, they developed the idea of state intervention to set matters right and to prevent imbalances resulting from capitalism (free economy) a solution to the misconception of laissez-faire. But it was only state intervention that was advocated. Even if they believe state intervention as important and laissez-faire was not working, the way how to intervene remained ambiguous. It is the Soviet Union in 1928 gave the idea of economic planning a real shape when the first five-year plan formulated. The main objective of the socialist (Soviet) plan was to achieve the rapid transformation of a backward agriculture sector (traditional sector) into a modern industrial sector.

1.2.2 Planning in Western Europe

A series of historical changes and like great depression of 1930th affected Europe and America, expansion of markets and specialization necessitated intervention and led to the coordination of economic policies.

a) The development of science and technology not only made material progress possible, but also they made planning possible as well improve computation facility; advances in management theory (organization coordination). The intervening depression reminded the state of the tragedy incompleteness of economic theory and public policy.

b) In the 1930's, the capitalist world was in the midst of the biggest depression in the world history. Capitalism failed an utter collapse and its inherent contradiction came up to the surface.

Economic growth collapsed and acute misery poverty well experienced by people. Therefore, economist and politician favored economic planning as a remedy for these and other economic ills. People's mind now turned to economic planning as panacea for their economic ills while Keynes writings also in a way strengthen the belief in the efficacy and economic planning in capitalist countries. Meanwhile there was an attempt to plan economic life in Nazi German and Fascist Italy during the time (thirties).

Note: -The objective of the economic planning in the West was basically different from that of the Soviet Union. The purpose of planning in Nazi Germany was primarily to build up the war potential rather than improving the living standard of the people.

c) The outbreak of World War I and II necessitates the proper and efficient planning of economic resources for successful prosecution of the war. [For coordinated management of scarce resources]

d) In the post war period, the war devastated countries of Europe were compelled to resort to economic planning to rehabilitate themselves owing to:-

As a condition for receiving assistance under the Marshal plan, the USA insisted upon these countries to formulate their rehabilitation plan covering almost every sector of the economy.

The USA itself has recognized the significance of economic planning when it adopts an economic program called the “new deal” to come out of the suffering from great depression in thirties.

e) The growth of markets and increased specialization led to increased interdependence among economic activities and to greater economic externalities, which lead to adoption of economic planning. There is a need to intervene public agencies to rectify the negative externalities.

f) The development of democracy also leads to the adoption of planning in order to rectify social inequalities people could vote for those who experience an interventionist approach.

1.2.3 Planning in Underdeveloped Countries

Economic planning was considered as important solution for underdeveloped countries in their desire for industrialization. They want to achieve rapid growth in short period of time.

Economic planning, therefore, was considered as a tool to achieve rapid economic development. However, the development (evolution) of planning took a different course (path) than the rich countries in the following reasons:

First, In Less Developing Countries, planning was considered as an ideology rather than a means. It has been believed according to Marxian philosophy that capitalism as a system is doomed to fail because of the inherent weaknesses. Apart from public ownership of the means of production, the ideology that motivates socialist countries also requires for its practice the instrument of planning. Planning as an institutional means also came handy to those who sought the fulfillment of the national aspirations of countries recently liberated from centuries of colonial rule. Almost all such countries adopted planning right from the inception of their independence. However, the then planning was not as a result of popular participation (bottom up planning). It was up down planning to express the need of the leaders who control the political structure - they dictate the plan. Planning here was not as a consequent of industrialization, which is the inverse of the Western, developed countries.

Second, a part from the dire and urgent need for shortening development into a few years, newly independent countries found in planning a symbol of asserting their liberation and sovereign status. Development planning enabled these countries to set their common goals and gave them a sense of being sovereign in respect of what to do and how to do it. These countries with backwardness hanging round their necks like a mill-stone, wanted to stage a dramatic break from the past and therefore achieve higher growth and industrialization and put their minds off from past misery and the humiliation associated with it. With a pre-vision of a bright future outlined and even quantified in plans, they were able to turn their back on the past.

In most of the developing countries development planning is a **post-World War II phenomenon**, although some preliminary attempts at planning were made in some countries before the war, usually under the auspices of the colonial powers. After the war, however, its importance accelerated rapidly and by the early 1960s there were very few developing countries which were not practicing, or at least attempting, some form of economic development planning. It probably reached its peak of popularity in **the mid-1960s** when national plan formulation was considered **as a symbol of sovereignty and modernity**. The

origins and rapid growth of economic development planning in the ThirdWorld can be attributed to several factors. The most obvious factor was the **desire toachieve development**. Planning was seen as a **means of accelerating the process of economic development** and preparing a sound economic basis from which the colonialterritories could launch out as independent nations.

The countries of south and south-east Asia, most of which became independent soon after the war, took the lead. For example, India, which has one of the longest histories of systematic development planning, established it's Planning Commission in 1950 and its First Five-year Plan began in 1951; While in the Philippines the first five-year plan document appeared even earlier, as part of the program of post-war recovery drawn up with the assistance of the United States.

In Africa, political independence came somewhat later, and planning thus evolved rather more slowly, under the control of the metropolitan powers. The United Kingdom, for example, required all its territories to prepare plans for the period 1946 – 56, as a basis for the allocation of increased funds which were made available under the 1945 Colonial Development and Welfare Act. However, by the early 1960s, when most countries had, or were about to become independent, the desire for planning emerged within the countries themselves.

In other parts of the third World the rise of economic development planning followed a similar pattern, with only relatively minor variations in timing and objectives. These variations can generally be explained in terms of the historical circumstances of individualcountries or regions. Thus, for example, in the South Pacific, where most countries did not achieve independence until the late 1970s, the rise of planning occurred rather later. Similarly, in Latin America, where political independence had occurred long before the birth of development planning, planning was introduced with somewhat less enthusiasm, since it was not encouraged either by the sudden achievement of political independence or by colonial pressures. Nevertheless, by the early 1960s the majority of Latin American nations had established some form of development planning, often with the main aim of attracting foreign aid, particularly from the United States. In some countries of Western Europe, notably France, economic

planning has played a more important role and assumed a developmental function although this role was relatively small as compared with that in either the former Soviet bloc or the majority of Third World nations.

However, **concern with development and the achievement of political independence** cannot alone explain why planning was seen by both third World Governments and colonial powers as such an important means of achieving development. Two other factors played a significant part. **One was the growth of economic planning in the socialist world.** In the former Soviet Union, which is generally regarded as the first country to practice systematic economic development planning, the **first five-year plan was adopted in 1929**. Prior to the Second World War the impact of the Soviet Union's planning experience on Third World nations was limited, partly because the majority of these countries were at that time still under the colonial rule. However, even at that time it aroused some interest, particularly in countries such as India and the Philippines. After the war the Soviet planning model spread to the countries of Eastern Europe – which came under the Soviet influence at that time – and to China, thus providing a much wider range of experience from which the developing countries could draw. Furthermore, as these countries became politically independent, the opportunities for communication between them and the Soviet bloc increased.

The Soviet approach offered a number of attractions for the newly independent states of the Third World. Planning in the Soviet bloc, as in the Third World, was seen as a way of bringing about radical social and economic change, although the type of change desired was rather different. Furthermore, the particular approach to planning designed especially for use in countries with a **high degree of state control** over the economy, and many developing countries considered that a considerable amount of state control was **necessary** – and in many cases also **desirable**, as a means of bringing about the type of development required. Consequently, the degree of desired influence which the Soviet approach has had on planning in individual countries is to some extent dependent on the degree of state control considered desirable in a particular country, those with a one-party system of government lending themselves particularly well to this approach. However, it is significant that even those countries characterized by a multi-party system of government, and relatively less state

control, have introduced a system of national economic planning which resembles in many respects the Soviet model.

The other influential factor was the experience of planning gained in Europe and the United States during the Second World War. This experience demonstrated to economists and others concerned with the national economy in these countries that it is possible for a government to influence the rate and direction of growth of a mixed economy (i.e., an economy with both private and public sectors), rather than rely entirely on market forces, should it wish to do so. Moreover, it also provided some useful lessons about the techniques of planning. The war-time experience did, however, have an important effect on the rise of economic development planning in the Third World. It encouraged the British and other colonial governments to introduce planning in their territories during the period leading up to independence and, after independence, it influenced the Western economists who were employed as economic advisers to the newly independent governments and the foreign aid donors (including both individual governments and international aid agencies) who increasingly demanded the preparation of a national plan as a prerequisite for the provision of financial aid. In the following section more robust reasons are provided as to why planning has been regarded as inevitably vital to bring

about an overall socio-economic transformation in Less Developed Countries in general.

1.2. The meaning of economic planning

There is no agreement among economists with regard to the meaning of the term “economic planning” The term has been used very loosely in economic literature. It is often confused with communism, socialism or economic development. Any type of state intervention in economic affairs should not be treated as planning because the state can interfere without making any plan. “Planning is neither the preparation of a list of schemes nor is it a political idealism; it is rational, wise and scientific method for achieving certain socio-economic goals and objectives.”(Jawaharlal Nehru). Therefore, economic planning

“According to Dr. Dalton, Economic planning is defined as: a deliberate direction by persons in charge of large resources of economic activity towards a chosen end.”

Jhingan (2011), define economic planning as a deliberate control and direction of the economy by a central authority for the purpose of achieving definite targets and objectives within a specified period of time.

One of the most popular definitions is by Dickinson who defines planning as” the making of major economic decisions what and how much is to be produced, how, when and where is to be produced, to whom it is to be allocated, by the conscious decision of a determinate authority, on the basis of comprehensive survey of the economic system as a whole.

Although there is no unanimity of opinion on the subject, yet economic planning as understood by the majority of economists implies deliberate control and direction of the economy by a central authority for the purpose of achieving definite targets and objectives within a specified period of time. Therefore, to plan is to act in the light of a definite predetermined objectives by designing and manipulating of factors which govern the achievement of the given targets so as to attain specific goals within the time limit which the planner sets to achieve.

On the other hand, Todaro and Smith (2011), define economic planning as a deliberate and conscious attempt by the state to formulate decisions on how the factors of production shall be allocated among different users or industries, thereby determining how much of total goods and services shall be produced in one or more ensuing periods. Jhingan (2011), define economic planning as a deliberate control and direction of the economy by a central authority for the purpose of achieving definite targets and objectives within a specified period of time

Planning is there in the household management or management of the private firms as well. It is a process which aims at choosing most economizing means for satisfying certain macro ends and a system under which coordination is brought about in the economic ends of individual producers and the production and exchange process is somewhat regulated and directed by the state, if not in its entirety. Now we can omit the need for having a strong central authority. There can be a planning commission which may tell different sectors of the economy (private, cooperative, joint, public etc) about the targets to be achieved or about the physical consistencies expected. The work is not to be sporadic nor transient.

It will not be limited to certain activities only (town and country planning) or a sector only (agriculture or irrigation only). Prototype planning was not planning within the economy; it was planning of the economy. In the changed environment rigorous planning of the economy by a centralized authority is to be excluded. Private enterprise and free consumer choices can now determine the investment pattern; comparative cost principle need not be discarded. Complete egalitarianism may not be insisted upon, though eradication of poverty, generation of higher employment and propagation of higher incomes will remain the important objectives of planning. Rationalized economic decision and coordination will remain the hallmark. The society cannot remain concerned with present only; “futurology” will be part of planning. Reductions in the inter-personal and inter-regional disparities remain the objectives of planning. Above all, the quality of life of people is to be improved.

1.2.1. Objectives of economic planning

There are a number of points we can raise to show the superiority of planning over market economy.

1. Create wider opportunities: -The fact that life-span of individuals is short and resources that an individual can command is limited strongly related with decision making in a market economy. To an extent that limitations are reduced by joint action on the part of individuals through such organizations as joint-stock companies, but these are never as long-range in vision and as large in resources as those of a community taken as a whole. As a result of these limitations, economic units in a market economy go for small and short-gestating investments, requiring small amounts of resources whose fruits can be reaped in the life time of an individual.

Besides, there is, in general, a preference for the production of consumption goods as they give immediate satisfaction to individuals, whereas in particular long-gestating investments would be of use to others- the unborn individuals belonging to the distant future.

The above-mentioned limitations, however, just do not exist in planning, where the resource user is the community as a whole. Community never dies and the resources of a community are larger makes it possible for a community to visualize a longer and larger horizon, as compared to that in the case of individuals, making the number of opportunities greater.

2. Public-Oriented Goals: Planning enables the community to use resources socially, as against individually under a market system. The production of goods meant for social consumption like education, health services, parks, etc. is possible only if undertaken by public authorities. In a market economy, such goods are not relevant or production of those goods whose demand is backed by money offer takes place (i.e., production is profit-driven, profit incentive). Even anti-planners concede the need and desirability of public goods by public authorities. The market system takes cognizance only of market- backed wants (depending largely on the institution of private property) and totally ignores non-management howsoever genuine and important they may be. This point needs no further stressing except to mention the fact that in richest capitalist countries on this earth, while luxury goods abound, hunger and poverty still stalk in those nations. When it is said that planning makes resource-use social, it is implied that society decides how much of individual wants, and how much of social wants can be satisfied with given resources and further how much of the productive capacity should be earmarked for future society, and how much for the present society.

3. Bigger Resources: another decisively superior rating of planning arises from the fact that the resources available under it are far more than the private operators can organize in the same set of circumstances. This point can be established with reference to the three principal ways in which larger resources became available

No Wastage Planning need not and should not involve frittering away of resources as is the case in a market. In a market system the wastage of resources occurs in the form of existence of idle capacity during the depression phase of business cycle, as also the misdirection of resources on account of selling costs (transactioncost) under imperfect competition. In planning there is no question of a business cycle because demand and supply are balanced in advance. As a result of this, there is no occasion for the capacity to remain idle. Moreover, there are no competitors but only partners in planning. Thus, there is no question of selling costs, involving misdirection of resources in senseless advertising, salesmanship etc. Therefore, the resources which remain in actual use and in proper use, are more than in a market economy.

Larger means and variety:the amount of resources available under planning is larger on account of the larger means to tap resources. This is so because plans include all types of resources regardless of the fact whether these are profitable in the market sense or not. In a market system, the total quantum of resources equals the sum of individual resources. Besides,

these resources are by and large those which are available in money form like savings in banks, share money, Profits etc. In planning, however, the available resources include not only the total available with the individuals, voluntarily parted within the form of deposits, equities, etc but also those which the government can secure over and above these through the use of compulsory devices like taxes, deficit financing etc.

Future Resources: The planning authority can enlarge the future horizon of resources by adopting a certain type of production activity rather than another type of activity. A government can opt for a program which makes available more resources in the future.

4. Larger Production: In a planned economy, total production of goods is bound to be a bigger quantity than that under a market economy largely for the following three major reasons:

Larger resources

Superior use- pattern: more capital goods and less consumer goods are produced under planning because the community is immortal whereas investors are myopic.

Higher Capital- out put ratio: this results from the less underutilized capacity and in case of perfect planning, no idle capacity. This occurs because demand and supply are balanced ex-ante

5. Better Technique: In planning, as compared to a market economy, there are opportunities to use any technique, provided it is in social interest, say large production. **6. Faster Growth:** - E.g. China experience Planning is superior to market in bringing about a faster rate of growth. This is because of Policy decision and Larger saving

6. Better Distribution: Distribution can be better by taking few measures like Eliminating property incomes, More public consumption, Larger incomes

7. Responsive to Big Tasks: Planning is responsive to big tasks during emergencies as opposed to market forces. The operation of the free market does not address national tasks and national emergencies, say; it cannot mobilize people to the war front when a country is invaded by intruders.

1.3. The need for Economic Planning

Planning is beneficial for both the developed and underdeveloped countries. for the developed countries to maintain or accelerate growth already achieved and for Under developed countries to overcome poverty and to raise the standard of living. Unless the underdeveloped countries

wake up and follow the planning, they will be left far behind in the race of economic well-being.

Planning has been introduced in different countries for different reasons.

In socialist countries, where revolutions preceded and public ownership of resources followed, planning became an institutional need of the system

In non-socialist countries, with private ownership, several factors have necessitated the use of the instrument of planning.

In underdeveloped countries, development needs have been predominant in popularizing planning.

The following arguments reveal an urgent need of planning in underdeveloped and developing countries.

The Market Failure Argument: This refers to a condition where both factor markets and commodity markets in Less Developed Countries are characterized by imperfections in structure as well as in operation. The markets are badly organized and hence there exist price distortions which give wrong signals to both consumers and producers such that these signals and incentives are a poor reflection of the real cost to society of the goods, services and resources utilized. Moreover, the failure of the market to price factors of production correctly is further assumed to lead to gross disparities between social and private valuations of alternative investment projects. In the absence of governmental interference, therefore, the market is said to lead to a misallocation of present and future resources or, at least, to an allocation that may not be in the best long run social interests. This argument designates one of the most widely expressed reasons for heavy government involvement in the economies of the less developed nations. Market failure can be explained under the following three contexts:

A case where the market cannot function properly or no market exists. The existence of public goods gives rise to the problem of 'free rider', in which case it becomes prohibitively expensive to try to exclude non-paying individuals from consuming such goods.

A case where, market exists but involves inefficient allocation of resources. Market power, usually manifested through the existence of monopoly, occurs when firms can influence price by restricting quantity produced.

A case where the market produces undesirable result as measured by social objectives. With externalities, consumers or firms do not have to pay all the costs of their activities or are unable to receive all the benefits.

By and large, the uncontrolled market economy in the developing countries can, and often does, subject these countries to economic dualism, fluctuating prices, unstable markets and low levels of employment. In particular, it is argued (by proponents of economic planning) that the market economy is not geared to the principal operational task of poor countries: **that of mobilizing limited resources in a way that will bring about the structural change necessary to stimulate a sustained and balanced growth of the entire economy.** Consequently, planning came to be accepted, as an essential and pivotal means of guiding and accelerating economic growth in almost all developing countries.

The Resource Mobilization and Allocation Argument: This mainly refers to prioritizing the economic sectors that will guarantee economic transformation in the long run. For instance, it may be required to mobilize resources so as to reallocate them from consumer goods producing sectors to capital goods producing sectors. It may also be necessary to reallocate skills from where they are less productive to where they are more productive. This may not be an easy task because of the fact that people naturally prefer to attach more weight to their present consumption than to the future.

Attitudinal or Psychological Impact Argument: It is often assumed that a detailed statement of national economic and social objectives in the form of a specific development plan can have an important attitudinal or psychological impact on a diverse and often fragmented population. It may succeed in rallying the people behind the government in a national campaign to eliminate poverty, ignorance, and disease. By mobilizing popular support and cutting across class caste, racial, religious, or tribal factions with the plea to all citizens to work together toward building the nation, it is argued that an enlightened central government, through its economic plan, can best provide the needed incentives to overcome the inhibiting and often

divisive forces of sectionalism and traditionalism in a common quest for widespread material and social progress.

Foreign Aid Argument: The formulation of detailed development plans has often been anecessary condition for the receipt of bilateral and multilateral foreign aid. With a shopping list of projects, governments are better equipped to solicit foreign assistance and persuade donors that their money will be used as an essential ingredient in a well- conceived and internally consistent plan of action.

Development Argument:The economic vicious circle of poverty arising due to low income, low savings and highpropensity to consume, and further lower investment and low capital formation, low productivity, low income and poverty must be broken and it can be done only byplanning. Planning is like a shot in the arm which enables a sick person to overcomehis sickness. Planning alone can create more jobs and remove the wide spread unemployment and disguised unemployment which is a common feature ofunderdeveloped countries. It is the sovereign remedy for raising national and per capitalincome, for reducing inequities in income and wealth, for increasing employmentopportunities and for achieving as all round rapid economic development. It is commonly said that the pendulum has swung too wide in favor of planning that is cannot swingback against planning.

Planning can transform an agricultural and primary producing economy into a more balanced economy with heavy, medium and light industries. Agriculture andindustry stimulate production in each other by creating demand for their products.Development of agriculture is also essential to supply the raw material to the industrialsector. Economic planning held in designing the plans of agricultural and industrial sectors of developing economies.

Planning can help an underdeveloped economy to build up its infrastructureirrigation and power, transport and communication and schools and hospitals. The establishment of these social economic overheads is essential for an all-roundharmonious and integrated development. The private enterprise is guided by profitmotive and is not interested in these items of social gain.

One of the principle objectives of the planning in underdeveloped countries is to increase the rate of economic development. In the words of D.R.Gadgil, “Planning foreconomic development implies external direction or regulation of economic activity bythe planning authority which in most cases identify with the government of state.” Itmeans planning increases the rate of capital formation by raising the levels of income, saving and investment. It is only a central planning authority which can control bankingand other credit institutions when these are under private enterprise they have a tendencyto crowd in urban areas. The vast rural areas are completely neglected and thrown tothe wolves, the indigenous money-lender. A planned economy can revolutionize the economy by providing financial institutions and by mobilizing savings and investments

1.3.1. Components of economic planning

The basic elements of the concept of planning are conveyed in the definition of planning – that planning is a continuous process involving decisions or choices about alternative ways of using available resources, with the aim of achieving particular goals. Thus, the following points are identified as basic elements of planning.

Making Choice: This involves**making decision** regarding which actions, strategies and desirable activities to adopt among a number of options. Two main types of choices are involved. The first one is related to **choosing priorities** because everything cannot be done at once; that plan cannot meet all needs and expectations at once. The second relates to the choice of **alternative courses of action** in order to achieve a given predetermined objective. Hence plan serves as a means to make choice.

Allocating Resources:The resource allocation element in planning deals with various issues related to the allocation of resources in a given economy within the prevailing circumstances. It needs to recall that ‘resource’ is understood as anything of potential use in achieving a particular objective – such as natural resources, human resources, and capital resources. Planning involves making decisions about how to make the best use of the available resources

The quantity and quality of resources available has a very important effect on the process of choosing between different courses of action. On the one hand, limited quantity and quality

becomes the main reason why planning involves deciding which of a number of desirable courses of action should be given priority. For example, limitations of such resources as finance and skilled manpower makes planning, as one possible course of action leading to the betterment of economic life, more important for a country. On the other hand, the availability of resources determines the range of alternatives available and the one which is likely to be most acceptable.

Another important component of the planning process, related to the task of resource allocation, is the collection and analysis of information about the availability of existing resources. This in turn raises both conceptual and methodological questions in terms of the quantity and quality of the information required and the ways of collecting and analyzing the information.

Achieving Goals: Now, it has been obvious that planning involves making decisions about alternative ways of achieving particular goals. But this makes it necessary to enquire into the nature of the goals and the process of goal formulation. Some goals may not be adequately defined, some other goals may be unrealistic or too much ambitious given the resources, some goals may be inconsistent to one another, some goals may even be contrary to the interests of the people whom the plan is intended to serve.

Time: Time is one other important element which, in a planning context, deals with the future. Concern with the future time is manifested in two ways. First, planning involves forecasting or making predictions about what is likely to happen in the future despite the risk and uncertainty involved in doing so. Secondly, planning plays a role in scheduling future activities, i.e., in terms of sequencing the various activities to be performed before achieving a goal. How much into the future does planning extend depends on the nature of the planning activity. For instance, some planning exercises may require to make predictions about the state of a nation several decades in the future whereas some other planning exercises related to individual persons or organizations can involve the planning of activities on a daily or even on an hourly basis.

Generally, Economic planning should comprise features such as: clearly designed targets and priorities, executed within a limited period of time, optimum resource allocation,

1.3.2. Plan Formulation and Requisites for Successful Plan

The following list provides the major requirements that must be fulfilled for the formulation, implementation and success of a development plan.

The Planning Commission: The establishment of a planning commission or some other form of organization is of prior importance. It should comprise people or professionals from different disciplines.

Objectives: The formulation of any development plan requires the choice of objectives which can be verifiable against achievements. A development plan can have such objectives as increasing national and per income, increasing employment, reducing inequalities in income and wealth, reducing market concentration, increasing agricultural and industrial output, achieving balanced regional development, etc. In general, objectives should be realistic, mutually compatible and flexible enough.

Statistical Data: This refers to data on existing and potential resources of a country. It requires to conduct an investigation of economic resources and check the availability of capital, natural resources, human resources, existing methods of production, infrastructure such as roads, other communication facilities, power, existing output capacity in agriculture, industry, services, etc. Major suppliers of survey data, in most countries of the world, are statistical authorities.

Fixing Targets & Priorities: This can be seen in two ways: fixing national targets and fixing sectoral targets pertaining to individual industries in the public sector or in the private sector or in both. Targets must be quantitative as in: tons of steel or grain, kilometers of road, etc. Besides, it requires considering resource scarcity so that those programs and projects which should be executed first must be given priority.

Mobilization of Resources: A plan fixes the public sector outlay for which resources are required to be mobilized. There are various internal and external sources for financing a plan. Savings, profits of public enterprises, net marketing borrowings, taxation and deficit financing are the principal internal sources of finance for the public sector. Net budgetary receipts corresponding to external assistance relate to the external sources of financing the plan. The plan

should lay down such policies and instruments for mobilizing resources which fulfill the financial outlay of the plan without inflationary and balance of payments pressures. At the same time, they should encourage corporate and household savings of the private sector.

Balancing in the Plan: Care, has to be taken during the plan preparation in order to avoid or minimize imbalances among economic sectors or roles during implementation. Three types of imbalances can be envisaged: **physical (material) balance, financial balance, and labor balance.** If the actual inputs required fall short of the amount required to realize the targeted output, then this shows that there is imbalance between the resources required and the target output. Physical balance is important for internal consistency of the plan. It also requires to assess the balance in terms of incomes of the people vis-à-vis the amount (or the value) of goods and services on which the money is spent, the amount of funds available vis-à-vis the investment requirements for both the public and the private sector, the resource gap that exists due to the condition in the trade balance, etc.

Incorrupt and Efficient Administration: successful plan implementation requires having a strong, competent, efficient, and incorrupt public administration. Government officials and administrative staff in various capacities **should play active and productive role** with a timely delivery, in the process of generating and formulating policies conducive for plan formulation and implementation, in providing reliable data, reports and in executing their day-to-day duties.

Proper Development Policy: Government should lay down a proper development policy for the success of a development plan and to avoid any pitfalls that may arise in the development process. Such a development policy consists of elements such as a prior assessment of development potential, the provision of adequate infrastructure such as road, power, communication, etc, training facilities including the expansion of education services, helping to create better functioning markets, the promotion of better utilization of resources, giving support and incentives for entrepreneurial efforts, measures to promote savings, etc.

Economy in Administration: Government administrative structure should be designed in a way that allows for efficiency and effectiveness. It should be reviewed and reformed so as to reduce government consumption expenditure and release adequate resources for development purposes.

An Education Base: To plan on a large scale and achieve the objectives and targets set by development plan, the role of well-educated, skilled manpower in both the private and the public sector is of paramount importance. It is also the case that education helps to inculcate ethical and moral values as well as discipline in all the people engaged in different economic activities.

Public Cooperation: Above all, public cooperation is considered to be one of the important levers for the success of the plan in a democratic country. Planning requires an unreserved support and cooperation from the people and hence popular participation and enthusiasm during plan formulation and implementation is of paramount importance for the success of any development plan.

1.4. Problems of planning: Changes in Scope and Approach

Since the mid-1960s there have been significant changes in development planning. In order to understand the nature of these changes it is necessary to look at the approach to development planning adopted in the immediate post-war period and at its achievements and shortcomings. Two main aspects of planning during this period warrant particular attention.

Firstly, development planning was primarily concerned with **economic development**, and in particular with the **growth and structure of the economy**. The concern with economic objective was manifested in a preoccupation with macroeconomic planning, i.e., planning the economy as a whole, with the aim of increasing the rate of growth and productive capacity and altering the balance between different sectors – and to a lesser extent, with the planning of major economic development objectives. Particular emphasis was placed on increasing the coverage of plans and the ultimate objective was considered to be the production of a **comprehensive plan**, which covers all sectors and, in mixed economies, includes the private as well as the public sector. This is an indication that, at that time, development was conceived primarily in terms of the rate of growth and structure of the national economy.

Secondly, the **methodological approach** to planning at that time gradually came to be the focus of attention and was subject to many criticisms. Some of the major criticisms are:

- ✚ That there was a tendency to have too much emphasis on simply writing plans and project documents as a blueprint with totally unrealistic objectives. Such a plan document was considered as an end in itself rather than a means for achieving development.
- ✚ That plans were rarely operationally oriented and no real attempt was made to consider how they might be implemented. Indeed, the gap between planning and implementation was, and still is, one of the major shortcomings of planning in the Third World. That many economic development plans were excessively rigid. This may be counterproductive to a country's interests if the government's ability to adjust and respond to changes in the economic environment is impaired. It is also argued that the need for short-term economic management may not be adequately recognized if government is preoccupied with medium-term development planning.
- ✚ That there were problems resulting from the nature of the relationship and the interaction that occurred between the politician, the planner, and the traditional administrator. These problems mainly arise because of basic differences in the way the three parties approach their joint task, due to differences in the education and experience which have molded them.

During the 1960s there was increasing disillusionment with this approach to planning and by the end of that decade it was widely accepted that it was not achieving its objectives. As people became aware that development involves more than just economic growth and that, in fact, economic growth may sometimes hamper the achievement of other goals such as social equity, it became obvious that development planning must also adopt a broader approach. It also became increasingly evident that planning as it was practiced at that time was having very little effect on the actual course of events. Large amounts of money and manpower were being used to prepare elaborate plan documents but when, at the end of a plan period, a review of progress was made, it was revealed that few of the targets or objectives specified in the plan had actually been achieved, and those that had been achieved had often occurred as a result of coincidence rather than action designed specifically to implement the plan. Awareness of these problems, in 1969, led to the recognition of what was referred to as a 'crisis in planning'. It is

important to emphasize that the role of development planning has not diminished as a result of the recognition of this crisis, probably because most Third World countries still face serious problems of underdevelopment and the gap between rich and poor countries is increasing rather than decreasing. Consequently, the need to plan development has not been reduced. However, the somewhat naïve belief that planning will solve most of the development problems of a country has generally been replaced by a more realistic view of both its potentials and its limitations, and this realization has been accompanied by significant changes in terms of both the scope and the approach to planning.

The crisis in planning has resulted in significant changes in the **scope** of development planning, which are closely related to changes which have occurred in the concept of development itself. Two types of changes are particularly important. The **first** type of change is related to the recognition that planning must take into account **political, social, and physical environmental considerations as well as economic factors**. Thus, for example, at the national level the objectives of development plans should include the achievement of political goals, the provision of social needs and the conservation of the natural environment, as well as growth or structural change of the national economy. Similarly, when planning a particular project, such as a mine, an industrial venture, or a new road the planners should consider the political, social, and environmental costs and benefits of the project as well as its financial costs and benefits. This broadening of the scope of development planning has resulted in changes in the techniques of planning and in the type of people employed as planners. The changes in techniques have been concerned with incorporating social and environmental factors into processes of decision making such as cost benefit analysis. Changes in the planners themselves have occurred partly through the realization that economists involved in planning must broaden their skills and attitudes and partly through an increased participation of professionals from different disciplines such as sociologists, environmental specialists, political scientists, statisticians, engineers.

It is also important to note that broadening the scope of development planning has not only resulted in the incorporation of non-economic factors into planning but also in a concern with the interrelationship between economic, social, political and environmental factors. In other words, the emergence of the concept of **integrated development** has resulted in a

corresponding concern with **integrated development planning**, in which all aspects of development are taken into consideration. This approach to planning has become particularly important at the regional or area level, since integration of the different aspects of development is more obviously needed and more easily obtainable within the confines of a specific geographic area.

The **second** type of change in the scope of development planning is related to the questions of **distribution and equity**. The experience of the early post-war years demonstrated that economic growth frequently results in increased inequality and that this realization resulted in a search for patterns of development which would reduce rather than increase inequalities, so that development would benefit the majority of the population rather than just a small minority.

The crisis in planning also resulted in changes in the **approach to planning**, designed in particular to improve **plan implementation**. In the early years of development planning the implementation of plans was more a matter of luck than good planning. The various changes in approach which have been introduced in an attempt to reduce this gap between planning and implementation can be divided into two broad types. The **first one** is associated with the recognition of the need for planning to be based on **a process of learning** to enable policy-makers to **respond to changing circumstances**. Planning should be a continuous process characterized by regular reviews of policy effectiveness and adjustments in policy where necessary. Planning must be flexible so that it can respond to uncertainty more effectively. Besides, instead of focusing all attention on planning at the macro level, more and more emphasis has been given to detailed planning at the sectoral, regional and project levels. Project planning, in particular, has received a great deal of attention since the early 1970s. Consequently, this change in the concept of planning helped to improve the link between planning and budgeting, since budgeting is the main means of allocating resources for plan implementation. The importance of regular monitoring of progress during implementation, so that problems can be identified as soon as they arise and plans can be amended accordingly, has also been recognized. Finally, it has resulted in less emphasis on planning for fixed periods of time (such as the previously very popular five-year plans) and more emphasis on annual plans, which are linked to the annual budget, and on rolling plans, which are extended year after year.

The **second type** of methodological change resulting from the crisis in planning can be attributed to the realization that **plans must be realistic**, in the sense that they take account of the social, economic, and political environment in which they have to be implemented i.e., the need to avoid over ambitiousness in planning. This means that planners must be aware of the resources (financial and manpower) available for implementing the plan and the various other constraints which will determine what can and can not be achieved. In other words, plans should represent what can realistically be achieved and **not** what the planners would ideally like to see happen. This has implications for the type of data required for planning, the way in which alternative courses of action are identified and appraised, and the role of the planner. In particular, it has implications for the relationship between planners, politicians and administrators, since it means that plans must be acceptable both to the politicians who will have to endorse and support them and to the administrative or technical staff who will have to implement them. It also strengthens the arguments for more popular participation in planning because plans must be relevant to local needs and conditions and acceptable to the people who are supposed to benefit from them.

Despite the above mentioned changes in scope and approach, the planning exercise has never remained without problems that diminish its roles in the development process. Two major problems can be cited for the subsequent disenchantment with planning: that of the discrepancy between the theoretical benefits expected of plan undertakings and the actual achievements obtained from implementing plans on the one hand; and other more fundamental defects in the planning process on the other hand.

Let's consider the first problem: the divergence between the theoretical assertions (expectations) about planning and the outcomes of actual plan practices. According to the market failure argument, which is one of the principal economic arguments in favor of planning, there is a presumed role of government in reconciling the divergence between private and social valuations of benefits and costs. But the experience of government policy in many less developed countries shows that the divergence has rather been exacerbated. As an illustration, it is possible to take the following four crucial areas where social and private valuations tend to

diverge and where the impact of government policy has often tended to increase rather than reduce these divergences.

i) Factor prices, Choice of Techniques, and Employment Creation: A presumed conflict between two major planning objectives – rapid industrial growth and expanded employment opportunities - has typically resulted in the neglect of employment creation in the interest of industrial growth. There need be no such conflict if government policies were more geared to adjusting factor- price signals to the real resource scarcities of developing societies. But in fact these private price signals have increasingly diverged from their implicit social valuations partly as a result of public policies that have raised the level of wages above labor's shadow price or scarcity value by various devices such as minimum-wage legislation, tying wages to educational attainment, and structuring rates of remuneration at higher levels on the basis of international salary scales. Similarly, investment depreciation and tax allowances, overvalued exchange rates, low effective rates of protection, quotas, and credit rationing at low interest rates, all serve to lower the private cost of capital far below its scarcity or social cost. The net effect of these **factor-price distortions** has been to encourage private and public enterprises to adopt more capital- intensive production methods than would exist if public policy attempted to correct the prices. This divergence between private and social valuation is one of the major reasons for the slow growth of employment opportunities.

ii) Rural-Urban Imbalances and migration: The widespread phenomenon of rural-urban migration has been one major problem contributing to the divergence between private and social costs and benefits. Public policy and plan intervention in order to remedy this problem has still been Counter-productive. Government policies that are strongly biased in favor of urban development have stimulated an excessive outflow of rural migrants in search of limited but highly paid urban jobs. With growing urban unemployment and stagnating agriculture, the continued heavy influx of rural migrant represents a net social loss to society in the context both of lost agricultural output and higher social costs of their urban accommodation.

iii Demand for Education and the Employment Problem: Since economic incentives given to secondary and tertiary education are high, this condition has resulted in the creation of more and more demand for schooling accompanied by high private valuations of returns from education relative to the lower social returns. The tendency to ration scarce high-paying employment opportunities by level of completed education and the policy of most less developed countries

governments to subsidize the private costs of education at the higher levels have together led to a situation in which the social returns to investment in further quantitative educational expansion seem hardly justified in comparison with alternative investment opportunities.

iv. Structure of the Economy: Planning and government policy have also contributed to the maintenance or exaggeration of socially incorrect signals and incentives, through the **emphasis on import substitution**. Government policies such as special tax concessions to foreign investors, overvalued foreign exchange, higher effective tariff rates designed to lower the cost of capital-and intermediate goods imports, quotas, subsidized interest rates, credit rationing, to new industries, and a whole array of bureaucratic industrial licensing procedures, etc have served to provide an **artificial stimulus to import-substituting industrial expansion**. For the most part, the experience of import substitution in Africa and Latin America has failed to meet planned expectations in terms of the eventual realization of low-cost efficient production by local industries. Moreover, the heavy emphasis on urban industrial growth and the concomitant attempt through an economic policy of distorted signals and incentives to reward private industrial activity have greatly contributed to the stagnation of the agricultural sector.

The **second reason** for the apparently diminished role of planning in development relates to the following set of **more practical problems encountered during the process of plan implementation**:

i) Deficiencies in Plans and their Implementations: Plans are often overambitious. They try to accomplish so many objectives at once without consideration that some of the objectives are competing or even conflicting. They are often very attractive in design but vague on specific policies for achieving stated objectives. Consequently, the gap between plan formulation and implementation is often enormous.

ii) Insufficient and Unreliable Data: The economic value of development plan depends to a great extent on the quality and reliability of the statistical data on which it is based. When these data are weak, unreliable, or simply nonexistent, as in many poor countries, the accuracy and internal consistency of economy wide quantitative plans are greatly diminished. And when these unreliable data are compounded by an inadequate supply of qualified economists,

statisticians and other planning personnel, the attempt to formulate and carry out a comprehensive and detailed development plan is likely to be frustrated at all levels.

iii) Unanticipated Economic Disturbances: These can be internal or external. Since the economies of most less developed countries are dependent and susceptible to changes in the world economic conditions in particular to changes in oil price, trade, aid, private foreign investment, etc, this makes it difficult to plan for a long term.

iv) Institutional Weaknesses: This refers to weaknesses such as the separation of the planning agency from the day-to-day decision-making machinery of government ; the failure of planners, administrators, and political leaders to engage in a continuous dialogue and internal communication about goals and strategies; and the international transfer of institutional planning practices and organizational arrangements that may be inappropriate to local conditions. Besides, there has been much concern about incompetent and unqualified civil servants; cumbersome bureaucratic procedures; excessive caution and resistance to innovation and change; inter-ministerial personal and departmental rivalries; lack of commitment to national goals as opposed to regional, departmental, or simply private objectives on the part of political leaders and government bureaucrats; and the political and bureaucratic corruption that is pervasive in many governments

v. Lack of Political Will: Poor plan performance and the wide gap between plan formulation and plan implementation are also attributable to a lack of commitment and political will on the part of many developing country leaders and high-level decision makers. Political will to develop entails much more than high-minded purposes and noble rhetoric. It requires an unusual ability and a great deal of political courage to challenge powerful elites and vested interest groups and to persuade them that such development is in the long run interests of all citizens even though some of them may suffer short-term losses. In the absence of their support be it freely offered or coerced, a will to develop on the part of politicians is likely to meet with staunch resistance, frustration, and growing internal conflict.

Despite the problems discussed above, as a developing nation, it is still necessary to do with plan than to do without it. By and large, **the focus of the planning exercise** in less developed mixed economies comprises **two principal components** or approaches working side by side.

The **first** one is related to the direct and deliberate use of **domestic saving and foreignfinance for indispensable public investment projects** such as roads & railways, education & health, power and communications and other basic social and economic infrastructure. These are investments with the greatest contribution toward the realization of long-term economic objectives.

The **second focal area** of planning relates to **stimulating, directing or even controlling** private economic activities so as to ensure harmonious relationship between private interests and government objectives (social objectives). This requires the instrumental use of government policy intervention through such measures as taxation and tariff settings, industrial licensing, and manipulation of quotas, wages, interest rates and prices.

1.5. Shortcomings of Planning

Besides its multifaceted importance, planning has been criticized for its shortcomings.

- Planning leads to rigidity

- Planning may not work in a dynamic environment

- Planning reduces creativity

- Involves huge cost

- Planning is time consuming

- It may not guarantee success

1.6. Implications of various economic controls in planned economy

There are close relationships among the concepts of planning, policy-making, and implementation as there are differences. Policy making involves making decisions about the general directions in which change or development should occur. In particular, decisions which have direct or indirect implications of a controversial, sensitive, value laden or political nature. Planning is concerned with the process of deciding what courses of action can best bring about these changes or developments and how they should be undertaken.

Implementation, on the other hand, involves the actual execution of the courses of action in the plan.

One of the ways in which their relationship is reflected is that these concepts generally tend to appear in sequence. Hence, it is usually appropriate for policy measures to precede planning decisions. This is because planning is a means of enabling general policies to be translated into practical action programs. Obviously, plan implementation should come at the end as a matter of translating words into actions. The other aspect of the relationship emanates from the division of responsibilities among the persons or parties who work together to achieve the same ultimate objective. Thus, policy making is, at least in part, the responsibility of politicians or others who are in a position to make political decisions whereas planning is the responsibility of those who have received professional training as planners. Implementation is undertaken by a separate group of trained administrators who are directly or indirectly linked with the policy-making, planning and implementation process.

Check your progress 1!

Summarize the problems associated with the traditional approach to development planning.

Check your progress 2!

Mention two general reasons for the divergence of the gap between public rhetoric and economic reality with regard to the role of planning in economic development?

Check your progress 3!

It is argued that many LDC policies, including planning as a policy instrument, have contributed to the perpetuation of poverty, inequality and unemployment instead of eliminating or reducing them (not intentionally, but being unaware of the consequences of their action). What are the specific explanations for this?

Check your progress 4!

Do you think that 'integrated development planning' is advantageous? Why?

1.6.2 The planning process

Rationality in Planning

The concept of rationality is central to the notion of a cyclical planning process and is of fundamental importance in the overall context of the theory of planning and decision making. The rationality approach is founded on principles of reasoning rather than simply on emotions or inspired guesswork. Rationality as a concept can be applied to the goals of behavior and to the ways in which people should ideally behave in reaching a particular decision.

Regarding the goals of behavior, rationality is generally taken to mean that one seeks to obtain maximum output for a certain input, or alternatively, to minimize the inputs required to obtain a certain output. It implies efficiency in resource allocation.

On the other hand, the rational approach to decision making involves the following sequence of activities.

Problem identification and definition

- Classification and organization of goals, values, and objectives relating to the problem

- Identification of alternative courses of action by which the problem may be solved or the objectives achieved

- Prediction of the consequences of each alternative course of action and the likelihood of these occurring

- Comparison of the predicted consequences in relation to specified goals and objectives
- Selection of a course of action

Although the rational approach is ideal, there are many factors that limit planners and decision makers from being perfectly rational. Some of the limitations relate to the following factors.

It is often difficult to get sufficient and reliable data, for each and everything, that help identify the nature and extent of prevailing problems in order to formulate solutions and reduce uncertainties that hinder plan performances. This, in general, is a fact of life when it comes to the conditions in many developing countries where there are acute data problems, shortage of resources and lack of skilled manpower.

It may not be always easy to frame planning objectives, and nor can it be easy to cost different courses of action.

Often, it is difficult to find out what people want and their preferences might be regarding policy options.

To be rational, it needs to be comprehensive in terms of collecting all the information relevant to a particular problem and get it analyzed, ranking all goals and objectives in order of preferences, predicting all the consequences of all possible courses of action before a decision is made. In reality, the costs of collecting and analyzing all types of data would be enormous and in fact, unbearable. The implication of all this is that planners and decision makers are, in reality, forced to accept and work with **limited rationality**.

Limited rationality means that only some selected alternatives and their most important consequences relating to key goals and objectives are actually considered in the decision making process. This means, goals, objectives, and alternative courses of action and their consequences are filtered out. Some of the ways of filtering out involve: ignoring consequences which are of no interest, adjusting the scope of one's concern as a planner or decision maker through learning from past decisions, satisficing which refers to making oneself ready to accept an outcome, as in a solution for a problem or a goal, which is satisfactory or sufficient and not the optimum. In general, planners are expected to pursue a pragmatic approach based on limited rationality. Planning and decision making should not always be taken as objective, technical process only. But it also requires to consider the fundamentally political nature of the decision making process.

In practical terms, planning is an attempt to reduce uncertainty about what will happen in the future by managing and controlling change to achieve desired objectives. But in the meantime, planning itself cannot escape the impact of uncertainty. Since planners have to work with limited amount of information about the prevailing situation, it is not easy to forecast or control the future. Two basic ways can be suggested to tackle this problem. The first one is by identifying the sources of uncertainty, understanding and controlling them. The second one is by adopting a flexible approach so as to adapt and respond to them.

There are **three** widely accepted areas of uncertainty that affect the planning process. The **first** one is the general environment which is outside the specific decision making systems actually involved in planning. These can be changes in international economic situation, natural factors such as floods, earthquakes, etc and other external socio-economic factors occurring as force majeure. The **second** one relates to decisions or policies which are outside the scope of the current planning exercise but which are related to it. For instance, efforts to introduce a new program related to the creation of a new settlement for some groups in the society, a program which was not in the scope of the development plan, affects at least the plan for the transport sector. Thirdly, lack of sufficient knowledge about the appropriate value judgments to be applied in making policy or plan decisions could be a another source of uncertainty.

Check your progress 5!

What does rationality actually mean in relation the goal of human economic behavior?

Check your progress 6!

What methods do you suggest to reduce uncertainties related to external factors such as natural catastrophe and possible changes in international socio-economic conditions?

Perspectives on the Nature of the Planning Process

Here, planning is viewed as a cyclical process involving a sequence of stages which are designed to link the formulation of basic policy goals with the design of specific projects or programs and to ensure that lessons learned from the implementation of these projects and programs are fed back into subsequent planning cycles. The following issues characterize the planning process as a whole. Firstly, the various stages involved in the planning process are interrelated; no one stage stands in isolation. This, in turn, has implication for links in techniques used in each stage and links in the organizational structure within which the whole process takes place. Secondly, the planning process is much more complicated a process than its simplified diagrammatic representation. For instance, the national or regional plan exercises usually involve a series of interrelated cycles with progress in one cycle taking place much faster than progress in another. Thirdly, despite the idealized representation of the planning process, there are often practical problems to progress through all the stages of the cycle.

The Decision to Adopt Planning

The tasks involved in this stage mainly include the decision to adopt planning as a means of tackling development problems and achieving desired goals and objectives, establishment of organizational framework for planning such as ministries, commissions, boards, agencies, etc., making manpower and financial resources available so as to enable the management and the controlling systems functional, conducting regular reviews to ensure organizational efficiency and effectiveness.

Planning Goals and Objectives

The overall performance of the development planning system will be measured in terms of its ability to achieve the goals and objectives. Goals and objectives are an expression of the priorities of planning. Goals, objectives and targets represent a hierarchy of concepts ranging from the very abstract to the very precise. They are related to time spans varying from perhaps many decades to just one year or even less.

Goals usually take the form of statements about what planning should ideally achieve in the medium to long term. Objectives are more precise, operational statements that represent specific steps on the way to attaining selected goals. Objectives usually relate to a shorter time period, often the lifespan of a particular plan. Progress towards the achievement of particular objectives can actually be measured and evaluated by setting targets in relation to objectives. Hence, targets are the least abstract of all the concepts mentioned and are clear statements about what should be achieved over a given time.

Data Collection and Analysis

This stage enables planners to analyze the existing situation so as to determine the nature and extent of particular planning problems. It serves as means to know where we start from. It represents an essential bridge between the goals and objectives of planning and the formulation of alternative courses of action designed to achieve the goals and objectives. Nevertheless, data collection and analysis requires considerable financial resources, skilled manpower and access to various kinds of facilities. Lack of availability of data is one of the most serious problems in developing countries.

Identifying Alternative Courses of Action

This stage is very much interlinked with the data collection and analysis stage and aims at specifying possible courses of action to solve problems. The stage enables us to spell out the means or mechanisms by which we can move from where we are at present to where we wish to be at some point in the future.

Plan and Project Appraisal

After alternatives have been identified they must be appraised or assessed. Appraisal refers to the act of identifying the advantages and disadvantages of different courses of action by analyzing and comparing them. In other words, it is an analytical exercise which focuses on the relative merits of different courses of action. The most widely used appraisal techniques are the social cost benefit analysis which helps to calculate the financial costs and benefits of different options, the environmental impact assessment which helps to assess the impact of new development projects on the physical environment, and the social impact assessment which provides a methodology for examining the social consequences of development projects.

Implementation

Because of the cyclical nature of the planning process, implementation cannot be seen in isolation from the other stages and hence remains to be the concern of planners as well. In fact, people other than planners especially those with technical and administrative responsibilities play decisive roles in plan implementation. Constraints affecting the implementation of projects and programs must be taken into consideration during the earlier stages of identifying and appraising alternative courses of action and during and after actual implementation. It also requires planning the implementation process in terms of identifying the various activities associated with the plan, preparing a time schedule to indicate when they will be undertaken, and in terms of mobilizing the resources for implementation.

Monitoring and Evaluation

Monitoring is a means of finding out what is actually happening during implementation. Evaluation, on the other hand, is designed to reveal the extent to which plan objectives have been achieved. Monitoring and evaluation, together, play a decisive role as a means of measuring past successes and failures and providing information needed to improve future planning activity.

CHAPTER - 2

CLASSIFICATION OF PLANNING: MEANING, CHARACTERISTICS OF DIFFERENT TYPES OF PLANNING AND THEIR RELATIVE MERITS AND DEMERITS

Dear learners! in this chapter, the criteria set to classify plan in to different forms and various types of planning, including their merits and demerits will be discussed.

Learning objectives

At the end of this chapter, students will be able to:

Identify the criteria to classify different types of plan.

Recognize various types of plan

Explain the characteristics of different types of planning.

Clearly elucidate the merits and demerits of various types of plan.

Introduction

In general, planning activity refers to any type of planning activities, including development planning, ranging from individual to regional to national or to international levels. By and large, planning activities can be classified based on four criteria. They are: the scope of

planning activities, the spatial level of planning activities, the operational level of planning activity, and the nature of planning goals.

2.1. The Scope of Planning Activities

Here, planning activities are classified based on the range of activities which planning is designed to influence. This approach tends to classify planning activities on the basis of disciplinary or professional lines and hence suggests the subject matter and the professional role of the planners involved. Hence, it is possible to think of social planning, economic planning, natural resource planning, architectural or engineering planning, etc.

b. The spatial level of planning activities

This classification is based on **space as a physical dimension** and hence indicates the spatial level at which the plan is practiced. Thus we have different spatial hierarchies such as international planning, national planning, regional or local planning, town or village planning, enterprise level planning or even family or individual level planning. Planning practices which are based on this type of classification touch upon the issues of centralization and decentralization. National plans which are strictly monitored, controlled and directed by a central government designate centralization or a centralized plan. On the other hand, regional or local plans relate to decentralization because such plans are designed, formulated, implemented, monitored and directed by regional/local authorities.

c. The Operational Level of Planning Activity

This refers to the more manageable, operational levels of a comprehensive national planning. There are three most common operational levels: project planning, sectoral planning, and integrated area planning.

Project Planning: Project refers to an activity or a set of related activities planned and implemented as an identifiable whole. A project usually has a specific geographic location with a clearly defined time-span. It includes the more obvious, physical projects like roads, housing complex, buildings for schools and health facilities, etc as well as such less visible projects as efforts to improve nutrition in a particular area. The important thing about project planning is that its boundaries are relatively clearly defined and it can be undertaken in isolation,

irrespective of any other form of planning activity. But it is usually more effective if project planning undertaken as part of a wider planning exercise instead of having it carried out in isolation.

Sectoral Planning: This is planning for a particular part or sector of a country's development. It is possible to identify sectors which correspond to the division of the government into ministries, departments or other organizational units. Thus, sectoral plans can be prepared for sectors such as agriculture, education, health, transport, housing, etc. Sectoral plans are normally prepared for the whole country, i.e., for all parts of the country to which they are applicable. Sometimes sectoral plans are produced independent of each other. For example, the ministry of health may decide to prepare a health plan irrespective of the planning activities in other ministries while in other cases they may be coordinated by some sort of national planning agency, usually as part of a national development plan.

Integrated Area Planning: This involves planning for all sectors or types of activity within a particular geographic area. It is a kind of planning which is multisectoral and integrated in its nature. It can be practiced in one area independently (for instance in area where there is a special problem) or in different areas simultaneously.

It requires to note that although the classification into the above three operational levels is useful to analyze different types of planning, there can often be an overlap between any two or more of the above plan types. For instance, one might say that the planning exercise associated with the construction of a large mining project should be regarded as area planning rather than project planning because one should plan for the integrated development of the whole area likely to be affected by the mine.

d. The Nature of Planning Goals

Planning activities can also be classified based on the nature of the goals which they are designed to achieve. Thus, we can have the following sub-classifications.

- i. War-time planning: This is planning in case of emergencies such as national disasters including war, earthquake, flood, storm, fire, et.

- ii. Town and country planning: This is concerned with the objective of allocating land between different functions or activities.
- iii. Anti-cyclical planning: It is designed to maintain stability in a national economy, i.e., to counteract the alternate booms and depressions.
- iv. **Development planning:** This type of planning is concerned with increasing the rate of economic and social progress.

Check your progress 1!

Provide some example of projects which can be regarded as both project planning and area development planning? What particular conditions indicate the effect of the project on the development of the area?

Check your progress 2!

How do you distinguish between a project and a program?

In general, planning can be classified based on differences in: Time period, Geographical area, Institutions affected, Media of planning, Extent of activities covered, Mode of executing plans etc. so, based on the above criteria, some types of development planning are:

- Planning by Direction and planning by Inducement
- Long-term, medium-term and short-term planning
- Fixed and Rolling plans
- Democratic and Totalitarian (Authoritarian) planning,
- Anti-cyclical and Development Planning,
- Physical planning Vs financial planning,
- Centralized and Decentralized planning.

2.2. Planning by direction and planning by inducement

2.1.1. Planning by Direction

This is a type of development plan practiced mostly by socialist countries such as the former Soviet Union (USSR), former East Germany, North Korea, Cuba, Ethiopia during the Dreg era, etc. In this type of development plan, there is a single planning authority which formulates the national plan, directs and orders the execution of the plan in accordance with predetermined

targets and priorities. The central planning authority fixes objectives, targets and priorities for each sector and enterprise, fixes prices and wages and takes all investment decisions. In order to execute the plan, the government controls the entire agricultural, industrial, transport and communication, banking & insurance etc sectors through its nationalization program. This type of planning is also known as centralized planning or command socialist planning or imperative planning.

Demerits

The major drawbacks associated with this type of planning relate to the fact that it is totalitarian in its nature. There is no consumer sovereignty. Prices are controlled and goods are rationed. All markets including the commodity markets and the resource markets are under control and hence labor and other inputs are allocated as per the plan requirements. The fulfillment of the plan targets is difficult and develops a tendency to procrastinate tasks as well as it is a costly affair.

2.2.2 Planning by Inducement

In this kind of planning economic agents in the private sector (individual, firms and industries) are induced to behave in a certain predetermined way usually through the use of discussions as well as the use of policy instruments such as fiscal and monetary policies. It is also known as indicative or decentralized planning or planning through the market. Given the rules of the game, people are left with all possible choices in making economic decisions such as investing in alternative areas, switching freely between consumption and saving, etc. This type of planning is characterized by market manipulation in which the private sector is given incentives in the form of subsidies, tax exemptions, tax holidays, manipulation of interest rates, liberalizing credit **conditionality, etc. The government role in the economy is limited to enforcing laws** and regulations and investing in some selected areas like the development of basic infrastructure such as roads, power, communication, etc, the initiation and development of scientific and technical research, the introduction of long-term cost reduction methods, etc.

The problem with this kind of planning is that, on the one hand, incentives to the private sector may not be adequate to guarantee the required behavior of economic agents while, on the other hand, fiscal and monetary measures may not be sufficient to increase the rate of capital formation and realize rapid economic growth.

2.3 Short term, medium term and long term planning

2.3.1. Long term /Perspective planning

Reflects long-term goals, objectives and targets and hence this type of plan stretches over a long period of at least ten or more years. The broader objectives and targets of such a plan are to be achieved by dividing the perspective plan (a long-term plan) into several medium and short term plans. This is because short-term plans and medium term plans are easy to handle and provide for greater precision by reducing uncertainty. The main purpose of a perspective plan is thus to provide a background for short term plans so that the envisaged lump sum achievements of the long-term are realized through the piecemeal achievements in the short term. Long-term planning is becoming quite popular these days to take a longish view of the future of the economy. The statistical techniques now available make it possible to forecast reasonably well the course of events for such a long period of time. Such as demography, education, health.

Characteristics of long term planning

A. Greater freedom of choice: - the number and intensity of constraints on choices are much less in long-term planning

B. Broadened scope: - It is possible to over-reach the narrow frame of purely economic considerations and to explore social and human implication of economic development. Besides; it may be feasible to overcome the narrow boundaries of national planning and plan in the international context. The resource availability over a longer period is much greater and more flexible than in a short period. Over a longer period one can include, besides the resources that will pile up over the years, new resources that will be made available only in the future. Such a comprehension of resource availability makes for greater freedom of choice in respect of planned activities as compared to medium-term and short-term planning periods

Merits of long-term planning

- A. Educative:** - long term planning provides an opportunity of informing and explaining to the public the major problems that are posed by the future society, the available choices and the limitations which surround these choices, It helps in preparing more realistic medium and short-term plans. There is a better understanding of the processes of economic development which is of particular relevance to developing economies.
- B. Explanatory:** - A long-term perspective is helpful in enlightening the decision makers and those who are to implement the plans. The information made available under this type of planning ensures integration of short-term plans into a longer-term framework. This enables the planning authority to make adequate preparation for the solution of problems that may arise in the future. Besides, perspective plans make it possible to assess the long-term implications of medium term and short-term decisions.
- C. Stimulant:** - Long-term plans by making obvious future choices and by reducing uncertainties enable decision-makers to act boldly in respect of decisions for shorter term plans. Public opinion too gets adequately stimulated because perspective plans open up prospects for progress and reduce incomprehension of the implications of the present. Such knowledge on the part of the public reduces hesitations in respect of short-term plans.

Demerits

future is uncertain

In case this type of planning is confined to prognostic forecasting (foretelling), no firm thinking on the subject will be possible

2.3.2. Medium term plans

Typically **ranges** between three to five years'. It represents the main type in the socialist communities. The medium term plan is mainly a production plan in which investment is the backbone. It is connected to the long-term plan through the frame of the long-term plan, and is considered as one of the basic tools to achieve the objectives of the long-term plan, so these medium plans are a connected series which leads to the objectives of the long-term planning.

The medium-term plan includes the targets of production development, national income and its contents, and ratio of development of these contents. It also includes levels of development for income and production of different economic sectors, and it contains all details, so this plan includes targets of production and percentage of contents development (construction of commodities of the outcome) e.g., size of production, levels of development. The plan includes the plan of investment showing the strategy of investment and its distribution to sectors and different economic activities. It shows the projects included in investment plan and their priorities, and standards of their selection, it includes the plan of consumption and other types of expenditure, and a plan for manpower. It includes also the behavior of all other variables as exports, imports, etc. The preparation of the medium-term plan is through the study of national economy capabilities as financial and human resources and expectations of their behavior in the future, depending on the past experience. Based on these studies, the Political Authority identifies the targets of the plan which shall be translated to details by Central Planning Authority including production, consumption, laborship, standards of growth of all sectors. The central planning authority sends this plan to various levels to prepare more detailed plan within the figures given by the central political authority, then these plans returned to the upper authorities where the central political authority incorporate in one plan.

2.3.3. Short term plans

Short term plans are typically **annual plans** but can also be extended to quarterly and monthly plans. Medium-term and short-term plans can easily be translated into regional, district and local operational plans and further in to operational plans for sectors such as agriculture, industry and service which in turn can be translated into plans for specific activities or projects such as plans for food grains, for coal, for iron & steel, for textiles, for exports, etc.

It is usually called the execution plan. The short plan represents the method to execute the medium-term plan. The medium term plan also represents the method to achieve the targets of the long-term plan. The short-term plan gives more flexibility for the five-year plan, where any modifications can be done to face any case of emergencies.

Annual plans are characterized with detailed objectives and methods and tools used to achieve these targets. It is more detailed than the 5 years plan because it puts the targets in quantity and

numerical methods; it also includes the increase in production and savings in costs. In investments, we consider the yearly plans as project's execution plan. It includes the present stage and ways of financing. It includes the plan of supply e.g. the plan of distributing of basic materials on different ways of use; it includes details of production objectives for commodity sectors and the needs of these sectors of production requirement and investment of foreign currencies. The preparation of the yearly plan is done 6 months before execution. All projects identify their targets for the next year according to the present plan, and state their needs of work, investment and foreign currency, and changes of production and supply plan for the project.... etc., then they send their plan to the higher level and so till it reaches the Central Committee for Planning, which prepares the year plan according to sector's plans within the five year plans which is already prepared. plan is prepared. Each year has a specific budget and targets.

2.4. Rolling Plan and Fixed Plan

2.4.1. Rolling plan

In the case of a **rolling plan**, every year three new plans, i.e., (annual plan, medium- term plan and perspective plan) are prepared and are acted upon. The annual plan for every year is fitted into each corresponding new medium-term plan and both are framed in the light of the perspective plan. For instance, if planning is started in 1970 in a country, there would be three plans under the technique of rolling plan: an annual plan for 1970, a five-year plan for 1970 – 74, and a twenty-year perspective plan for 1970 – 89. The broad aims and objectives are laid down in the twenty-year perspective plan. When the plan starts in 1970, there will be an annual plan in every subsequent year. The five-year plan for 1970 – 74 will also roll on for the subsequent periods by shedding each previous year so as to become a plan for 1971 – 75, 1972 – 76, etc. such that one always finds himself working at the beginning of a new five-year plan. Since planning is a continuous process, every year the plan is revised in the light of new information, improved data and improved methods of data analysis.

Characteristics of rolling plan

They are based on unfixed dates. Revisions and adjustments are part and parcel of the technique of rolling planning and rolling plans always keep open the door for changes.

The merits in the rolling plan

There is always a possibility for revising plan targets, projections and allocations taking into account the changing circumstances in a country. Hence, rolling plan gives an alternative and a solution for the rigidity encountered in fixed plans. Moreover, this type of planning is a realistic exercise. The targets and the provisions for them remain feasible propositions in view of the revisions and adjustments that are made as per changes in the circumstances surrounding the plan. Being flexible a rolling plan is more realistic than a fixed plan. It takes into consideration such unforeseen natural and economic changes

Demerits of rolling plan

Rolling plan is criticized for many reasons. First, it lacks targets and objectives that are meant to be achieved within a fixed period of time - because of the persistent changes in targets and time frames every year. Secondly, it creates uncertainties in the private and public sectors of the economy. Both sectors lose the urge to make changes in their production plans or to proceed in accordance with the previously laid down targets and may consequently develop an attitude of non-commitment, lack of interest and enthusiasm regarding the plan. Thirdly, the success of a rolling plan mainly depends on the availability of efficient and high-tech communication system, efficient and continuous data flow, trained manpower, a computerized system of analyzing data, the capacity and commitment of the planning body to cope with the work load, day-to-day knowledge on the progress and shortcomings of projects under implementation, etc.

2.4.2. Fixed plan

It refers to the unchanging period of time for which a plan is prepared. For example, a plan for a period of five years, 1975-80, will be a plan for this period alone. After the plan for this period runs its full course of five years, another plan of five years will begin spanning the next period from 1980 to 1985. While the fixity of period is the basis of this type of planning, there is more that goes with it than the given length of time. Fixity implies that the targets that have been formulated /quantified are equally fixed and so are the means that have been designed for the purpose. The plan thus is unchangeable for the period of five years. Fixity on both the time period and the targets is the hallmark of fixed plans. A fixed plan is thus a plan that remains fixed (given) for a specified time period. Sometimes important changes can be incorporated in

fixed plans, When Resources may fall far short of needs or International development upset calculations in respect of foreign resources etc.

It helps to lay down definite objectives, targets and priorities to be achieved during a single specified period. It gives an opportunity for both the private and public sectors to cooperate and focus on achieving the specific targets within the given period, taking for granted that all parties will be mutual beneficiaries of the end result. Also, it makes it convenient to evaluate plan

Merits

It makes for boldness in planning i.e. under such a planning one can design for higher objectives with larger resources, with little fear of their being scuttled down. It ensures effective implementation, because this type of planning presupposes commitment to the plan. provides for stability in the economy. Fixed plans act as performance-test to check on the efforts made, their adequacy or inadequacy and success/ failure to locate the points that deserve approbation/ disapproval as also to draw lessons there from. There is a “checking” mechanism built into the planning system. Everyone will therefore be subjected to scrutiny. There is bound to be disciplined thinking and action in respect of the formulation of policies and their execution.

Demerits

Weaknesses arise from the inflexibility of such plans. Plan targets are rigidly fixed. Changes cannot be easily made. Wastage of resources prevails if the plan gets out of tune with the reality.

2.5. Democratic Vs Totalitarian (Authoritarian) planning

2.5.1. Democratic planning

It implies planning within democracy. people are associated at every step in the formulation and implementation of the plan. It is characterized by the widest possible consultations with the various state governments and private enterprises at the stage of preparation. It seeks to avoid clashes, and tries to harmonize all opinions that are for the welfare of the people. Cooperation

of different agencies, and voluntary groups, and associations plays a major role in its execution. The plan is fully debated in the parliament and the state legislatures and in the private forums. The plan prepared by the planning commission is not always accepted as it is. It can be rejected or modified by the parliament of the country. Hence, the plan is not forced upon the people from above, it is planning from below. Democratic planning respects the institution of private property. Nationalization is resorted to the limited extent absolutely necessary and reasonable compensation is paid in all cases. Such planning allows Price mechanism to play its due role.

The government only seeks to influence economic and investment decisions in the private sector through fiscal and monetary measures. The private sector operates side by side with the public sector and here is healthy competition between the two for the fulfillment of the plan targets. Its objective is reduction of inequalities of income and wealth through peaceful means by taxation and government spending on social welfare and social security schemes. Individual freedom prevails i.e. People enjoy social, economic and political freedoms.

Criticism

Critics claim that democratic planning is a myth. meaning, some sort of state intervention is inevitable even in democratic planning whereby economic freedom becomes ridiculous

2.5.2. Totalitarian Planning (authoritarian planning)

This is a comprehensive planning. There is central control and direction of all economic activity in accordance with a single plan. In such a planning, all economic activities like consumption, production, exchange, and distribution are all controlled by the state. The planning authority is the supreme body. It decides about the targets, schemes, allocation, methods and procedures of implementation of the plan. There is absolutely no opposition to the plan, People have to accept and rigidly implement the plan. Under which, Economic and political powers are polarized and social life is regimented. There is thus no democratic freedom in authoritarian planning which is extremely rigid.

Drawbacks

It sacrifices peoples" freedom of choice. In other words, the loss of economic, social and political freedoms is enormous.

2.6. Anti-cyclical Vs Development Planning

2.6.1 Anti-cyclical (corrective) planning

A number of maladjustments arise in a capitalist economy. When the government plans and adopts various fiscal, monetary and direct control measures to rectify them, this is called corrective planning.

If the economy suffers from Inflationary pressures, the government adopts such corrective measures as: - a contractionary monetary policy like raising tax rates, reducing consumption, investment and public expenditure, surplus budgetary policy.

In the event of a depression, corrective planning includes: An **expansionary monetary policy** like Reducing tax rates, Stimulation of consumption, Increase in private and public investment, Deficit budgetary policy.

Corrective planning can be used to reduce inequalities of income distribution and concentration of monopoly power. To reduce inequalities of income distribution, corrective planning requires the adoption of such measures as: - imposition of heavier burdens on the higher income groups through death duties, steeply progressive income taxes, increased expenditure on public works and social security etc. To control monopoly concentration, the government may encourage competitive small business, start public enterprises, pass anti- monopoly laws etc.

2.6.2. Development planning

This is meant to develop the economy as a whole. It involves "the application of a rational system of choices among feasible courses of investment and other development actions. For this, it relies to a large extent on the market mechanism.

Under development planning, the government formulates a development plan for the whole economy. It includes consideration of the most important economic aggregates such as totalsaving, investment, output, Government expenditure, foreign transactions and the likes.

Development planning also explores sectoral relationships in the overall framework of the economy. In particular, it lays down investment priorities for the public sector.

2.7. Physical planning Vs financial planning,

2.7.1. Financial Plan

This is a very important type of plan because it deals with the key issue of financial resources required to carry the national development plan to its successful culmination. A careful formulation of the financial plan makes it easy to achieve physical targets in the overall plan. The financial plan must estimate the savings which are likely to be forthcoming from private households, business enterprises the government sectors, and from external sources, and it must compare this with the capital requirements of individuals, businesses and government.

The financial plan must also indicate the requirements for tax, expenditure, public debt management, and is directly related to the national budget, the plan for balance of payments, the cost-benefit plans of projects and the means of financing each project or program. The national budget is one typical form of the financial plan which is used to present the revenues and expenditures involved within a given fiscal year. The budgeting process is instrumental in determining the sources and amounts of revenue to be generated and the expenditure allocations and priorities to be made in the face of competing claims for the available funds.

Financial planning is essential in order to remove disproportions between supplies and demand and for calculating costs and benefits of the various projects. In this plan, “the outlay is fixed in terms of money and the estimates are made on the basis of various hypotheses regarding the growth of the national income, consumption, imports etc., to cover the outlay by taxation, savings and the increase in the cash holding. “Financial planning should also be important to:

Establish equilibrium between Private investment and public investment as well as Foreign payments and Foreign receipts

Balance demands and supplies,

Avoid inflation and bring about economic stability

Limitations

In an underdeveloped country there is a vast subsistence non-monetized sector and a small organized money sector. This will lead to shortages in supplies and to an inflationary rise in prices.

Supplies can be increased through imports which will lead to balance of payments difficulties from which under developed countries already suffer.

Financial planning can create inflationary pressure in the economy.

Financial planning could aggravate the disparity of income distribution i.e. worsen income inequality

Measures to mobilize financial resources through taxation may adversely affect the propensity to save.

2.7.2. Physical planning

This is planning in terms of factor allocations and product yields so as to maximize incomes and employment. The physical balance consists in a proper evaluation of the relation between investment and output. Investment decisions to be made in each sector are articulated in physical planning. Besides, the amount and kinds of various goods needed in order to obtain an increase of output of a product are specified.

In physical planning, an overall assessment is made of the available real resources such as raw materials, man power etc. It requires the fixation of physical targets with regard to: Agricultural and industrial production, Socio-cultural and transportation service, Consumption levels and employment, Income and investment levels of the economy. Physical planning has to be viewed as an overall long-term planning rather than a short term piecemeal planning.

Limitations

Lack of statistical data and information with regard to the available physical resources. If physical targets are fixed beyond the availability of resources on the basis of inaccurate data, planning will end in a fiasco.

Problem of balancing the different segments of the economy. It is not possible to attain internal consistency of a high order in an underdeveloped country due to its inherent structural difficulties

Shortages in physical targets are likely to lead to inflationary pressures through an increase in prices.

Physical planning cannot succeed without financial backing

2.8. Centralized and Decentralized planning

2.8.1. Decentralized planning

This is associated with capitalist economies and even in mixed economies, with a significant proportion of public sector enterprises. The predominant characteristic of decentralized planning is the dominance of the market in decision making.

Under this planning, the central authority only fixes the overall targets of production and investment, but considerable freedom is given to various bodies like State Government. On the different levels like state level and district level they fix their own production targets within national framework. There is freedom to fix the prices and wages. In Decentralized planning, the planning authority may endeavor to influence economic activities indirectly through incentives. Decentralize planning is conceived as a more efficient and more productive in attaining desired result

Limitations

Incompatibility /between what the plan requires and what the market does.

Adjustment difficulty: it is not possible to know in advance the reactions of the market. Imbalance between demand and supply

2.8.2 Centralized planning

Under centralized planning, the main decisions are made by the central planning office. Main decisions could vary with time and circumstances. However, the predominant ones include: Prices, Volume & investment, Amount of wages etc.

Limitations of Centralized planning

Difficulties of calculation

Inadequate control and information

Rigidity and bureaucracy

Check your progress 3!

Considering the national development planning experience of Ethiopia, which of the two main types of planning, i.e., indicative planning plan (or plan by inducement and plan by direction), were exercised during the following periods:

- § pre -1974 era,
- § within the period between 1974 – 1991, and
- § Post-1991.

Check your progress 4!

Why does maintaining balance in the plan become important?

Review Exercise 2.1

Read each expression carefully and choose the most appropriate answer. Check your answers by making a reference to the ‘**Key to Review Exercises**’ part at the end of this module.

1. One of the following is unlikely to be contained in a development plan:
 - a) A list of proposed public expenditures.
 - b) A macroeconomic projection of the economy.
 - c) A set of statements about government policies and strategies.
 - d) All except “c” are unlikely
 - e) None of “a”, “b”, and “c” above is unlikely.
2. Government can use its budget as a principal instrument of planning so as to:
 - a) Fix the quantity of money in circulation
 - b) Fix the interest rate
 - c) Fix the rate of foreign exchange
 - d) Fix the amount of credits
3. One of the following is not true regarding the evolution of economic development planning in LDCs.
 - a) Economic development planning is a post-world war II phenomenon.
 - b) There were many cases where it was initiated and recommended by the then colonial rulers.
 - c) It was regarded as a symbol of sovereignty and modernity.
 - d) The rise and spread of development planning over all developing countries around the world occurred at about the same time.
 - e) All are correct
4. Which one of the following is a correct expression?
 - a) A laissez-faire economic system guarantees a fair distribution of incomes and the production of more urgent goods.
 - b) A free market creates mechanisms whereby the wage relations are humanized.
 - c) In command economic planning, such objectives as growth and fair distribution are likely to be achieved at the cost of efficiency in both production and consumption in the economy.

- d) “b” & “c” are correct expressions.
 - e) None of the above is correct.
5. As an economic planner, which one of the following do you think is correct when shortages occur?
- a) Price control leaves demand in excess of supply.
 - b) Rationing and taxing can serve best with price control so as to curtail demand.
 - c) Price control curtails supply unless accompanied by subsidy.
 - d) With rent control, the supply of well-maintained houses remains meager.
 - e) All are correct

CHAPTER 3

QUANTITATIVE DEVELOPMENT PLANNING TECHNIQUES:

3.1. Introduction

As it is already discussed, development planning is a form of policy analysis which involves the use of planning models. A planning model helps to specify, in quantitative terms, the relationships between objectives, constraints and policy instrument variables. The model is then used to calculate a feasible or consistent solution, defined as a set of values for the policy instruments that satisfies the specified objectives and does not exceed the predetermined constraints. Models can also be designed to match the constraints and policy objectives of individual countries, rather than using a standard framework. Also, the shift towards simulating market outcomes means that policy analysis has shifted away from the setting of targets to the comparison of instruments and programs. Evidences from the Newly Industrializing South East Asian countries have demonstrated that governments of these countries have played significant roles through planning and directing the economy in order to realize the achievements. The quantitative planning models therefore provide a framework within which the various agencies involved in the planning process can carry out a fruitful dialogue regarding the possibilities and trade – offs facing thenation. In short, planning models are useful precisely because they forced the planners, policy makers and others involved in the planning process to set out the structure of the economy and to focus on the relationships that determine the outcome of policy changes.

A further value of analytical planning methods is that they require a comprehensive data base, which forces the economists and statisticians to assemble existing data in to a consistent and accessible form, and to identify gaps where additional information is needed. Nevertheless, it should not be regarded that exercises with analytical planning models give the final, decisive solution to an economic development problem. What they offer is a significant contribution of views that help decision making far better. Besides, there is no single model that can be regarded as the best. Both in theory and in practice, different types of models are suitable for examining different policy problems. Some of the model characteristics are discussed below.

Learning Objectives:

After studying the contents in this chapter students should be able to:

Explain how models are useful in analyzing development options,

Identify and explain the different characteristics of development planning models, Identify and explain the aggregate consistency models,

Identify and explain the disaggregated consistency models,

Explain the purpose of using linear programming models,

3.2 Choice of planning techniques – pro and cones of labor and capital Intensive techniques**3.2.1 Capital intensive technique of production**

'**Capital**' refers to the equipment, machinery, vehicles and so on that a business uses to make its product or service. More formally, can be defined as a good first produced and used to produce other goods and services.

Capital-intensive processes are those that require a relatively high level of capital investment compared to the labor cost. Capital Intensive' industries require a greater amount of machinery to produce the product. Telecommunications, airlines, automobile manufacturing, oil production to name a few Enterprises

These processes are more likely to be highly automated and to be used to produce on a large scale.

Capital-intensive production is more likely to be associated with flow production (see below) but any kind of production might require expensive equipment.

Capital is a long-term investment for most businesses, and the costs of financing, maintaining and depreciating this equipment represent a substantial overhead.

In order to maximize efficiency, firms want their capital investment to be fully utilised (see notes on capacity utilization).

In a capital-intensive process, it can be costly and time-consuming to increase or decrease the scale of production. Moreover, capital intensive techniques

- Reduces human error – more accurate production.
- Greater speed (efficiency) and uniform effort / output: meaning, product is consistent throughout the production process. This implies both quality and quantity are similar because of automation.
- Technical economies of scale: increased efficiency => Average cost is low.
- No problems with labor shortages / planning labor

Limitations of capital intensive technique

- Initial high costs of investment and possible training costs.
- Lack of flexibility in responding to a fall in demand. In contrast, labour can be used flexibly, e.g. using temporary workers.
- Machinery lacks initiative, e.g: it is unlikely to be innovative, provide ideas on how to improve production or take on extra responsibilities

3.2.2 Labor-intensive technique of production

Labor refers to the people required to carry out a process in a business. Labor-intensive processes are those that require a relatively high level of labor compared to capital investment. These processes are more likely to be used to produce individual or personalized products, or to produce on a small scale. The costs of labor are: wages and other benefits, recruitment, training and so on. Some flexibility in capacity may be available by use of overtime and temporary staff, or by laying-off workers. Long-term growth depends on being able to recruit sufficient suitable staff

Labor intensive processes are more likely to be seen in Job production and in smaller-scale. Labor Intensive' product requires a larger amount of human labor to bring it off. Labor Intensive goods and services would include food service, hospitality, public education, agriculture (to some extent...but not as it used to be 50 years ago).

Advantages of labor intensive production

1. Staff, unlike machinery can be used flexibly to meet changing levels of consumer demand, e.g. temporary workers.
2. Can provide a 'personal touch' and be more in-tune with customer needs and wants.

3. Can provide tailor made products or services for different customer needs and wants. Machinery is not flexible enough to provide custom made products or services for individual customers.
4. Labor can provide feedback that delivers ideas for continuous improvement. Workers can adapt to introduce new ideas.

Disadvantages of labor intensive techniques

Relatively expensive in the long-term when compared to machinery – higher per unit costs due to lower levels of productivity.

Relatively inefficient and inconsistent levels of effort. Labor relation problems, e.g. may go on strike.

There could be a shortage of skilled labor, unlike machinery.

3.2.3 Appropriate technique for developing countries

People debate about the appropriateness of production techniques in developing countries.

However, there is no precise consensus and the perception varies.

Arguments for labor intensive techniques:

The first argument in favor of labor- intensive or capital-saving technology is its high employment potential. Poor LDCs suffer from huge unemployment problem.

These countries also experience a huge army of surplus labor. By using labor-intensive industry like small-scale and handicrafts industry, employment possibilities of the unemployed labour force can be met in a greater way.

Secondly, this technique makes an equitable income distribution since this technique helps in raising the income level of a relatively large member of workers and hence poverty level gets reduced. This technique either increases employment or minimises the problem of unemployment by absorbing workers.

This then increases output, consumption, etc. All these have the potentiality of spreading higher equality among masses. Thus, the roadmap for an egalitarian society is built up. Social justice—an important objective of growth and development—is ensured.

Thirdly, labor-intensive techniques are not import-dependent technologies as such. Being simple, these technologies are produced domestically. As a result, scarce foreign exchange reserves are not drained out. On the other hand, developing countries need to import capital-intensive technologies as these technologies are not manufactured in these economies. Thus, capital-intensive techniques of production fail to save scarce foreign exchange.

Fourthly, for the reduction of regional inequalities, this technique is considered to be an ideal one, since labor-intensive industries can be set up anywhere in the country. Establishment of these industries do not require large investment. Nor do these industries require social and economic infrastructures. That is why small-scale and cottage industries are set up even in rural areas. In other words, decentralization or dispersal of industries is made possible through this technique.

Fifthly, another powerful argument in favor of labour-intensive techniques of production is that it can use local latent resources in a multifarious and varied manner. Often in rural areas and even in urban areas, one may find the presence of some skilled workers as well as small entrepreneurs who are deemed to be competent for running and managing small industries. Large-scale modern industries, however, do not entertain these local resources which are considered as 'unfit' for these industries. Thus, by building up small-scale and cottage industries, a country can utilize its latent resources in a more effective way.

Finally, underdeveloped countries suffer from shortage of capital. To fill this gap, foreign assistance is often recommended though these countries fail to attract such aid because of many reasons. Under the circumstance, a labour-saving capital-using technology can absorb very few people. This means that it would 'create small islands of high productivity whilst leaving large parts of the economy untouched'. On the contrary, labour-using technology is capable of utilizing scarce capital in an optimal manner in more important areas of production, particularly consumption goods.

Arguments against Labour Intensive Techniques:

Labour intensive technique is static and of short term in nature which cannot be applied in the long run period.

As this technique leads the redistribute incomes in favor of those who have low marginal propensity to save, this results low rate of capital formation.

There is no possibility of improved and more advanced skill during the course of labor intensive techniques.

The production process is very costly. No possibility of research, modernization

Arguments for Capital-intensive Techniques:

Some economists like W. Galenson and Harvey Leiben-stein have challenged labor-intensive techniques of production as ideal technologies for LDCs and have made a strong plea for capital intensive industries on the following grounds: First, the capital-intensive techniques of production will make possible a rapid rate of investment as this technology maximizes productivity per worker minus consumption per worker.

On the contrary, labor-intensive technology attracts more employment but at low wages. Thus there is little leftover income for savings and investment. But the capital-intensive technology has the highest reinvestment quotient' a faster economic development appears because of high income, savings, and investment.

Secondly, since economic growth rate tends to be higher and faster under capital-intensive technology, it generates more employment opportunities over a long period of time compared to the labor-intensive techniques. Although small scale and cottage industries have the greater potential of employment of labor in the current period, capital- intensive industries open up employment opportunities in the long run on a wide scale. In other words, employment multiplier of this kind of industry is not weak as was assumed by Galenson, Liebenstein, etc.

Thirdly, economic development of any country or the sectoral activity largely depends on the availability of economic infrastructures. Capital- intensive techniques assist in the development

of such infrastructures. Further, by building up infrastructural facilities, capital-intensive industries may be diversified.

Fourthly, it is strongly argued that capital-intensive plants enhance the skills and the efficiency of the workers as well as managers. In this way, it helps in removing the shortage of experience, competent and skilled personnel that an LDC experiences in its growth process. In other words, learning by doing argument is very strong in the case of capital-intensive technology.

Finally, mass production at a low cost is possible under labour-saving technology. Inexpensive products mean low prices. One of the main reasons towards increasing the size of a plant has been the economies of large-scale production.

What is now clear from the above discussion is that both the techniques have advantages. Some people argue: Small is beautiful, while others argue: Large is beautiful. Hence the controversy: Which technique is to be chosen?

Indeed, it is because of the conflict between employment and output, and between employment and savings in the choice of techniques, there is no ‘unambiguous’ answer.

Check your progress 1

It has been argued among economists and others about the techniques of production. Many people suggest that these techniques should be employed based on the availability of resources (capital and labor) in the country. If so which technique is better for developing nations like Ethiopia? Do you have any different conception?

3.3 An Overview of characteristics of development planning Models

The characteristics of development planning models can be analyzed in terms of the scope, aggregation, time, behavior, closure, and accounting framework in the context of which the models are applied.

Coverage

In terms of coverage or scope, planning models can be classified into:

- i) overall or national models,
- ii) sectoral or regional models,
- iii) special models and

iv) Project analysis.

The **overall models** deal with the entire economy and the nation's development strategy is analyzed within them. The **sectoral and regional models** deal with individual producing sectors and regions and can be used to examine the consistency and feasibility of the overall objectives. The **special models** are designed for selected aspects of the overall plan, e.g. foreign trade or manpower development. Plans are ultimately implemented through projects, and it is at this stage that **project analysis** is used to examine the choice of techniques, location and size of plants within the overall objectives of the national plan. The technique that is most widely used for this purpose is social cost – benefit analysis.

Aggregation

Planning models can also be classified in terms of the degree of aggregation:

- i) aggregate models,
- ii) main – sector models and
- iii) Multi-sector models.

The **aggregate models** treat the entire economy (or a region, depending on its scope or coverage) as one producing sector and are concerned with the forecasts of such major national accounts aggregates as savings, investment and gross national product (GNP). The most representative example of this type is the Harrod – Domar model.

The main – sector models divide the economy (or a region, as the case may be) into a few producing sectors and examine the interrelationships between them. For example, the consumption – capital goods version of the main sector models, known as the Mahalanobis model, was used extensively in the early planning exercises in India.

The multi-sector models divide the economy or region into a large number of producing sectors. The core of such models is the Leontief input – output analysis. One of the advantages of the multi – sectoral models is that they provide systematic linkages between the overall and the sectoral plans. In addition, they provide a framework for consistency checks among the various sectoral plans.

Time

There are two aspects of the time dimensions in planning models. The first is how far into the future a model is designed to project and the second is the way time is treated within a model. With respect to the first criterion, we can distinguish three broad types of planning models:

- i) Short-term, covering typically a year (or **sometimes 1-3 years**) ;
- ii) Medium-term, covering a 3 – 7 year horizon (typically 5 years); and
- iii. Long-term, extending to 10 years or more. In the treatment of time, models can be either
 - i) Static or
 - ii) Dynamic.

The static models compare one future date with the present: they indicate the future values of the model variables but do not describe the path of the economy between the starting and end periods. In contrast, the dynamic models incorporate endogenous variables from a number of time periods and provide information on the nature of movement of the economy from the present to some target year.

Behavior

Planning models can be classified as either stochastic or deterministic systems, depending on the way in which behavioral relationships are treated. In the stochastic models, behavioral relationships, e.g. savings and investment, are estimated by using econometric models which allow for stochastic or random disturbances. Short-term macroeconomic models are in general stochastic. Hence results obtained from such models must be treated as probabilistic. In contrast, deterministic models, such as the open input-output system, do not specify any behavioral relations and instead treat them as exogenously or administratively determined.

Closure

Sometimes the number of equations is less than the number of variables in a model, i.e. some of the variables are not explained within the model. Thus, a modeler must choose the variables to be explained (endogenous variables) to close the model. The closure rules, i.e. which variables should become endogenous and which variables should be treated as

exogenous, depend on the problems at hand. Accordingly, planning models can be classified in to:

- i) open systems,
- ii) closed or fully determined systems and
- iii) Partially determined systems.

An example of the open system is the input – output model which treats the final demands as exogenous or given (i.e. not explained within the model). However, the final demands can be endogenized by using some form of Engel curve or demand function, linking expenditure with income. In this case, all the variables or unknowns can be calculated within the system once certain policy variables are specified, and the model then becomes “closed”, or fully determined. These models are commonly known as simulation or forecasting models. The simulation models provide alternative scenarios for different possible sets of policy or exogenous variables and thereby help evaluate outcomes of alternative policy measures.

However, in some cases the solution of the system is not determinate. That is, more than one value of the unknowns is possible for a given set of exogenous or policy variables. In that case, some sort of optimization technique must be used to choose the set of values which minimizes the objectives of the overall plan, given the constraints. Linear programming is the technique most often selected; hence this set of techniques is referred to as programming models.

Accounting framework

Every economic model must satisfy some definitional equality, known as an identity. This follows from the fact that all models have either an implicit or an explicit accounting framework. This is because every income must be matched by corresponding outlays as every receipt is also expenditure. The accounting framework provides the data base for the implementation of the respective model. Hence planning models can also be classified according to their data base or accounting framework. For example, the national income accounts yield the macroeconomic identities, such as GNP which is the sum of final expenditures, required to close the aggregate models. Accordingly, the aggregate models can be classified as national- accounts based models. Similarly, the main sector and multi-sector models are input output accounting- based models.

Models that make use of identities derived from the accounting frameworks are generally referred to as **consistent models**. This is because the accounting identities imply consistency between sectoral supplies and total supply and between total supply and total demand. The consistency models do not in general contain any ex ante welfare or optimization functions and guide resource allocation according to some prespecified goals without examining whether these are optimal outcomes. As opposed to consistency models, there are programming models which allow for inequality relationships and deal with optimum and efficient allocation of scarce resources.

The above schema of classification is not mutually exclusive. Neither is it possible to identify a single set of model characteristics which may be regarded as the best. This is because what is best for examining one type of problem may not be the most suitable for another kind of policy dilemma. Therefore, the **choice of a model must be guided by the problems at hand**. The planner usually deals with a variety of interrelated problems and hence must use more than one planning model. In fact, as the classification schema shows, the various planning models have overlapping components. This implies that the results obtained from one type of model can be fed into another. This in turn forces the estimates from different model exercise to be consistent.

Check your progress 2!

Mention the different characteristics based on which models are classified.

Check your progress 3!

Which accounting framework renders aggregate consistency models their internal consistency?

Check your progress 4!

1. Mention one common characteristic of consistency models in general.

3.4 Growth Models - Review of Models in Development Economics

The process of economic growth is central to the economics of development, and growth models represent the earliest approach to development planning. In this section, two simple and well – known aggregate consistency models, namely the Harrod-Domar (H-D) model and the two – gap model are discussed.

3.4.1 The Harrod – Domar Growth Model

In drawing up a development plan, the usual first step is to assess the aggregate rate of growth of the economy that can be attained within the prevailing socio-economic conditions. The possible overall rate of growth can most easily be determined by analyzing the past and present relationships between such aggregate variables as gross domestic product (GDP), consumption, savings, investment and the rate of population growth. The model was developed independently by Sir Roy F. Harrod in 1939 and Evsey Domar in 1946. The Harrod – Domar (HD) model was the precursor to the exogenous growth model.

The H-D growth model provides the simplest possible framework within which the relationships among the aggregate macro variables can be examined. Despite its simplicity, a host of planning problems and a wide range of possibilities can be analyzed within the H- D framework. In fact, the H-D model or some variant of it is the most widely used quantitative planning technique, and even though many plan documents do not explicitly present the H-D model, elements of it can be found in the way investment requirements and the role of savings are analyzed in the formation of the economic growth.

H -D model is used in development Economics to explain an economy's growth rate in terms of the level of saving and productivity of capital. It suggests that there is no natural reason for an economy to have balanced growth. In its simplest terms, economic growth is the result of abstention from current consumption. HD is the first and basic model of capital accumulation and growth.

Basic Assumptions

1. Assume unemployed labor, so there is no constraint on the supply of labor
2. Production is proportional to the stock of machinery: IF more workers (L) are added without investing in more capital (k), output will not rise.

Capital (K) and labor (L) are used in a fixed amount to produce a certain amount of output.

3. There is no substitutability between labor and capital

4. Constant Returns to scale: In order to double output Y , you need to double both capital and labor. Because of constant returns to scale (CRS) K/Y and L/Y ratios are constant

Algebraic representation

Let t denote time periods, $t = 1, 2, 3, 4, \dots, n$

$Y(t)$ denotes the total income at date t .

$C(t)$ denotes the consumption at date t and

$S(t)$ denotes total savings (net of borrowing for current consumption). then,

$$Y(t) - C(t) = S(t) \dots\dots\dots 1$$

The other side of the coin is the value of produced output, also equal to Y must be matched by goods produced for consumption plus those needed by investors; that is,

$$Y(t) = C(t) + I(t) \dots\dots\dots 2 \text{ Where } I \text{ denotes investment.}$$

If we put these two equations (1 and 2) together, we get the famous macroeconomic balance equation that savings equals investment.

$$S(t) = I(t) \dots\dots\dots 3$$

We can use equation (3) to complete our basic argument. Investment augments the national capital stock K and replaces that part of it that is wearing out. Suppose that a fraction of the capital stock depreciates. Then of course, the capital accumulation equation overtime can be written as

$$K_{t+1} = (1 - \delta) K_t + I_t \dots\dots\dots 4$$

Equation (4) tells us how the capital stock changes over time. Now let us introduce two concepts. The savings rate which is just $s = S(t)/Y(t)$ assume that it is constant.

The capital – output ratio $K(t)/Y(t)$ which we also assume is constant and represented by

Combine equations (3) and (4) to obtain

$$K_{t+1} = (1 - \delta) K_t + S_t \dots\dots\dots 5$$

And since $S_t = sY_t$ as well as the fact that the capital – output ratio is constant, i.e. $K_t/Y_t = k$ we get,

$$\frac{Y_t}{Y_{t-1}} = 1 + s \frac{Y_t}{Y_{t-1}} - \delta \quad (6)$$

Dividing the whole expression by Y_{t-1} yields

(+) $\frac{Y_t}{Y_{t-1}} = 1 + s \frac{Y_t}{Y_{t-1}} - \delta$ rearranging the equation yields HD model.

$$\frac{Y_t}{Y_{t-1}} - s \frac{Y_t}{Y_{t-1}} = 1 - \delta \quad (7)$$

The left hand side is simply the rate of growth of income, output, or GDP which we denote as g , given the historically determined and constant values of s and δ , the maximum rate of growth of capital stock is determined by the ratio s/δ . This in turn determines the maximum attainable rate of growth of GDP under the existing economic environment. In many developing countries, the savings rate, s , is quite low and δ is high, implying inefficiency of investment. Hence the growth of the economy is low and may be insufficient to absorb a rapidly growing labor force.

It becomes necessary, therefore, to accelerate the growth of the economy beyond the limit set by the historical values of s and δ . the planning problem begins here. It involves two issues: fixing the target and determining how to achieve it. Obviously the target growth rate must be sufficient to absorb the growing labor force.

The next question, therefore, is how to raise the savings rate. There are three main sources of domestic savings:

- i) Personal savings,
- ii) Business savings and
- iii) Government savings.

Most of the planning exercises emphasize the need to raise the government savings through taxation and thereby restrict consumption to fill the financial gap between actual savings and required investment. This presumes that savings cannot be raised significantly from the other two sources as they are largely voluntary in nature. But taxation is a financial matter which falls outside the domain of the planning agency. In most developing countries the planning and the budgetary management functions are directed by separate agencies. A common analytical framework is therefore needed to harmonize the concerns of the two agencies for the successful implementation of the plan, and to avoid any potential conflict of objectives.

The need for harmonization between the planning and the budgetary agencies becomes clearer if the planning problem is viewed from an alternative perspective. Since capital is seen to be the limiting factor to growth, the cost of capital (real interest rate) in the developing countries is often kept deliberately below the market rate. This deliberate credit rationing policy, instead of encouraging private investment, leads to the misallocation of investible funds and results in a higher capital – output ratio, v . at the same time, a low (and in an inflationary situation, a negative) real interest rate discourages private savings, resulting in a low savings rate, s , and thus giving a clue to the historically low s/v ratio. This policy induced distortion is compounded in an underdeveloped economy characterized by the existence of a large non – monetized sector. In such an economy the absence of well-developed financial institutions means that a significant portion of the real investible surplus over consumption is not transformed into financial capital. Thus, two policy implications follow.

- a) It needs to “liberalize” the financial market, i.e. allow the interest rate to rise to its market equilibrium level. To the extent that the low value of s/v is due to policy-induced distortions, this will improve the economy’s growth potential by encouraging private savings and improving the efficiency of capital.
- b) It also needs to develop financial institutions which will mediate between savers and investors. Given adequate financial incentives, the accessibility to banks and other financial institutions is likely to tap the surplus over consumption which would otherwise have found its way into either hoarding or precious metals. Therefore, the program for financial reforms should be an integral part of development planning.

If the mobilization of domestic savings through taxation and financial reforms is not enough to finance the required investment, the savings – investment gap can be closed by foreign savings. This can be seen quite clearly from the following familiar national accounts identity for an open economy:

$$Y = C + I + G + XM \dots\dots\dots (8)$$

$$Y = C + S + T \dots\dots\dots (9)$$

Where Y is gross national product (GNP), C is consumption expenditure, I is gross investment expenditure, G is government expenditure, X is the quantity of exports, M is the

quantity of imports, S is the amount of savings, and T is the tax revenue. From (58) and (9) it follows that

$$[S+(T-G)]=M-X\ldots\ldots\ldots(10)$$

That is,

Investment – (Private savings + government savings) = Current account deficit / surplus

From the above identity the financing options become clear. In a closed economy, if investment is to rise and private savings cannot be raised substantially then the only option left is to increase government savings through taxation. But in an open economy there is an additional option. The gap between the “required” investment and “actual” domestic savings can be financed by a deficit in the current account (the gap between imports and exports).

Check your progress 5!

According to the Harrod-Domar model, what is the ultimate determinant of the growth in the economy and the rate of capital accumulation?

Review exercise 3.1.

1. Suppose that you live in a country where the savings rate is 20% and the capital output ratio is 4. Assume a depreciation rate of 2% and population growth is 1%. What is the approximate growth rate of per – capita income?
2. Suppose the population of Ethiopia is expected to grow at 3% and the planners would like to achieve a steady 4% rise in per capita income. Furthermore, it is given that the aggregate capital-output ratio for the economy is 3. What should be the required saving rate to achieve the given per capita growth target. Use the Harrod-Domar model.
3. From 1980 to 1990, real GDP in India grew by 5.8 percent per annum, while investment averaged 23.1 percent of GDP. What was the ICOR for India between 1980 and 1990?
4. In Indonesia during the 1970s the incremental capital –output ratio (ICOR) average 2.50. what saving rate would have been required for Indonesia to achieve an aggregate growth rate of 8 percent per annum

3.4.2 The Two – Gap Model

The previous section showed how foreign savings could meet a shortfall of domestic savings and enable the “required” level of investment to be undertaken. Consideration of the role of foreign savings in the growth process is the main focus of the two – gap model (a model put forth by H. Chenery and others).

In most developing countries, not only does the level of domestic savings fall short of the required investment, but also export earnings are less than import expenditures. Foreign exchange is, therefore, required for the dual function of meeting both the “trade gap” and the “savings gap”. The contribution of this model is in identifying which of these gaps is the effective constraint on growth.

To further discuss the two gap model, let’s start with the following assumptions.

1. There exists a fixed maximum propensity to save out of income, such that

$$\text{Max } S = sY \quad 0 < s < 1 \quad (11)$$

Where, s is the average and marginal propensity to save.

2. Certain capital goods can only be obtained from foreign sources.
3. There is a lack of substitutability between domestic and foreign resources. In particular, it is impossible to transform domestic savings into foreign savings via increased export flows. Given (2), this means that there is always a minimum amount of foreign exchange required to sustain growth.

Thus, the fixed proportion production function of the H – D model can be rewritten as

$$Y = \min\left(\frac{K_d}{k_1}, \frac{K_f}{k_2}\right) \dots \dots \dots (12)$$

Where $k_1 = K_d / Y$ is the amount of domestic capital required to produce one unit of output and $k_2 = K_f / Y$ is the amount of foreign capital required to produce one unit of output.

Given the lack of substitutability between domestic and foreign resources, the production function (12) implies that the growth will be constrained by either K_d (domestic capital) or K_f (foreign capital), whichever is the minimum. Unless the constraint is removed, a portion of the other factor (resource) will be unused.

To see the implications of the existence of a domestic savings or foreign exchange constraint, we can assume for simplicity that the country in question imports capital goods only, so that

$$M = I_f \dots\dots\dots (13)$$

$$= \frac{\Delta}{\Delta} \dots\dots\dots 14$$

Let us further assume that imports are a fixed proportion of GNP, such that

$$M = mY \dots\dots\dots (15)$$

From the supply side, export possibilities depend on the economy's output capacity, so that $\text{Max } X = xY, 0 < x < 1 \dots\dots\dots (16)$

Let us suppose that the growth rate permitted by foreign exchange is less than that permitted by domestic savings. Thus, from the production function (12), we have

$$Y = \dots\dots\dots (17)$$

Differentiating both sides of the above equation with respect to time t , we obtain $\frac{\Delta Y}{Y} = \frac{1}{2} \frac{\Delta}{\Delta}$, or $\dots\dots\dots (18)$

Substitution of equation (14), (16) and (17) yields,

$$\dots\dots\dots (19)$$

That is, the growth of output is equal to the ratio between the import – output ratio m and the incremental foreign – investment – goods – output ratio k_2 .

Similarly, if domestic savings is the limit to growth, we shall have $\dots\dots\dots (20)$

This is exactly the same condition as the fundamental equation of the basic H – D model.

If the planners set a target growth rate of, say, g^* , the required savings ratio s^* and import ratio m^* can be calculated from equations (19) and (20) as:

And

$$s^* = g^* k_1 \dots\dots\dots (21)$$

$$M^* = g^* k_2 \dots\dots\dots (22)$$

If the maximum domestic savings is found to be less than the level required to achieve the target growth, then there is said to exist an investment – savings gap equal to

$I_d^* - \max S = S_d^* - \max S$,(since in equilibrium I_d^* must equal S_d^*)

$$I_d^* - \max S = s^*Y - sY \\ = k_1 g^* Y - sY \dots \dots \dots (23)$$

Similarly, if the maximum export potential (earnings) is found to be less than the minimum import requirements for the target growth then there is said to exist an import – export gap equal to

$$M^* - \max X = k_2 g^* Y - xY \dots \dots \dots (24)$$

Even though, according to the national accounts identity, the ex -post investment – savings gap must be equal to the ex post import – export gap, there is no reason for these two gaps to be equal ex ante (in a planned sense). Therefore, the investment – savings and import – export gaps (ex- ante) can be written as:

$$k_1 g^* Y - sY \leq F \dots \dots \dots (25)$$

And

$$k_2 g^* Y - xY \leq F \dots \dots \dots (26)$$

Where, F is the foreign capital (exchange) inflow.

Thus, it is intuitively clear that if the target growth is to be achieved, foreign capital inflow must fill the larger of the two gaps so that the bottleneck can be avoided. Developing countries are often found to suffer from the “foreign exchange constraint” (i.e. the import – export gap is larger than the investment – savings gap). In this situation, the willingness to save is frustrated by the inability to acquire imports which are required to produce investment goods. That is, a portion of the maximum potential domestic savings remains unutilized in the presence of a constraint imposed by the availability of foreign exchange. This situation can be depicted graphically by plotting inequalities (24) and (25) in a $g^* - F$ plane, as in Figure 3.1 below. To the left of F^* , the foreign exchange constraint is operative, a situation believed to be faced by a typical developing country. In such a situation, unless the constraint is removed, the growth will be lower

☞ **Check your progress 6!**

What is the main issue addressed by the Two Gap model?

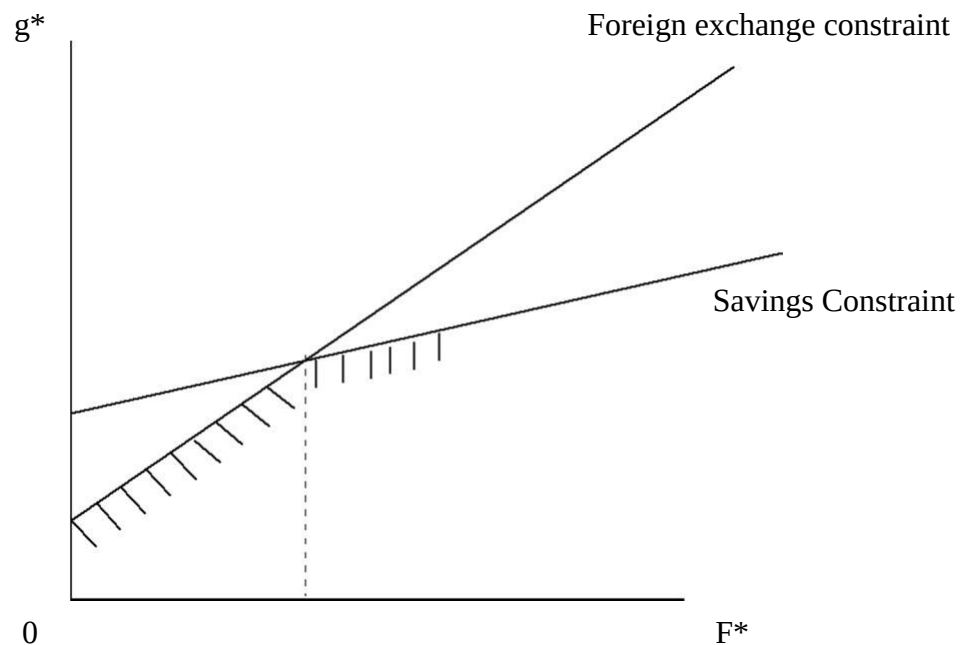


Figure 3.1 Two-gap model restrictions (Source: Chowdhury & Kirkpatrick, 1984)

then what the maximum potential domestic savings would have allowed. Herein lies, according to the two-gap model, the importance of foreign aid in the development process.

Disaggregated Consistency Models

The planning exercise does not stop at the most aggregate level with the setting of a GNP growth target and the calculation of required investment, savings and foreign capital inflows. As mentioned earlier, the whole process proceeds in stages and the second stage of the planning exercise usually involves a further breakdown of the plan to cover a number of strategic sectors of the economy. The economy is the sum of the individual sectors, so the target growth of GNP will imply specific rates of growth for the component sectors. The second stage therefore involves the translation of the overall growth target and investment requirements into sectoral growth targets and investment requirements. This is the concern of disaggregated consistency models. In this chapter we consider two such models: the main – sector model and the multi – sector model.

3.4.3 Main-Sector Models

Besides increasing the overall growth rate, development planning also aims at transforming the sectoral balance of the economy. Typically, this implies the transfer of resources from agriculture to industry as the economy grows. But at the same time, the agricultural productivity must improve so that industrial production is not hampered by shortages of raw materials, food and manpower. This means that at the second stage the planners must ensure that the target sectoral growth rates satisfy the conditions for a “balanced” growth. The main – sector models enable the planners to break down the aggregate growth target and investment requirements into sectoral targets and requirements as well as to specify conditions for a “balanced” growth.

Characteristics of the main – sector models

Even though the focus of the main – sector models is sectoral growth and investment, the scope still remains the overall economy. From this perspective the main – sector models must fulfill certain requirements.

These are: completeness, consistency, and economical and realistic requirements.

- a) **Completeness:** - the main sector models are economy wide models and hence when sectoring the economy, no activity can be left unaccounted for. That is, all the activities must be allocated to a sector. For this reason, it is sometimes convenient to have a residual sector, “the rest of the economy”, which includes activities which cannot be allocated to the other main sectors.
- b) **Consistency:** - this requirement follows from (a) above. Since the coverage is the whole economy, the sectoral value added must add up to the GDP. In addition, the accounting relationships require that the total demand (final and intermediate) for a sector’s output must not exceed its total output or supply.
- c) **Economical and Realistic Requirements:** - There are operational requirements. While the whole economy must be covered, the number of sectors should be kept within a manageable limit. As the term “main sectors” indicates, the model should

Subdivide the economy into a few strategic sectors only and focus on essential relationships.

Consider, the two sectors: Consumption goods sector and Investment goods sector.

In the first stage of the planning exercise with the aggregate models, we have seen the crucial role of capital accumulation and savings. Since savings is an abstinence from present consumption, it must be rewarded with a higher level of consumption in the future. That is, growth should ultimately mean an increased provision of consumption goods. Therefore, at the second stage of the planning exercise, the planners can divide the economy into an investment goods sector and the consumption goods sector. This will enable the planner to evaluate the trade-offs between present and future consumption.

If for simplicity we assume that there is no intermediate transaction between the two sectors and that they only purchase final goods from each other, then the output of the two sectors will add up to the GDP.

That is,

$$X_1 + X_2 = \text{GDP}$$

Where X_1 is the output of the investment goods sector and X_2 is the output of the consumption goods sector.

Given the marginal propensity to consume (MPC), the supply of consumption goods should be sufficient to meet the demand for them.

Thus,
$$X_2 = b (X_1 + X_2) \quad (27)$$

Where, b is the MPC.

From equation (26) one can see that, for a given MPC, the output or productive capacity of the two sectors must bear a constant relationship to each other such that

A typical planning problem, therefore, is to determine the distribution of investment goods between the two sectors that will ensure a “balanced” growth of the sectors as determined by (28).

Given the target (desired) rate of growth of income, the prevailing consumption- income ratio (or MPC) determines the demand for consumption goods. But often this level tends to exceed the existing capacity of the consumption goods sector. Therefore, if shortages of consumption goods and resultant inflation are to be avoided, the production capacity of the consumption goods sector must be raised by new investment in that sector. But the new investment goods must be supplied by the investment goods sector and hence the investment goods sector must have the capacity to produce additional machines. Otherwise, the capacity of the machine producing sector must be raised first. Obviously, in such a situation, the growth of present consumption must be restrained in order to provide funds for the initial expansion of the investment goods sector. This makes the distribution of investment a difficult choice.

The debate on the question of the distribution of capital goods when such goods are in short supply was formalized by the Soviet engineer – economist Feldman. This model was later modified by Domar (1957), and Mahalanobis (1953) developed a very similar model where production of “machines to produce machines” is the central issue.

The key assumption of the Feldman – Domar – Mahalanobis (F – D – M) model is that capital cannot be shifted away from the sector in which it is first installed. The main question it seeks to answer is: what fraction of investment goods should be assigned to the investment goods sector itself and how much to the production of new consumer goods?

Suppose k_1 is the capital – output ratio in the **investment goods sector** then, assuming full – capacity utilization, **the output of capital goods** will be,

$$1 = \frac{1}{k_1} \dots \dots \dots (29)$$

Let us assume that initially a fraction r of the newly produced capital goods is assigned to the investment goods sector for the expansion of the sector itself. Then the net addition to its capital stock (assuming no depreciation) will be

Therefore, $\frac{\Delta K_1}{K_1} = \frac{\Delta K_2}{K_2} = 1 - r_1$

of capital stock in the investment goods sector.

If a fraction r_1 of capital goods is assigned to the investment good sector then $(1 - r_1)$ will be left to be assigned to the consumer goods sector. Therefore, the net addition to the consumer goods sector's capital stock (again, assuming no depreciation) is

$$\frac{\Delta K_2}{K_2} = \frac{\Delta K_1}{K_1} (1 - r_1) \quad (31)$$

Clearly, the growth of the consumption goods sector's capital stock depends in the

composition of capital stocks ¹ in the two sectors. If we plot the equations (30)

implications of this relationship between the growths of capital stocks in

and (31) we can see the ² the two sectors (Figure 3.2)

E_0 is the initial steady – state equilibrium where the growth rates of capital stocks in the two sectors are then same. This ensures that the output or capacity of the two sectors bears a constant relationship as indicated in equation (28).

If a more aggressive investment program is adopted requiring the fraction of capital stock assigned to the investment sector to rise from r to r^* then the lines showing the growth of capital stocks will shift to new positions (broken lines). Thus, the growth rate of K_1 will be r^* / k_1 . On the other hand, the line for K_2^* will be less steep, implying a fall in the growth rate of capital stock (and hence capacity) in the consumption sector.

However, ultimately the growth rate of capital stock in the consumption sector will rise to a new level, and a higher steady – state equilibrium will be established at E_1 when

*

$$\frac{\Delta K_2}{K_2} = \frac{\Delta K_1}{K_1} (1 - r^*) \quad (32)$$

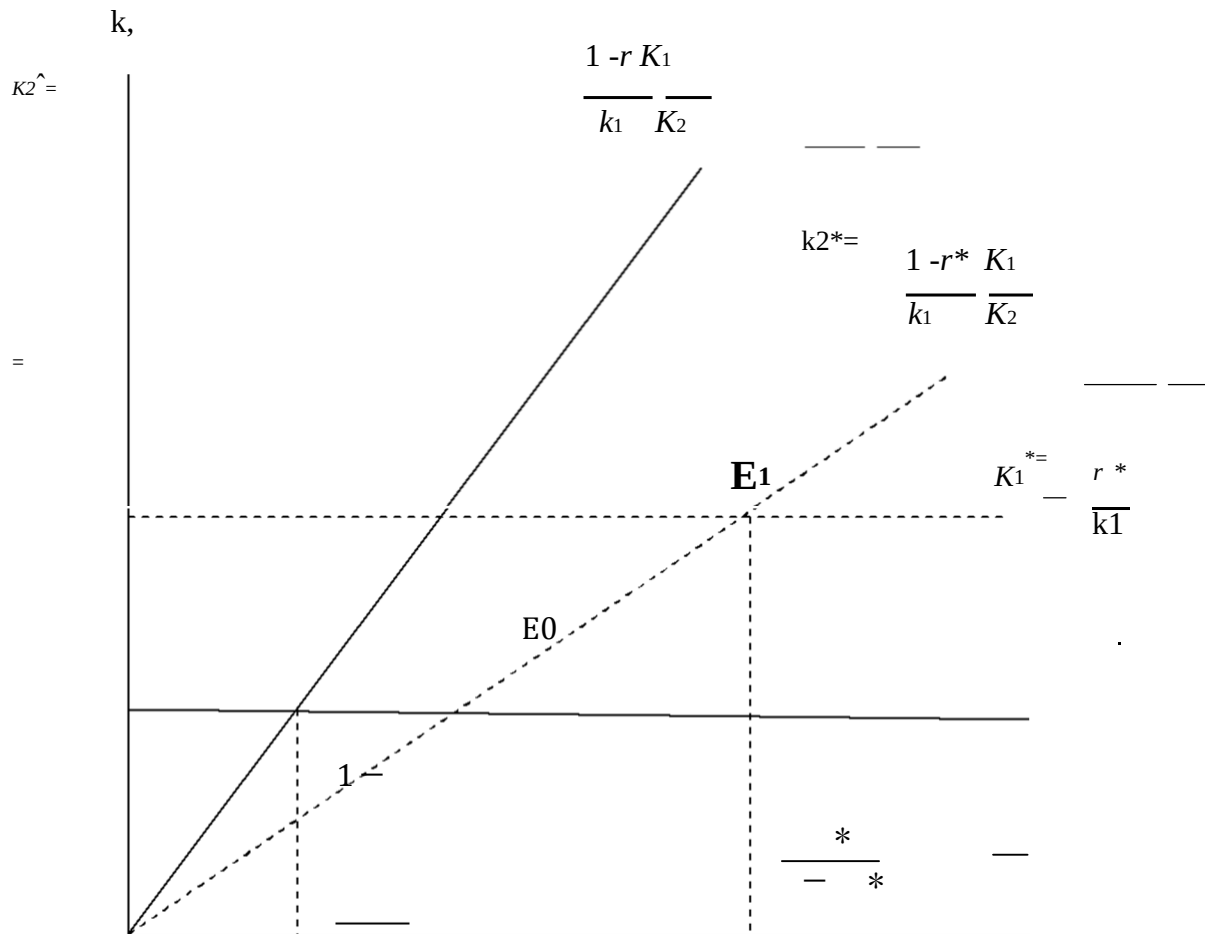


Figure 3.2 Solution to the F – D – M model (Source: Chowdhury & Kirkpatrick, 1984)

For policy purposes, it is essential to ask what happens to consumption in the short run under the new investment plan. Obviously, during the period when the growth rate of the consumption goods sector falls, the growth of consumption must be restrained to keep it within the supply capacity of the sector. This essentially means a reduction in the consumption – income ratio or raising the savings rate to finance the aggressive investment program. In terms of the “balance” equation (28), it requires an alteration of the existing relationship

between the two sectors (i.e. lowering the ratio $b/(1 - b)$) in favor of the investment goods sector. Therefore, the savings ratio $(1 - b)$ becomes a policy parameter.

This brings out an important difference between the H – D model and the F – D – M model. While in the aggregate H – D model the savings rate is determined by behavioral characteristics of the decision – making agents, the F – D – M model treats it as a rigid function of certain structural features of the economy such as the capacity of the domestic investment and consumption goods sectors. This model therefore plays down the importance of savings as a limitation on growth; rather it regards the capacity of the investment goods sector as the constraining factor. By making the allocation ratio a policy variable, it shows that a higher allocation of investment goods to that sector itself would mean a higher savings rate at the margin and hence a higher rate of growth of output. In deriving this central proposition, the F – D – M model implicitly assumes that the government is in a position to control consumption completely. This is a weakness of the F

– D – M model. Even if the government can control private consumption, the choice of too large a value of the allocation ratio and the consequent repression of consumption may be politically unacceptable. Moreover, the F – D – M model is a closed economy model and hence does not consider foreign trade.

The central message of the main – sector models is that when there are shortages of some crucial factor (be it capital goods or foreign exchange), it is not efficient to invest in all the sectors. Rather the investment plan should concentrate on a few “strategic” or “key” sectors which, in practice, are identified using backward and forward linkages resulting from an input-output analysis.

Check your progress 6!

Explain the major purpose of working with the main sector models.

3.5 Multi-Sector Models: Input-output Analysis

At the core of a multi – sector planning model is the input – output analysis. The essence of the input – output analysis is that it captures the interrelationships of the production structure arising through the flow of intermediate goods. There are numerous uses of the input-output put

technique and it is the most widely used planning tool. The most common uses of it for planning purposes can be summarized as follows.

- a) Being a consistency model, the input – output technique can be used for projecting and forecasting sectoral production or supply requirements to meet the sectoral demands implied by alternative targets for GDP.
- b) Once the sectoral supply is projected, the analysis can be extended to forecast the requirements for primary factors, e.g. skilled labor, for sectoral capacity expansion and investment, and for noncompetitive imports.
- c) Since the input – output table contains information on intermediate transactions between the producing sectors; it can be used to identify the “key” sectors with maximum interdependence.
- d) The input – output table can also be used to forecast the impact of supply shocks and cost inflation.
- e) Finally, the input – output technique can be applied to determine comparative advantages.

Main Assumptions:

- a) A linearly homogenous production function is assumed.
- b) Technology remains unchanged.
- c) There are no externalities
- d) There cannot be negative output, i.e., the sum of coefficients for a column industry must be less than unity.

The input – output framework can be represented in a schematic form, using the following table.

		INDUSTRIES (PURCHASING)							FINAL DEMAND				Total Demand
		1	2	3	.	.	j	n	C	G	I	E	
Industries(selling)	1	X_{11}	X_{12}	X_{13}	.	.	X_{1j}	X_{1n}	X_{1c}	X_{1G}	X_{1I}	X_{1E}	X_1
	2	X_{21}	X_{22}	X_{23}	.	.	X_{2j}	X_{2n}	X_{2c}	X_{2G}	X_{2I}	X_{2E}	X_2
	3	X_{31}	X_{32}	X_{33}	.	.	X_{3j}	X_{3n}	X_{3c}	X_{3G}	X_{3I}	X_{3E}	X_3
	i	X_{i1}	X_{i2}	X_{i3}	.	.	X_{ij}	X_{in}	X_{ic}	X_{iG}	X_{iI}	X_{iE}	X_i
	.	.		QI	.	.	.	.	.	QII	.	.	.
	.	.			.	.	.	.	.	.	.	.	.
	.	.			.	.	.	.	.	.	.	.	.
	n	X_{n1}	X_{n2}	X_{n3}	.	.	X_{nj}	X_{nn}	X_{nc}	X_{nG}	X_{nI}	X_{nE}	x_n
payments	Wages	W_1	W_2	W_3	.	.	W_j	W_n	W_c	W_G			W
	Rent	R_1	R_2	R_3			R_j	R_n	R_c	R_G			R
	Interest	D_1	D_2	D_3	QIII		D_j	D_n	D_c	D_G	QIV		D
	Profit	P_1	P_2	P_3			p_j	p_n	P_c	P_G			P
	import	M_1	M_2	M_3			M_j	M_n	M_c	M_G			M
	Total SS	X_1	X_2	X_3			x_j	x_n	C	G	I	E	

Table 3.1 A schematic input-output table. (Source: Thirlwall, 1989)

In the '**Processing Sector**', X_{ij} shows origin (i) and destination (j) of the output of row industry i.

In the '**Payments Sector**', subscripts indicate the industry or final demand sector making payments for factors and payments for imports.

Quadrant I, indicated by QI in table 3.1, records inter-industry transactions.

Quadrant II (QII) records payments by industries to factors of production and to foreigners for purchase of imports.

Quadrant III (QIII) records the final demand for goods and services including exports.

Quadrant IV (QIV) records the direct sales of factors of production and imports to final users.

Now, considering an output X_1 from the first row, we can have:

$$X_1 = X_{11} + X_{12} + X_{13} + \dots + X_{1n} + Y_1 \dots \dots \dots (33)$$

Similarly, for $X_2, X_3 \dots X_i$. It indicates that the domestic output, X_i must equal all its intermediate uses plus all its final uses.

The final uses for the output from industry 1 can be expressed as:

$$Y_1 = X_{1C} + X_{1G} + X_{1I} + X_{1E} \dots \dots \dots (34)$$

The final demand, Y_i , from each industry, i, can be expressed in a similar way.

On the other hand, an output X_1 from the first column industry can be written as:

$$X_1 = \sum X_{11}, X_{21}, X_{31}, X_{i1}, X_{n1}, W_1, R_1, P_1, D_1, M \quad (35)$$

This indicates that the output of the column 1 industry equals the value of all domestic inputs into the industry plus value added plus imports. The value added elements are given by W_1, R_1, D_1 and P_1 .

The input coefficients

The **input coefficients**, also known as **technology coefficients**, can be derived as in the following.

$$a_{ij} = \frac{\text{input of industry } j \text{ to industry } i}{\text{total output of industry } j}, \text{ where } 0 < a_{ij} < 1 \quad (36)$$

This means each element of the first quadrant, also known as the **make matrix**, is divided by the total output of each industry to obtain the input coefficient a_{ij} .

Using the matrix notation a_{ij} can be written as:

$$A_{ij} = A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

For n industries, the inter-industry flows in combination with the final demand elements can be given using the following system of linear equations.

$$\begin{aligned} X_{11} + X_{12} + X_{13} + \dots + X_{1n} + Y_1 &= X_1 \\ X_{21} + X_{22} + X_{23} &+ \dots + X_{2n} + Y_2 = X_2 \\ \vdots & \vdots \vdots \\ X_{n1} + X_{n2} + X_{n3} + \dots + X_{nn} + Y_n &= X_n \end{aligned} \quad (38)$$

Since $X_{ij} = a_{ij}X_j$ and Y_i is final demand, the above system of equations (i.e., the expression in (38)) can be written as:

$$a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + \dots + a_{1n}X_n + Y_1 = X_1$$

$$a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + \dots + a_{2n}X_n + Y_2 = X_2$$

$$a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + \dots + a_{3n}X_n + Y_3 = X_3$$

$$\vdots$$

$$a_{n1}X_1 + a_{n2}X_2 + a_{n3}X_3 + \dots + a_{nn}X_n + Y_n = X_n$$

$$\dots\dots\dots(39)$$

In matrix notation, the above expression can be written as:

$$AX + Y = X \dots\dots\dots 40$$

Where, A $\equiv$ the technology matrix

X $\equiv$ the column vector of total output for each industry

Y $\equiv$ the column vector of final demands for each industry

Then, from equation (40),

$$Y = X - AX = (I - A)X$$

Thus, $Y = (I - A)X \dots\dots\dots(41)$

Multiplying both sides of (40) by $(I - A)^{-1}$ results in,

$$X = (I - A)^{-1}Y \dots\dots\dots(42)$$

Where, I $\equiv$ the identity matrix

$(I-A)^{-1} \equiv$ the Leontief inverse matrix (after Wassily Leontief who introduced the Input-output model)

$Y \equiv$ the matrix of final demands

Equation (41) implies, if matrices A and Y are known, it is possible to determine the output level 'X' of each industry.

Backward and Forward Linkages

Backward linkage helps to indicate where an industry gets its inputs from. Backward linkage can be measured using the following formula.

(43)

=

On the other hand, the forward linkage helps to indicate where an industry's output goes. It can be determined using the following formula.

(44)

Σ

Where, $LB_j \equiv$ a measure of the backward linkage of the industry in the j^{th} column, $LF_i \equiv$ a measure of the forward linkage of the industry in the i^{th} row
 $X_{ij} \equiv$ the input to industry delivered by industry i ,
 $X_j \equiv$ the total output supplied by the industry in the j^{th} column,
 $X_i \equiv$ the total output demanded from the row industry i .

Example:1

Consider an economy where there are two industries, coal and steel. The input coefficients matrix and the final demand matrix are given in the table below.

	Coal	Steel	Final Demand
Coal	0.1	0.4	15
Steel	0.3	0.2	10

a) Determine the level of total output required to satisfy the final demand.

suppose the final demand for steel is projected to increase by 50% whereas final demand for coal remains the same. Determine the change in output for both sectors.

b) Considering the initial final demand conditions, determine the backward and forward linkages for each industry.

Solution:

a) **Let's start by providing the input-output model as:**

$$X = (I - A)^{-1} Y$$

Matrix A can be obtained from the problem given, as:

$$A = \begin{pmatrix} 0.1 & 0.4 \\ 0.3 & 0.2 \end{pmatrix}$$

Then, find the matrix (I - A), as:

$$I - A = \begin{pmatrix} 1 & 0 & 0.1 & 0.4 & 0.9 & -0.4 \\ 0 & 1 & 0.3 & 0.2 & -0.3 & 0.8 \end{pmatrix}$$

Now, find the matrix $(I - A)^{-1}$, which will be found after computation, as:

$$(I - A)^{-1} = \begin{pmatrix} 1.3333 & 0.6667 \\ 0.5 & 1.5 \end{pmatrix}$$

Note: in order to find the inverse of a matrix, you can follow these steps: find the determinant; find the cofactor matrix; find the adjoint matrix; and finally, divide the elements of the adjoint matrix by the determinant – the resulting matrix is the inverse of the original matrix. Students are advised to refresh your memory by revising your course on linear algebra.) The final demand matrix, Y, is given in the problem as:

Thus, total output for both products is found to be:

$$Y = \begin{pmatrix} 10 \\ 15 \end{pmatrix}$$

Hence, Coal output = 26.67

Steel output = 22.5

b) Similarly, for the new, projected level of demand, given by the new final demand matrix as:

$$Y = 15_{15}$$

Recall that, in the problem given it is said that the final demand for steel will increase by 50%, which means the demand for steel increases from 10 to $10 \times 1.5 = 15$.

Thus, the corresponding level of output can be worked out as:

$$1.3333 \quad 0.6667 \quad 15 \quad 30$$

$$0.5 \quad 1.5 \quad 15 = 30$$

Which means,

Coal output = 30

And Steel output = 30

This indicates in order to satisfy the increase in final demand, coal output must increase by **3.33** and steel output must rise by **7.5**.

To compute the backward and forward linkages of an industry, refer the formulas under equation (42) and (43) above. Thus, the **backward linkage** for both the industries can be given as:

$= \sum = 0.1 + 0.4 = 0.4$ $= \sum = 0.4 + 0.2 = 0.6$
and, the **forward linkage** for both industries can be given as:

$$FLC = \sum , = . + . = 0.3 + 0.2 = 0.5$$

$$= \sum , =$$

The above result shows that the steel industry has relatively strong forward and backward linkages

A hypothetical example of the Input-Output table

	Sectors	Purchasing sector					
		Input to agriculture	Input to manufacturing	Input to service	Total immediate input	Final demand	Gross output x_j
Selling sector	Agriculture	50	150	0	200	100	300
	Manufacturing	100	100	50	250	250	500
	Service	0	150	50	200	100	300
	Total intermediate purchase	150	400	100	650	450	1100
	Household (primary inputs)	150	100	200	450	50	500
	Gross in put (x_j)	300	500	300	1100	500	1600

Because of the assumption of fixed proportions, to produce a birr worth of agricultural output requires:-

$$50/300 = 0.17 \text{ worth of agricultural goods}$$

$$100/300 = 0.33 \text{ worth of manufacturing goods}$$

$$0/300 = 0.00 \text{ worth of service goods}$$

The same analysis applies to the other sectors i. e manufacturing and services The intersectoral technical matrix $A = a_{ij}$ for our hypothetical example

$$A = \begin{bmatrix} 0.17 & 0.33 & 0.00 \\ 0.33 & 0.20 & 0.17 \\ 0.00 & 0.30 & 0.17 \end{bmatrix}$$

Let X_i =total output of sector i. X_{ij} = the amount of the product of industry i used as an intermediate input by industry j. D_i = the amount of output of sector i produced to satisfy final demand

The set of equations for the three sectors therefore can be put in linear form: Suppose the planned target settled by the planer for the next year as final demand in our hypothetical example

is birr 150 worth of goods for agriculture, 300 for manufacturing and 150 for service sector.
What level of output should be produced to meet the target?

$$A = \begin{bmatrix} 0.275 & 0.099 & 0.141 \\ 0.613 & 0.249 & 0.565 \\ 0.099 & 0.249 & 0.565 \end{bmatrix} \quad D = \begin{bmatrix} 150 \\ 300 \\ 150 \end{bmatrix}$$

$$I - A = \begin{bmatrix} 0.725 & -0.099 & -0.141 \\ -0.613 & 0.751 & -0.565 \\ -0.099 & -0.249 & 0.435 \end{bmatrix}$$

$$(I - A)^{-1} = \frac{1}{|I - A|} \text{Cofactor transpose } C^T = \text{Adj}(I - A)$$

$$= \frac{1}{\begin{vmatrix} 0.725 & -0.099 & -0.141 \\ -0.613 & 0.751 & -0.565 \\ -0.099 & -0.249 & 0.435 \end{vmatrix}} \begin{bmatrix} 0.613 & 0.249 & 0.051 \\ 0.099 & 0.249 & 0.565 \\ 0.099 & 0.249 & 0.565 \end{bmatrix}$$

$$|I - A| = \begin{vmatrix} 0.725 & -0.099 & -0.141 \\ -0.613 & 0.751 & -0.565 \\ -0.099 & -0.249 & 0.435 \end{vmatrix} = 0.427$$

$$\text{Cofactor } C = \begin{bmatrix} 0.613 & 0.249 & 0.051 \\ 0.099 & 0.249 & 0.565 \\ 0.099 & 0.249 & 0.565 \end{bmatrix}$$

$$\text{Cofactor transpose } C^T = \text{Adj}(I - A)$$

$$(I - A)^{-1} = \frac{1}{0.427} \text{adj}(I - A) = \begin{bmatrix} 0.613 & 0.249 & 0.051 \\ 0.099 & 0.249 & 0.565 \\ 0.099 & 0.249 & 0.565 \end{bmatrix}$$

$$\begin{bmatrix} 0.613 & 0.249 & 0.051 \\ 0.099 & 0.249 & 0.565 \\ 0.099 & 0.249 & 0.565 \end{bmatrix}$$

$$X_i = \begin{pmatrix} 1.436 & 0.583 & 0.119 \\ 0.232 & 0.583 & 1.323 \end{pmatrix} \begin{pmatrix} 150 \\ 300 \\ 150 \end{pmatrix}$$

$$X_1 = 1.436(150) + 0.583(300) + 0.119(150) = \mathbf{408.15}$$

$$X_2 = 0.641(150) + 1.613(300) + 0.33(150) = \mathbf{629.55}$$

$$X_3 = 0.232(150) + 0.583(300) + 1.323(150) = \mathbf{408.15}$$

Example 3

Consider an economy consisting of three sectors, agriculture, manufactures and services. The hypothetical flow of goods and services in physical units is summarized in the following table.

	Agriculture	Manufacturing	Services	Final demand
Agriculture		180	0	120
Manufacturing	30	60	30	180
Service	0	40	10	100

If the demand changes to [150, 160, 180], what will be the new output?

Solution The matrix of input –output coefficients is given by

$$\begin{pmatrix} 0.3 & 0.3 & 0 \\ 0.2 & 0.2 & 0.1 \\ 0 & 0.133 & 0.133 \end{pmatrix} \begin{pmatrix} 150 \\ 160 \\ 180 \end{pmatrix} = \begin{pmatrix} 45 \\ 46.6 \\ 26.6 \end{pmatrix}$$

Let X = denotes the new output and D = Denote the demand vector

$$X = [I - A]^{-1} D$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 0.5 & 0.1 & 0.1 \\ 0.1 & 0.2 & 0.1 \\ 0.1 & 0.1 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.5 & -0.1 & -0.1 \\ -0.1 & 0.8 & -0.1 \\ -0.1 & -0.1 & 0.8 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 6 & -3 & 5 & 0 \\ 2 & 3 & 14 & 83 & 150 \end{bmatrix}$$

$$|I - A| = \begin{vmatrix} 0.5 & -0.1 & -0.1 \\ -0.1 & 0.8 & -0.1 \\ -0.1 & -0.1 & 0.8 \end{vmatrix} = 0.5(0.64 - 0.01) - 0.1(0.08 - 0.08) - 0.1(0.08 - 0.064) = 0.275 \neq 0$$

$$\begin{bmatrix} 18 & 14 & 1 \\ 25 & 7 & 1 \\ 90 & 9 & 4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 90 & 19 & 73 & 60 \end{bmatrix}$$

$$\begin{bmatrix} 18 & 14 & 1 \\ 25 & 7 & 1 \\ 90 & 9 & 4 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 18 & 14 & 1 \\ 25 & 7 & 1 \\ 90 & 9 & 4 \end{bmatrix}$$

$$396.14$$

300.13

$$235.75$$

Review exercise 3.2

1. For a three sector economy, input-output coefficients, a_{ij} 's are given below

$a_{11}=0.5$
 $a_{21}=0.1$

$a_{12}=0.1$
 $a_{22}=0.2$
 $a_{13}=0.1$
 $a_{23}=0.6$

- i) Determine the gross output for the three sectors when the final demand values for the three sectors are 21,000, 42,000 and 63,000 units respectively.
- ii) Determine the new level of output if the final demand increases by: 1500, 3,000 and 4,500 units respectively.

Output	Total input			Intersectoral demand	Consumer demand	Total output
	Agriculture	Industry	services			
	1	2	3	4	5	6
agriculture	industry	services				

2. Given the following input output table of a certain economy in a given year,

Exercise

- 1 Obtain the input –out put coefficients for the following input-output table of a certain economy in a given year (figures in million of Birr).

From(output)	Total (input)			Inter sectoral demand	Consumer demand	Total demand or total output
	Agriculture	Industry	Services			
	1	2	3	4	5	6
Agriculture	80	100	100	280	40	320
Industry	80	200	60	340	60	400
Services	80	100	100	280	20	300

- Interpret the table clearly.
- Obtain the gross outputs of the three sectors to meet the final demand.

3. Given the following inter-industry matrix,

Inter-industry matrix	A agriculture	production
agriculture	0.25	0.16
production	0.35	0.12

- Interpret each entry.
- Calculate the gross output of the two sectors
- Calculate backward and forward linkages for both industries

Determination of employment level

We can use the input-output model to see the impact of any change in final demand or total output on the level of total industrial employment in the economy. The labor coefficient (l_i) required to produce a birr worth of output in sector I is given by

$$l_i = \frac{L_i}{X_i}$$

$$L_i = l_i X_i$$

The level of employment in each industry is uniquely related to the amount of total output produced by that industry. Thus, to find the amount of labor employed in industry i , we merely multiply the corresponding labor coefficient by the total output of X_i of that sector. By summing the products of labor coefficients and total outputs of all industries throughout the economy, we can derive the total industrial employment i.e.

$$L_T = \sum \ell_i X_i$$

$$= \ell_1 x_1 + \ell_2 x_2 + \ell_3 x_3 + \dots + \ell_n x_n \text{ where } L_T = \text{total industrial employment}$$

Similarity the change in employment as a result of a change in total output can be expressed as:

$$\Delta L_T = \sum_{i=1}^n \ell_i \Delta x_i$$

$$L_T = \sum \ell_i x_i$$

Using matrix algebra we can represent the equation for our three sectors economy as:

$$L_T = [\ell_1, \ell_2, \ell_3] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

in simple way

$$L_T = lX$$

Where l = a matrix of labor coefficient

X = a matrix of total output.

3.5.2 The Social Accounting Matrix (SAM)

Introduction

The inability of the input – output model to deal with issues of income distribution and growth and the incomplete nature of multiplier analysis can be overcome by extending the

input – output table to include institutional accounts–income and expenditure of households and other socio –economic groups. In terms of the accounting framework, it involves the mapping of factor incomes into incomes of various households and institutions. **This extended data system with institutional accounts in it is known as the social accounting matrix (SAM).** The term “social” as opposed to “national” has special significance which arises from the attempt to classify various institutions according to their socio–economic background (e.g. rural–urban, poor–rich, etc. Instead of their economic or functional activities (e.g. labor – capitalist) alone, as in national and input – output accounts. Since a SAM contains both social and economic data, it provides a conceptual basis to examine growth and distributional issues within a single analytical framework. This is a distinct advantage over the traditional national and input – output accounts which record “economic” transactions alone irrespective of the social background of the transactors.

The Social Accounting Matrix

Let us consider the table below in order to explain how a SAM can be used to analyze income distribution as an integral part of the growth process. The whole arrangement can be thought of as a partitioned matrix.

Receipts	Expenditure				
	Factors of Production	Institutions	Production Activities	Other accounts	Total
Factors of production	0	0	T13	T14	t ₁
Institutions	T21	T22	0	T24	t ₂
Production activities	0	T32	T33	T34	t ₃
Other accounts	0	T42	T43	T44	t ₄
Total	^	^	^	^	

Table 3.2 A Schematic SAM (Source: Chowdhury & Kirkpatrick, 1984)

That is, each element $\mathbf{T}_{ij}$ in Table .2 represents a sub matrix.

Thus, T_{33} is the input – output flow matrix which records transactions between producing sectors or industries.

When written explicitly,

where, the X_{ij} represent sales from the i^{th} sector to the j^{th} sector.

Similarly,

the sub matrix T_{13} represents payments by producing sectors to factors of production

and T₂₁ maps **household** and **other institutional** incomes from factor incomes.

The transformation of institutional incomes into demand (expenditure) for production activities is recorded in the sub matrix T_{32} .

The row sum t_i is the total receipts of the i^{th} account

By the accounting rule, $t_i = \hat{t}_i$.

- On the assumption that each account distributes its income in fixed proportions we can normalize each transaction sub matrix T_{ij} by the vector $\hat{t}$ to give

That is, A_{ij} is obtained by dividing each element of T_{ij} by the sum of the column in which it appears. Assuming that there are only two types of household (namely, rural and urban) and two production activities (namely, agricultural and manufacturing), the normalized coefficient sub matrix for the institution accounts, for example, will be as follows:

$$= \text{where,.....46}$$

C_i is the total consumption expenditure of the i th type of household (r = rural, u = urban)

and C_{ki} is the consumption of the k^{th} sector (a = agriculture, m = manufacturing) by the i^{th} household type.

Since total outlay is equal to total income, C_{ki} / C_i represents the i^{th} type household's average propensity to consume (spend) the k th sector's product.

A similar interpretation can be given to all other A_{ijs} .

In terms of partitioned matrices of average expenditure propensities, we can, therefore, write the balance equation as

$$= \begin{matrix} 0 & 0 & 0 & \wedge \\ 0 & & & \wedge \\ 0 & & & \wedge \end{matrix} +$$

Where Q_i is the vector of row sums of the sub matrix T_{i4} for $i= 1, 2, 3, 4$.

Assuming that each of the Q_{is} is an exogenous set of numbers we can decompose the above expressions as,

$$= \begin{matrix} 0 & 0 & 0 & + \\ 0 & & & \end{matrix} \dots\dots\dots 47$$

$$= \begin{matrix} + \\ + & \end{matrix} \dots\dots\dots 48$$

The above decomposition implies that we can derive the t_4 set of accounts once we have obtained the other three sets of accounts. Therefore, we shall concentrate only on (49) which gives us balance equation for **factors, institutions and production accounts**. Since

$t = \hat{t}$, we can express (48) in matrix form as,

$$t = At + Q \quad (49)$$

After necessary manipulations, we can obtain

$$t = (I - A)^{-1} Q \quad (50)$$

This is an analogous procedure to that followed for solving the conventional input – output model. But in this case the inverse $[I - A]^{-1}$ is more generalized as it includes the feedback from income generation to demand and as such provides “Keynesian” multipliers for various producing sectors. This becomes clear if we write the production account (which is the same as the input – output account) explicitly. In terms of equation (48) this implies solving for sectoral output sub matrix t_3 as:

$$t_3 = [I - A_{33}]^{-1} (A_{32} t_2 + Q_3). \quad (51)$$

A_{32} represents the marginal propensities to spend by the households on different sectoral products. That is, the coefficient sub matrix A_{32} relates expenditure to institutional incomes and determines induced demand.

t_2 is the level and distribution of income across institutions. Therefore, $[I - A_{33}]^{-1} A_{32} t_2$ gives the sectoral distribution of induced demand. But in the conventional input – output analysis, final demands are treated as exogenous and hence A_{32} is zero. Therefore, in terms of equations system (51), the conventional input – output solution for sectoral output level will be

$$t_3 = [I - A_{33}]^{-1} Q_3 \dots \dots \dots (52)$$

Owing to the absence of induced expenditure coefficients A_{32} in (52), the simple input – output model misses the link between production activities and induced demand. As a result, it fails to address the question of absorptive capacity. Hence, conventional planning

based on simple input – output forecasting relies heavily on **public spending** to improve demand. In addition, the conventional input – output model cannot explain the production structure as determined by the initial income distribution.

On the other hand, a SAM – based model as presented in the equations system (49) describes a system in which the production structure and income distribution are determined simultaneously. Therefore, it can be used to formulate a strategy of growth with distribution.

Moreover, the SAM helps to analyze institutional accounts in terms of **current account** and **capital account**.

The current account records consumption by various socio – economic groups and it allows us to check the validity of the contention that the rich in LDCs indulge in conspicuous consumption or spend disproportionately more on imported products. The current and capital accounts are interlinked through savings. The difference between income and consumption (i.e. savings) enters in to the capital account as a receipt. On the expenditure side the capital account shows who invests on what. Thus the capital account in a SAM framework allows us to examine both savings and investment behaviors of different socio – economic groups.

Limitations of Multi - Sectoral Planning Models

Despite their numerous uses, the input – output and SAM – based multi-sectoral planning models have certain limitations. These limitations stem from their assumptions regarding technology. Two of the fundamental input output assumptions are that the technology and capital coefficient matrices are constant and

the technology and capital coefficient matrices are unique, i.e. there is only one Production technique available to each sector or industry.

There are two problems associated with the first assumption.

a) The assumption of constant technical and capital coefficients implies constant returns to scale and hence appears to be in contradiction with economic development characterized by

the phenomenon of increasing returns to scale. Since investment goods are indivisible, a “big push” in investment is likely to generate increasing returns to scale. In fact, market failure arising from increasing returns to scale is one of the arguments used in favor of planning. Besides capacity expansion, investment planning aims at introducing new methods of production and improved technologies. Therefore, it is extremely hazardous to project output and capital requirements based on existing technology and capital coefficients which are likely to change during the process of economic development owing either to deliberate attempts or to indivisibilities of investment.

- b) One of the main objectives of development planning is to bring about a structural change of the economy. This involves initiating new activities and phasing out some existing ones. The new configuration of activities will therefore generate a different input output relationship. The existing input -output relationships appear to offer little or no help in considering the establishment of new industries or activities. The problem of variable coefficients is generally tackled by forecasting changes in the input structure and product mix on the basis of past experience. The problem of introducing new activities is handled by adding new rows and columns with technical coefficients obtained either from engineering data or on the basis of statistical experience of similar activities already established in countries of comparable economic development.

The second assumption of a single process production function poses a more serious problem. It does not allow the possibility of substitution and alternative ways of doing things. In reality, though, inputs can be combined in various proportions to obtain the same level of output. That is, there exists more than one set of technical coefficients. The job of the economist is to choose the most economical one from the set of technically efficient production processes. In technical terms, the problem is to choose the **optimal production** process, given the scarcity price of resources under their existing configuration. The standard input – output technique which is the core of multi-sectoral planning models cannot handle the problem of choosing the optimal production process which would yield the same total output while making the least use of whatever resources are most limited. This involves supplementing the standard input-output methodology with the linear programming method.

• **Check your progress 7!**

What is the most important issue that makes SAM different from an input- output model?

Check your progress 8!

What are the major structural elements in the SAM?

Check your progress 9!

Refer Table 3.2 above, what type of transaction is represented by the flow element T_{22} ?

3.5 .3 The Programming Approach to Planning: Linear Programming

Linear programming is the most widely used programming method in which all the functions involved are assumed to be linear. Linearity implies that the objective function and all the constraints are summations of decision variables, each of which is multiplied by a coefficient or parameter. That is, variables are in additive relation in each equation, and no variable is raised to a power higher than unity. One further assumption is that the decision variables must be non-negative.

An illustrative example:

Assume that a country produces two products: agricultural and manufactured. Each unit of agricultural product sells at \$1 and the manufactured product at \$4. It takes two workers and four units of capital to produce one unit of agricultural product and ten workers and five units of capital to produce one unit of manufactured product. The total number of workers and amount of capital available are 1000 and 600 respectively.

Based on the above information, construct a linear program to allocate the country's resources (labor and capital) ,so as to maximize the total value of output or GDP.

The first step to find the solution is to be able to define the decision variables and parameters.

The decisions are the amounts of products, that is, levels of agricultural and manufactured output that the country should produce. Define X_1 as the level of agricultural product and X_2 as the level of manufactured product.

The parameters of the problem are:

Number of workers required per unit of agricultural and manufactured products,

Units of capital required per unit of agricultural and manufactured products

Total available amount of resources (labor and capital)

Price per unit of agricultural and manufacture products

State the objective function and constraints. The objective is to maximize the value of total output (GDP). Hence,

$$\begin{array}{llll} \textbf{Objective function: } Z & = & 1X_1 & + & 4X_2 \\ & & \text{Total value} & & \text{value of} \\ & & \text{of output} & & \text{agriculture} \\ & & & & \text{value of} \\ & & & & \text{manufacture} \end{array}$$

- The constraints are on the availability of resources. That is, in producing the two products we cannot use more of any resource than is available. Thus the constraints take the form:

Resources used $\leq$ resources available

In terms of the parameters and the decision variables, the constraints are:

$$2X_1 + 10X_2 \leq 1000 \text{ ----- labor constraint}$$

$$4X_1 + 5X_2 \leq 600 \text{ ----- capital constraint}$$

The condition that negative amounts of neither product can be produced implies a further

constraint as: $X_1 \geq 0$ and $X_2 \geq 0$

Therefore, we can summarize the country's resource allocation problem as:

$$\begin{array}{ll} \text{maximize} & Z = 1X_1 + 4X_2 \\ \text{subject to} & 2X_1 + 10X_2 \leq 1000 \\ & 4X_1 + 5X_2 \leq 600 \end{array} \quad \left. \vphantom{\begin{array}{l} \text{maximize} \\ \text{subject to} \end{array}} \right\} \quad (53)$$

with non-negativity conditions: $X_1 \geq 0$ $X_2 \geq 0$

The solution to the linear programming problem entails finding values for X_1 and X_2 which will maximize Z and at the same time are feasible in the sense that the attainment of these values does not violate any of the constraints, including the non-negativity conditions.

The solution to a linear programming problem can be sought using either the graphical method, or the simplex method.

Graphical Solution

The first step in the graphical solution is to convert the inequality constraints into **equality constraints** so that they can be drawn as straight lines, assuming as if all the resources are fully utilized.

Thus, the linear programming problem under (53) above can be rewritten as:

$$\text{maximize} \quad Z = 1X_1 + 4X_2$$

$$\text{subject to} \quad 2X_1 + 10X_2 = 1000$$

$$4X_1 + 5X_2 = 600$$

$$\text{with non-negativity conditions: } X_1 \geq 0 \quad X_2 \geq 0$$

Let X_1 , the level of agriculture output, be represented along the horizontal axis and, X_2 , the level of manufactured output be represented on the vertical axis.

Feasible solution: refers to all those values of X_1 and X_2 which satisfy the given set of Constraints.

Feasible region: is the region which contains all possible feasible solutions. Considering Fig. 3.3 below, OAED is the feasible region because the output levels given by points on or inside the boundary are attainable without violating any of the constraints.

Optimal solution: is a feasible solution which optimizes the objective function.

$$\text{For the labor constraint} \quad 2X_1 + 10X_2 = 1000$$

$$X_1 \text{ intercept} = 500 \text{ and } X_2 \text{ intercept} = 100$$

$$\text{For the capital constraint} \quad 4X_1 + 5X_2 = 600$$

$$X_1 \text{ intercept} = 150 \text{ and } X_2 \text{ intercept} = 120$$

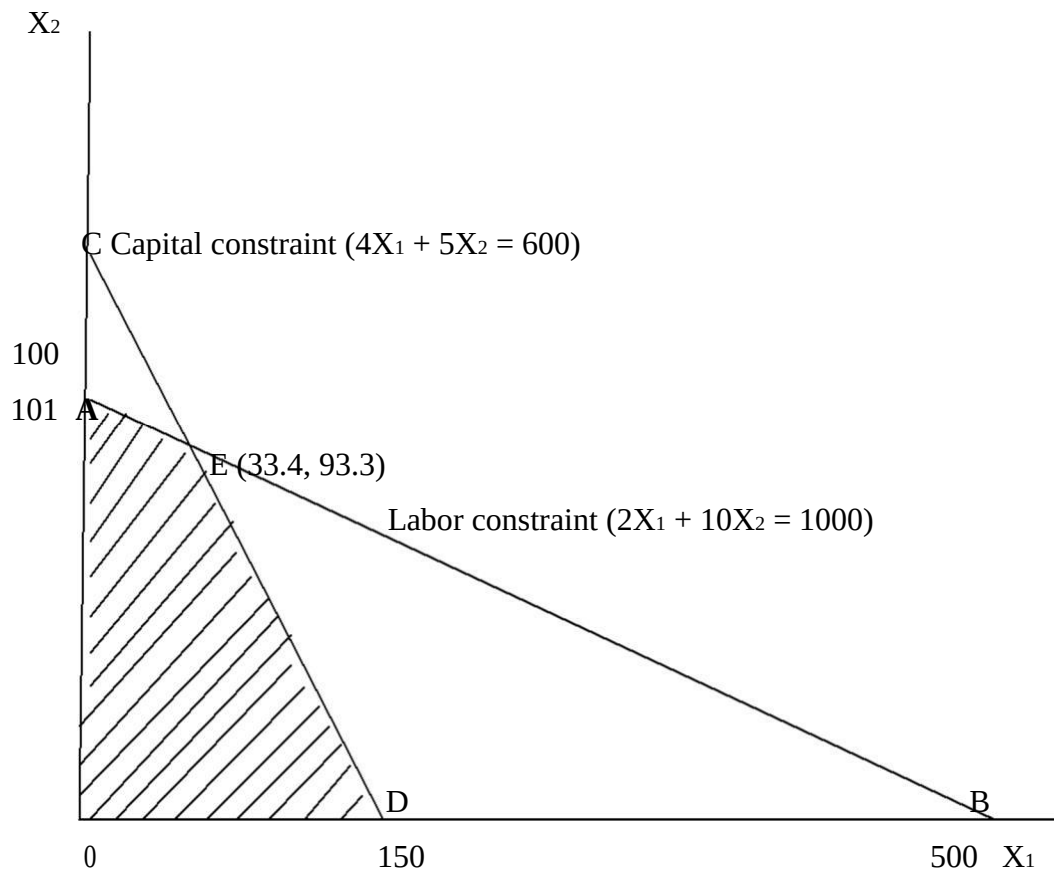


Figure 3.3 A hypothetical linear program

To find the optimal solution:

- a) It needs to consider only the corner points of a feasible region. The corner points are the extreme points, indicated by the intercepts and the kink points, as we move 'north-east' from the origin. Locate the corner points using the following procedures:
 - i) Find the intercepts for each constraint
 - ii) Determine the points of intersection of constraints.
- b) After determining the corner points, find all possible values of the objective function Z at the corner points.
- c) The optimal solution to the optimization problem (in this example, maximization) is the feasible solution which yields the **highest value** of the objective function.

The coordinates at E can be determined using a simultaneous equation system as:

$$2X_1 + 10X_2 = 1000$$

$$4X_1 + 5X_2 = 600$$

From which we have, $X_2 = 1400/15 = 93.3$

And $X_1 = 33.4$

<u>Corner points</u>	<u>Value of Z ($Z = X_1 + 4X_2$)</u>
O (0, 0)	$(1*0 + 4*0) = 0$
A (0,100)	$(1*0 + 4*100) = 400$
E (33.4, 93.3)	$(1*33.4 + 4*93.3) = 406.6$
D (150, 0)	$(1*150 + 4*0) = 150$

Therefore, the value of **Z is maximum, i.e Z = 406.6, at point E,**

Where, $X_1 = 33.4$, and $X_2 = 93.3$.

3.5 The Dual and Economic Interpretation of its Solutions:

The original linear program is usually referred to as a ‘primal’ program and its mirror image as a ‘dual’ program. The dual program bears certain relationships to the primal program as summarized below.

- The dual of a maximization problem is a minimization problem, and vice versa.
- The dual has one decision variable for each constraint in the primal problem.
- The dual has as many constraints as there are decision variables in the primal problem.
- Coefficients in the primal objective function appear as constants (parameters) in the dual constraints, and vice versa.
- Each column of coefficients in the primal constraints becomes a row of coefficients in the dual constraints.
- Inequality signs in the primal constraints are reversed in the dual constraints.
- The non-negativity conditions (≥ 0) on decision and slack variables are retained.

(Slack variables are variables, usually denoted as $S_1, S_2 \dots$, which are used in the constraints of a linear programming problem to represent unused resource capacity)

Following the above relationships between a primal program and its dual, we can convert our resource allocation problem in (53) to maximize national output into a cost minimization or efficiency pricing problem as follows.

$$\begin{array}{ll}
 \textbf{Primal:} & \text{maximize} \quad Z = 1X_1 + 4X_2 \\
 & \text{subject to} \quad 2X_1 + 10X_2 \leq 1000 \\
 & \quad \quad \quad 4X_1 + 5X_2 \leq 600 \\
 & \text{non-negativity} \quad X_1 \geq 0 \quad X_2 \geq 0 \\
 \\
 \textbf{Dual:} & \text{minimize} \quad = 1000Y_1 + 600Y_2 \\
 & \text{subject to} \quad 2Y_1 + 4Y_2 \geq 1 \\
 & \quad \quad \quad 10Y_1 + 5Y_2 \geq 4 \\
 & \text{non-negativity} \quad Y_1 \geq 0 \quad Y_2 \geq 0
 \end{array} \tag{53}$$

As is the case for the primal problem, the solution to the above dual problem can be found by using either the graphical method or the simplex method.

The solution to the dual program will have the following properties which are known as the **duality theorem**.

Theorem I The optimal values of the primal and the dual **objective functions** are always identical provided that optimal feasible solutions do exist.

Theorem II That is, optimal = optimal **Z**.

- a) If a certain decision variable in the primal program is optimally non-zero then the corresponding slack variable in the dual program must be optimally zero.
- b) If a certain slack variable in the primal program is optimally non-zero then the corresponding decision variable in the dual program must be optimally zero.

The essence of the duality theorem is the valuation or the pricing of resources. In giving an economic interpretation to dual solutions, we must know the nature of dual variables as well as their unit of measurement. The primal problem in the above example is the maximization of the value of national output, and the objective function Z is expressed in money terms. By theorem I, therefore, the dual objective function given in the above example must also be in money terms. But 1000 and 600 are in physical units denoting resources. Therefore, the coefficients Y_1 and Y_2 in the dual objective function must denote some price variables per unit of each resource. Since at these prices cost is minimized, these imputed or accounting prices can be regarded as **efficiency prices**. They **measure the opportunity cost of using resources**. Therefore, $Z =$ means that, in the optimal solution, the total product must be imputed or allocated in its entirety to the resources via accounting prices. The non-negativity conditions in the dual program imply that opportunity costs cannot be negative. By Theorem II, if there is a slack in the use of a certain resource, i.e. a non-zero solution for a slack variable in the primal, then its opportunity cost is zero. This is an argument used by many economists to treat the opportunity cost of labor as zero in labor surplus LDCs.

Coefficients '2' and '4' in the first constraint of the dual, describe the amount of each resource (labor and capital) required to produce a unit of the first (agricultural) product. Since Y_1 and Y_2 are the opportunity costs of labor and capital, the first constraint is the total opportunity cost of producing one unit of agricultural product. Since '1' is a coefficient in the primal objective function, it denotes the per unit contribution of the first product to the objective function (it is recalled that '1' is the per unit price of the agricultural product). Therefore, the first constraint requires that the opportunity cost of producing the agricultural product be imputed at a level at least as large as its net contribution to the national output. Similarly, the second constraint requires that the opportunity cost of producing the manufactured product be imputed at a level at least as large as its net contribution to the national output (which in this case is '4'). The implication of this requirement is that **if the marginal opportunity cost of producing a product is not equal to its marginal contribution to net returns then the resource allocation is not optimal**.

Check your progress 10!

• •

Why do the constraints in a maximization problem take a “ $\leq$ ” sign?

Check your progress 11!

What do the constraints in the dual represent?

The Simplex Method

The simplex method is a method used to solve linear programming problems especially when we have three or more decision variables. The simplex method is an iterative procedure which makes use of corner points of the basic feasible region. The iteration continues until the optimal solution is obtained.

Example:

Consider the linear programming problem mentioned under (53).

$$\begin{aligned} &\text{maximize } Z = X_1 + 4X_2 \\ &\text{subject to } \quad 2X_1 + 10X_2 \leq 1000 \\ &\quad \quad \quad 4X_1 + 5X_2 \leq 600 \\ &\text{where, } \quad X_1 \geq 0 \quad X_2 \geq 0 \end{aligned}$$

Now, introduce the slack variables S_1 and S_2 and rewrite the LP program as below. Also, we need to change the ‘inequality’ in the constraints into ‘equality’.

$$\begin{aligned} &\text{Maximize } \quad Z = X_1 + 4X_2 + 0S_1 + 0S_2 \\ &\text{subject to } \quad 2X_1 + 10X_2 + S_1 = 1000 \\ &\quad \quad \quad 4X_1 + 5X_2 + S_2 = 600 \\ &\text{where, } \quad X_1 \geq 0 \quad X_2 \geq 0 \end{aligned} \quad \left. \vphantom{\begin{aligned} &\text{Maximize } \quad Z = X_1 + 4X_2 + 0S_1 + 0S_2 \\ &\text{subject to } \quad 2X_1 + 10X_2 + S_1 = 1000 \\ &\quad \quad \quad 4X_1 + 5X_2 + S_2 = 600 \\ &\text{where, } \quad X_1 \geq 0 \quad X_2 \geq 0 \end{aligned}} \right\} \quad (54)$$

The inequality is changed to equation because of the assumption that there is a possibility of slacks in the resource use.

The problem indicated by (54) can be written in its standard form as:

$$\begin{aligned} &Z - X_1 - 4X_2 - 0S_1 - 0S_2 = \\ &0 \quad 2X_1 + 10X_2 + S_1 = 1000 \end{aligned}$$

$$4X_1 + 5X_2 + S_2 = 600$$

The next step is constructing the simplex tableau using the coefficients and the values on the right-hand side as indicated in Tableau I.

Table I

Basis*	X1	X2	Z	S1	S2	RHS**
S1	2	10	0	1	0	1000
S2	4	5	0	0	1	600
Z	-1	-4	1	0	0	0

* This is the column which contains the basic variables.

** contains the values on the Right-Hand Side.

Then, determine the entering variable and the departing variable.

The column variable with the largest negative coefficient is taken as the entering variable.

Hence, the entering variable is X_2 .

The departing variable is determined using the minimum ratio rule. The minimum ratio is determined by dividing the values under the **RHS column (i.e the values indicating the maximum resource capacity given as 1000 and 600) by the corresponding row values under the column for the incoming variable, i.e. X_2** . Using this procedure we obtain:

$$1000/10 = 100, \text{ and } 600/5 = 120$$

Since **100 < 120**, the departing variable is S_1 .

Now, take the **pivot element** in Tableau I (i.e. the element at the intersection of the column of the entering variable and the row of the departing variable), i.e. 10; Divide each element across row S_1 in Tableau I by 10 so as to have '1' in the place of the pivot element.

Generate the next tableau, Tableau II, with the new row elements across the row X_2 . Table II

Basis	X1	X2	Z	S1	S2	RHS
		1				
X_2	1/5		0	1/10	0	100
S_2	4	5	0	0	1	600
Z	-1	-4	1	0	0	0

Next while converting the elements below (and above, if there is any) the pivot element (the encircled '1') to zero, the other row elements below (and above, if there is any) the pivot row are also converted.

Accordingly, to convert the element below the pivot element (i.e. '5') to zero, think of a certain number λ ,

where, $(\lambda * 1) + 5 = 0$,

from which we have: $\lambda = -5$.

Then multiply each element in the pivot row by -5, add the result to the corresponding element in the S_2 row of Tableau II, and then report the final result in Tableau III across the S_1 row. For instance, the operation: $(-5 * 1/5) + 4 = 3$ helps to find the new entry (i.e. 3) in row S_2 and column X_1 of Tableau III, etc.

Perform a similar operation on row Z elements in Tableau II by starting from the pivot element (i.e. '1') and the corresponding element in the Z row and X_2 column (i.e. -4).

Thus, by following similar procedures, Tableau III can be completed as given below.

Table III

Basis	X1	X2	Z	S1	S2	RHS
X2	1/5	1	0	1/10	0	100
S2	3	0	0	-1/2	1	100
Z	-1/5	0	1	2/5	0	400

Now, examine the elements (numbers) in the Z row. If there exists a negative element in this row, then this is an indication that the **iterative process** will continue until all negative elements are removed from this row. Since -1/5 appears in the Z-row, it needs to repeat the same procedures applied on Tableau I and Tableau II.

Thus, once again, determine the entering variable, the departing variable and the pivot element based on the information in Tableau III. In this case, the entering variable becomes X1 and the departing variable becomes S2 (because $100 / (1/5) = 500$, and $100/3 = 33.3$ and thus $33.3 < 500$). Then, generate Tableau IV with row X1 having the new pivot element (the encircled '1' in Tableau IV).

Table IV

Basis	X1	X2	Z	S1	S2	RHS
X2	1/5	1	0	1/10	0	100
X1	1	0	0	-1/6	1/3	100/3
Z	-1/5	0	1	2/5	0	400

Now, **consider Tableau IV** and then convert the elements above and below the pivot element (i.e. 1/5 and -1/5 and) to zero and then all others across row X2 and row Z to their corresponding values, one by one. Accordingly, the completed Tableau V is generated as in below.

Tableau V

Basis	X1	X2	Z	S1	S2	RHS
X₂	0	1	0	2/15	-1/15	93.3
X₁	1	0	0	-1/6	1/3	33.3
Z	0	0	1	11/30	1/15	406.7

Finally, after having completed Tableau V the optimal solution is obtained because at this stage there is **no any negative element in the Z-row**. Tableau V is the optimal tableau.

Thus, **the solution** as obtained from Tableau V is:

$$X_1 = 33.3,$$

$$X_2 = 93.3,$$

$$\text{and } Z = 406.7.$$

Note that this answer is the same as the answer obtained using the graphical method under section



Review Exercise 3.2

- A. Read each one of the following statements carefully and determine whether each one is ‘**True**’ or ‘**False**’. Check your answers by making a reference to the ‘**Key to Review Exercises**’ part at the end of this module.
1. One important aspect of models used for planning is that they help to analyze the problems and show the complex relationships between the variable involved.
 2. The completeness property in the main sector model requires that the number of sectors involved in the model should be as few as possible, preferably two to four.
 3. Deterministic models give rise to probabilistic results whereas stochastic models help to establish results in non-probabilistic terms.

4. Endogenous variables are variables whose values are determined within the model whereas exogenous variables are types of variables that could be determined by policy makers.
5. Despite the recommendation by the two-gap model to use foreign aid as a means to rescue investment, there are, on the other hand, unproductive critiques which assert that there is a possibility for converting domestic savings into foreign exchange earnings via exports.
6. In the H-D model, saving is treated as a limiting factor and hence is determined by the model, whereas in the F-D-M model it is treated as a non-constraining factor determined by what happens in the investment and consumption goods sector.

B. Work out the following problems. Check your answers by making a reference to the '**Key to Review Exercises**' part at the end of this module.

1. Consider an economy where there are two industries, namely, electricity and manufacturing. In order to produce a \$1 worth of electricity product it requires a \$0.20 worth of electric power supply, and a \$0.30 worth of supplies from the manufacturing sector. In order to produce a \$1 worth of manufactured output it requires a \$0.30 worth of supplies from electricity sector, and a \$0.40 worth of manufactured inputs from the manufacturing sector. In each month the external demands for electricity and manufacturing are given as \$90,000 and \$120,000, respectively.

Based on the above information:

- i. Construct the matrix of input coefficients (in the order: **electricity, manufacturing**)
- ii. Determine the monthly level of output that would be produced by each industry.
- iii. Determine:
 - a. The backward linkage for each industry
 - b. The forward linkage for each industry
- iv. A forecast made for the total final demand of each industry shows that the external demands for electricity and manufacturing would increase by 10% for each.

- a. Provide the new production schedule for each industry.
 - b. Determine the change in the output of each industry required to meet the changes in demand.
2. Optimize the following linear programming problem using graphical method. Minimize: $Z = 8X + 12Y$
 Subject to: $7X + 2Y \geq 14$
 $2X + 2Y \geq 10$
 $4X + 8Y \geq 32$
 $X, Y \geq 0$
3. Using the **simplex method**, find the solution for the following linear programming problem.

$$\text{Maximize: } Z = 150X_1 + 80X_2$$

$$\text{Subject to: } X_1 + X_2 \leq 600$$

$$4X_1 + 2X_2 \leq 2000$$

$$X_1, X_2 \geq 0$$

$$X=2, Y=3, Z=52$$

.The solution for the maximization problem using the simplex method is given

$$\text{below. Maximize: } Z = 150X_1 + 80X_2$$

$$\text{Subject to: } X_1 + X_2 \leq 600$$

$$4X_1 + 2X_2 \leq 2000$$

$$X_1, X_2 \geq 0$$

Tableau I						
Basis	X_1	X_2	Z	S_1	S_2	RHS
S_1	1	1	0	1	0	600
S_2	4	2	0	0	1	2000
Z	-150	-80	1	0	0	0

After putting the equations in the standard form, the following three simplex tableaus can be constructed using the iterative procedure discussed.

Tableau II

Basis	X_1	X_2	Z	S_1	S_2	RHS
S_1	0	$1/2$	0	1	$-1/4$	100
X_1	1	$1/2$	0	0	$1/4$	500
Z	0	-5	1	0	37.5	75,000

Therefore, the solution is: $X_1 = 400$, $X_2 = 200$, and $Z = 76,000$

desirable and undesirable effects, merits and demerits of alternative courses of action and their incidence before proceeding to the implementation phase.

Broadly viewed, they are economic appraisal, physical planning appraisal, environmental impact and social impact appraisal techniques.

Implementation actually refers to what happens after the activities to be done have been selected, endorsed and presented in the form of a plan/ program/project. Broadly seen, the major factors affecting plan implementation are associated with the nature of the planning process, the content of the plan, the organizational aspects, and with those related to the management of the implementation process.

In general, plan implementation techniques can be helpful as a means of structuring implementation problems and to draw a sequence of activities within a limited time framework. This has also implication for program/project budget utilization. The use of implementation techniques can be taken as part of the implementation management process.

CHAPTER 4

PLANNING IN PRACTICE: EXPERIENCES FROM ETHIOPIAN AND OTHER COUNTRIES

Planning is not a recent phenomenon, it has been practiced in Soviet Union during 18th century and afterwards, various countries adopted it within different socioeconomic setups. In developing nations it has been pronounced widely after nations got independence from colonial restraints. These phenomena brought about high expectation for accelerated socio economic change using planning as an effective means.

For those nations, planning is considered effective in mobilizing resources and allocating them into priority areas of development, thereby helping developing countries to break out of their vicious circle of poverty. This chapter addresses the planning experience of developing countries including Ethiopia. Therefore, the historical experience of planning in developing nations will be discussed so forth.

Ethiopia is one of the few African countries that adopted a more or less comprehensive planning system from the beginning as a means of pursuing economic and social development. Planning in Ethiopia has always been seen as involving the proper selection of targets and rationalising the use of available resources through the implementation of different projects and hence serve as a mechanism for tackling some of the specific problems individual economic and social sectors face.

Learning objective

At the end of this chapter students will be able to:-

Articulate the planning experience of developing countries

4.1 An overview of the planning Experience of Ethiopia

Pre - 1974 Period

In 1945 a ten-year programme for industrial development was formulated as the first exercise in planning in the country's history. Subsequently, sector programmes in the field of agriculture and forestry, transport and communication, education and water resources development were formulated. However, planning for the national economy as a whole did not begin until the formulation of the First Five Year Development Plan (FFYDP) in 1957 by the National Economic Council, which was established in 1955.

Recognition of these facts, combined with several other factors such as the rising preference of planning in developing countries by western countries providing loans and grants, led the government to formulate an overall development plan. Thus administrative machinery for formulating plans called the National Economic Council was established in 1955. The Council consisted of a Planning Board and a Secretariat to the Board, specifically charged with the task of drawing up plans. The Executive Committee of the Planning Board was chaired by the country's Prime Minister and had the following members: 1) Minister of Finance; Mining and State Enterprises; 2) Minister of Health; 3) Minister of Public Works and Communications; 4) Minister of Agriculture; 5) Minister of National Community Development; 6) Governor of the State Bank; 7) Minister of Posts, Telegraphs and Telephones; 8) Minister of Commerce and Industry; 9) Minister of Information; 10) Vice Minister of Education and Fine Arts; and 11) Vice Minister of the Planning Board, Secretary. Ethiopia's First Five Year Development Plan (1957-61) and its Second Five Year Plan (1962-67) were prepared under this arrangement. A number of developments, important to the economy as well as to the structure of the government itself, have taken place during these years.

The council was headed by a Planning Board. Other functional government institutions were later established to facilitate the task of drawing up plans. Since 1974, the country has had a perspective plan, supported by a series of operational plans.

A development plan is basically a general guideline for policies to be pursued and measures to be taken. Based on such policies and measures, it defines broad areas of economic and social activity to be promoted. The major elements of this action programme are the specific projects such as transport projects, hydroelectric projects, industrial projects, agricultural projects and like. Each of these create linkages between the overall development plan and projects.

The FFYDP covered the period 1957-61 which was later extended by the decision of the Planning Board up to the end of the budgetary year of 1961. Judging from its socio-economic objectives, the FFYDP reflected the first stage of the development programme for a modern economy in Ethiopia, since it gave priority to the development of infrastructure which represents a prerequisite for accelerating economic growth [PCO 1962:32].

The Second Five Year Development Plan (SFYDP) was prepared in 1963 and covered the period between 1963 and 1967. This plan was a logical continuation of the FFYDP, but gave greater emphasis to productive activities that would produce more quantities of consumer goods and on the creation of new working opportunities for Ethiopia's increasing population. In addition to this, much stress was laid on research and the generation of statistical information so as to obtain adequate and reliable data for future projects.

In preparing the SFYDP, a two-tier assessment of immediate and future needs and possibilities were made. First, all the ministries and government agencies prepared their long-term development programmes with the aim of extending and improving social services, public administration and the economy at large. Secondly, the Planning Board worked out a twenty-year development projection intended to forecast the growth of population, production and consumption, as well as the costs of the anticipated development. Its particular aim was to integrate the SFYDP into the following twenty-year periods and be able to assess the objectives and targets of the second plan period, as well as to forecast the resources that will be available.

The Third Five Year Development Plan (TFYDP) started in 1968 and was completed in 1973, i.e., one year before the 1974 revolution. This was also a logical continuation of the two preceding plans. Unlike the two previous plan periods which gave emphasis directly to infrastructure and productive undertakings (manufacturing industry, mining, electricity) respectively, the TFYDP gave priority to agriculture. Apart from this, the TFYDP had the following distinctive features:

a) Formulation of the plan was based on more and better information about the country; b) Administrative reforms were foreseen as a precondition of plan implementation; c) Distribution of real incomes and opportunities in the various regions of the country; and d) The plan clearly defined the specific tasks and responsibilities of each ministry and agency in the implementation of the plan.

Although we had a sort of comprehensive planning system before the Second Five Year Plan period, much emphasis was not given to the preparation of projects until the establishment of the

Technical Agency. In other words, the absence of such an institution, which would elaborate plan and project, was a serious obstacle to the preparation of projects and the timely utilization of foreign loans and assistance. It was in light of these problems that it was proposed to set up the Technical Agency.

The agency took the identification, elaboration, evaluation and implementation of projects as its responsibilities. Since then, the Technical Agency has been working as the government's representative in evaluating projects submitted for financing. The main tasks of the agency were to:

- a) take care of the technical preparation, construction and supervision of productive projects initiated by the government; b) represent the government in the capacity of an investor and to perform all technical, financial and administrative functions in the name of the government; and
- c) secure managerial and professional personnel for the operation of constructed projects.

Above all, the establishment of the agency enabled the government to save several million Birr in the identification and preparation of new projects by engaging domestic as well as foreign experts.

Post - 1974 Period

Macro Planning

The National Revolutionary Development Campaign and Central Planning Supreme Council was established by proclamation on October 29, 1979. Immediately after its establishment, the Council launched a Development Campaign the major objective of which was to concentrate on the immediate and pressing problems. Although the campaign was intended to put emphasis on agriculture, industry, trade and social problems, its immediate objectives were:

- a) the elimination of food grain shortages; b) increasing and earning foreign exchange; c) increasing industrial production; d) bringing order to the trade sector; and e) laying the foundation for step by step elimination of social problems such as unemployment.

Being a one-year programme with specific objectives oriented towards solving pressing economic and social problems, the Development Campaign did not follow the conventional planning method. Neither did it start from the elaboration of macro aggregates. However, in order to make a complete assessment of the implementation of the campaign and draw lessons for the preparation of the next plan, it was necessary to forecast the direction and magnitudes of the aggregate impacts of various targets and measures incorporated in the programme. Particular

attention was thus given to the effect of the Development Campaign on the Gross Domestic Product (GDP). The Campaign, as its name implies, was not able to consider projects because projects are translators of development plans over a longer period of time. Therefore, there was no attempt to relate the plan objectives with projects.

Although a series of three of five-year development plans were formulated before the revolution, they were neither comprehensive nor enforced through the implementation of concrete projects. Consequently, the plans were not able to have real direct impact on the development of the country. However, a considerable effort was made after 1984 to set up a central planning system and bring about changes in the economy that the government wanted through the Ten-Year Perspective Plan, covering the period 1984/85-1993/94. The plan's long-term economic objectives were as stated in the programme of the National Democratic Revolution (NDR) of Ethiopia. Tables 1 and 2 list the projects of the plan in terms of priority in implementation and budgetary allocation while Table 3 describes the overall phasing of investment outlays on identifying projects and programmes.

KEY TO REVIEW EXERCISES

Chapter 1

Check your progress 1!

The major problems associated with the traditional approach to development planning can be summarized as: too much emphasis on the plan and not enough on its implementation, overemphasis on the medium term, excessive rigidity, and differences in perspective and inadequate communication between politicians, planners, and administrators.

Check your progress2

Firstly, plan theories and models provide a range of possibilities that are supposed to be helpful to bring about economic prosperity. But on the other hand the benefits sought and the growth envisaged could not be achieved even after repeatedly working with different plan models and methodologies. Here comes the conflict between the theory and the practice. This is generally related to the problem of divergence between social valuation and private valuation of goods and resources.

The second group of problems relate to the problems which arise during the plan implementation process itself and which are expressed in terms of factors such as overambitiousness and impressive design but with little real values in the development plans, data

problems, the prevalence of different uncertainties/disturbances in the economy, institutional weaknesses and lack of political determination.

Check your progress 3

The undesirable consequences of government policies can be explained in terms of the effects of the policies (distortions) on factor prices & employment creation, rural-urban imbalances, structure of the economy.

Check your progress 4

Yes, because 'integrated development planning' helps to bring all types of expertise required for preparing a realistic plan enriched with views from many dimensions of knowledge. It, therefore, helps to bridge the gap between 'economic development planning' and 'physical planning'.

Check your progress 5

In this respect, rationality refers to the general economic behavior expressed in terms of the utility maximizing behavior of consumers and the profit maximizing behavior of producers.

Check your progress 6

The best way to tackle this type of uncertainty problem is by conducting further research and collecting and analyzing information, despite the resource constraints.

Check your progress 7

Other than the ones mentioned, other conditions also can make the planning process more complex. For instance, detailed work in one stage may reveal the need to go back and reconsider earlier stages in the cycle. Specifically, during appraisal stage, for instance, a need may arise to reconsider basic policy objectives or to collect more data.

Check your progress 8

- Major problems that hinder progress during the planning process are usually associated with such factors as inadequate data, time, manpower on one hand and problems of communication and coordination between planners, politicians and administrators.

Review Exercise 1

1.FALSE 2.TRUE 3. FALSE 4. FALSE 5. TRUE 6. TRUE 7. TRUE

Chapter two

Check your progress 1

Such projects as huge hydroelectric power stations, irrigation projects, university establishments, etc provide huge opportunities for areadevelopments. Such projects, although they have their own unique objectives, give rise to the development of the surrounding area in terms of getting new roads, new residential quarters, new business centers, new

Check your progress 2

Project is about interrelated set of activities planned to be carried out at a specific location and within a predetermined period of time. A Program is also limited by time but it usually suggests sets of related activities which are not necessarily limited to a specific geographic location. It also has specific objectives and special resources allocated to it

Check your progress 3

- indicative planning
- Command socialist planning

- Planning by inducement

Check your progress 4

It is important because it requires to maintain consistency in the plan in order to achieve the targets set by the plan.

Review Exercise 2.1

2.a 1. E 2. A 3. D 4. C 5. E

Chapter three

Check your progress 1

Models are classified based on the degree of aggregation, the accounting frame in which the models are used, time, closure, behavior and coverage characteristics.

Check your progress 2

The national accounts data framework, also known as the System of National Accounts.

Check your progress 3

Consistency models are deterministic models and hence do not in general involve optimizing criteria. They guide the resource allocation process according to some predetermined objectives without examining whether such objectives are optimal.

Check your progress 4

Both the growth in the economy and the growth in the accumulation of the capital stock is determined by the ratio the saving rate (s) to the capital-output ratio (v).

Check your progress 5

The main idea explained by the Two-Gap model refers to the role of foreign savings (i.e. foreign exchange) to meet the shortfalls in domestic savings so as to enable the required level of investment, given an open economic system. Securing the required level of investment in turn ensures the attainment of the growth target indicated by the plan.

Review exercise 3.1

Q3. To calculate the ICOR (v), use the Harrod-Domar equation, which can be rewritten as $g \cdot v = \frac{1}{s}$. Thus, the ICOR was about 4.0.

Q4. $g \cdot v = s$ in order to solve for the required saving rate (s). In order to achieve an 8% growth rate, Indonesia would have to have a saving rate of 20%.

$$S = 0.8(2.5) = 0.2 = 20\%$$

Check your progress 6

The major purpose of the main sector models is to break down the aggregate growth and investments targets and assign them to the sectors available so that sectoral growth goes consistent with the national growth.

Review ex 3.2

Q3.iii

a) Using data in Table 2 we obtain a matrix of allocation coefficients denoted as B:

allocation coefficients	agriculture	production
agriculture	0.25	0.20
production	0.28	0.12

$$200 = 0.25 \cdot 200 + 0.28 \cdot 250 + 80$$

$$250 = 0.20 \cdot 200 + 0.12 \cdot 50 + 180$$

allows us construct the Ghosh system of equations:

$$x_1 = b_{11} \cdot x_1 + b_{21} \cdot x_2 + v_1$$

$$x_2 = b_{12} \cdot x_1 + b_{22} \cdot x_2 + v_2, (3)$$

where v_1, v_2 – primary factors.

1. Direct forward linkages are: $b_{11} + b_{12} = 0.25 + 0.20 = 0.45$ for agriculture;

$$b_{21} + b_{22} = 0.28 + 0.12 = 0.40 \text{ for production.}$$

Interpretation- Producing total output for 1 USD in agriculture creates in economy demand for 0.60 USD.

Equation $b_{11} + b_{12} = 0.45$ shows location of 1 USD agriculture product supply in economy as interindustry consumption:

$$x_1 + x_2 = (b_{11} + b_{12}) \cdot x_1 + (b_{21} + b_{22}) \cdot x_2 + (v_1 + v_2).$$

A similar interpretation may be given for direct forward linkage for production.

Equation $v_1 + v_2 = (1 - b_{11} - b_{12}) \cdot x_1 + (1 - b_{21} - b_{22}) \cdot x_2$ shows that sums $(1 - b_{11} - b_{12})$, $(1 - b_{21} - b_{22})$ are the value added multipliers.

For example, $1 - (b_{11} + b_{12}) = 1 - 0.45$ denotes the value added throughout all sectors of the economy that is associated with a 1 USD increase in total output of agriculture.

From system (3) the system (4) follows and the Ghosh inverse matrix denoted as

$$G: x_1 = g_{11} \cdot v_1 + g_{21} \cdot v_2, 200 = 1.4570 \cdot 80 + 0.4636 \cdot 180,$$

$$x_2 = g_{12} \cdot v_1 + g_{22} \cdot v_2, 250 = 0.3311 \cdot 80 + 1.2417 \cdot 180$$

Ghosh inverse G

	agriculture	production
agriculture	1.4570	0.3311
production	0.4636	1.2417

2. Total forward linkages are: $g_{11} + g_{12} = 1.4570 + 0.3311 = 1.7881$ for agriculture; $g_{12} +$

$$g_{22} = 0.4636 + 1.2417 = 1.7053 \text{ for production}$$

b) By using data in the table below we obtain a matrix of interindustry coefficients denoted as A:

	agriculture	production
agriculture	0.25	0.16
production	0.35	0.12

the balancing system:

$$200 = 0.25 \cdot 200 + 0.16 \cdot 250 + 110$$

$$250 = 0.35 \cdot 200 + 0.12 \cdot 250 + 150$$

ensures data for us to develop the direct input-output model:

$$x_1 = a_{11} \cdot x_1 + a_{12} \cdot x_2 + y_1,$$

$$x_2 = a_{21} \cdot x_1 + a_{22} \cdot x_2 + y_2.$$

(a_1) Direct backward linkages are:

$$a_{11} + a_{21} = 0.25 + 0.35 = 0.60 \text{ for agriculture;}$$

$$a_{12} + a_{22} = 0.16 + 0.12 = 0.28 \text{ for production.}$$

Interpretation: In the respective economy the producing total output for 1 USD in agriculture creates in economy demand for 0.60 USD.

The producing total output for 1 USD in production creates demand for 0.28 USD.

Another interpretation follows from system (1). If total output in agriculture decreases for 1 USD, ceteris paribus, than the summary final product increases for $(a_{11} + a_{21}) - 1$ dollars:

$$y_1 - 1 + a_{11} = (1 - a_{11}) \cdot (x_1 - 1) - a_{12} \cdot x_2$$

$$y_2 + a_{21} = -a_{21} \cdot (x_1 - 1) + (1 - a_{22}) \cdot x_2.$$

Analogous interpretation can be given for direct backward linkage for production. Equation

$y_1 + y_2 = (1 - a_{11} - a_{21}) \cdot x_1 + (1 - a_{12} - a_{22}) \cdot x_2$ shows that sums $(1 - a_{11} - a_{21})$, $(1 - a_{12} - a_{22})$ are the final product multipliers.

For example, $1 - (a_{11} + a_{21}) = 1 - 0.60$ denotes the final product throughout all sectors of the economy that is associated with a 1 USD increase in total output of agriculture. From system (1) the system (2) follows and the Leontief inverse matrix denoted as

$$: x_1 = s_{11} \cdot y_1 + s_{12} \cdot y_2, 200 = 1.4570 \cdot 110 + 0.2649 \cdot 150$$

$$x_2 = s_{21} \cdot y_1 + s_{22} \cdot y_2, 250 = 0.5795 \cdot 110 + 1.2417 \cdot 150,$$

Check your progress 7

SAM is different from Input-output framework because, unlike input-output, the SAM provides a comprehensive data framework which helps to analyze production and distribution relationships.

Check your progress 8

The major structural elements of SAM are provided in the rows as: factors of production, institutions, production activities, commodities, and external transactions.

Check your progress 9

Transaction T22 in Table 3.2 represents current and capital account transactions taking place among institutions.

Check your progress 10

For a maximization problem the constraints indicate limitations of resources for achieving the given objective.

Check your progress 11

The constraints in the dual represent the opportunity cost of producing a unit of each one of the products, in this case – agriculture and manufacture.

1. TRUE 2. FALSE 3. FALSE 4. TRUE 5. TRUE 6. TRUE

2. The matrix of input coefficients, A, and the final demand matrix Y are given as

	Electricity	Manufacturing		Final demand
Electricity	0.20		0.30	90,000
Manufacturing	0.30		0.40	120,000

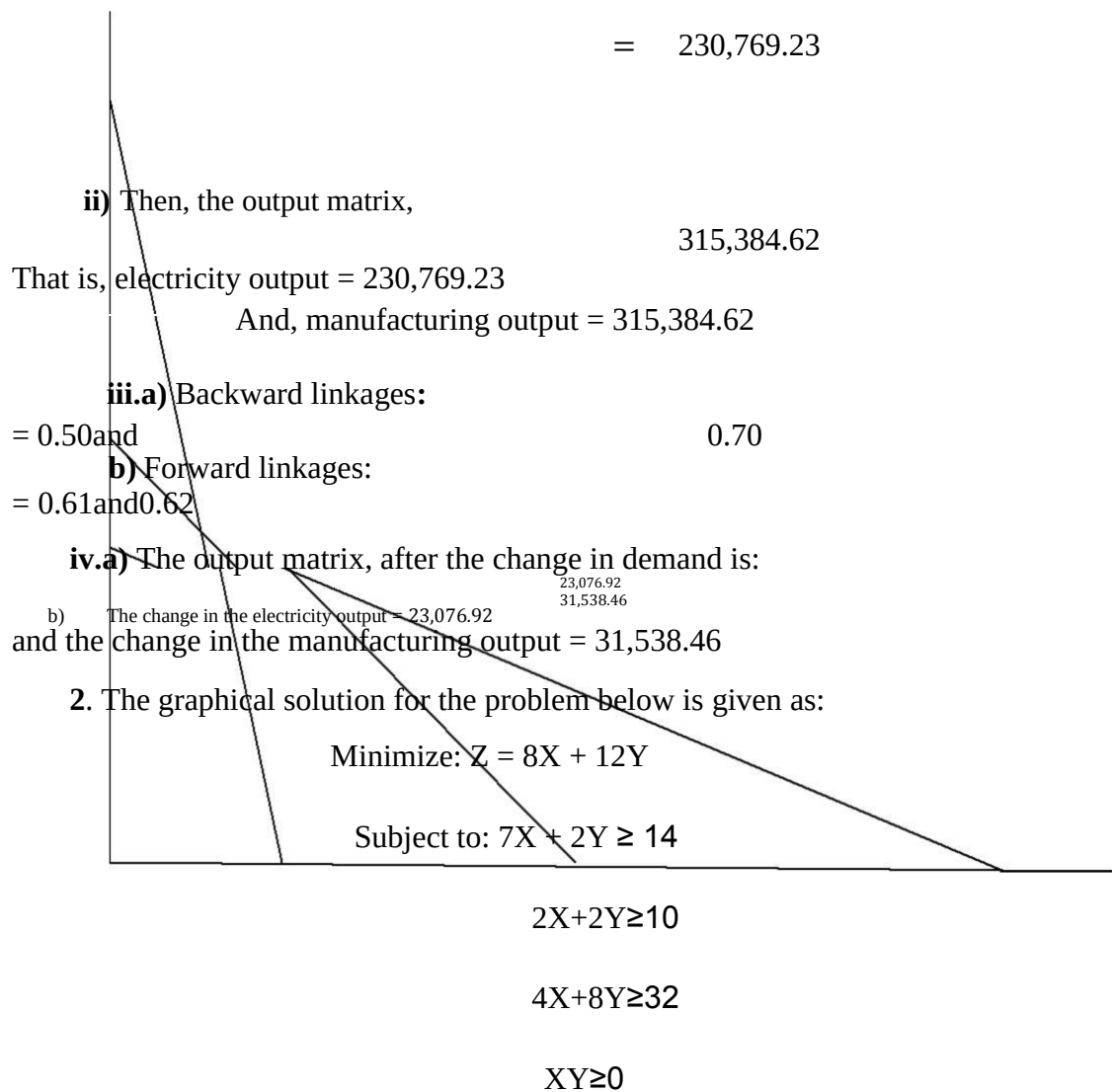
0.20 0.30

0.30 0.40

A =

And,

120,000



A(0,7)

B (4/5, 21/5)

C(2,37)

D(8,0)

0

2

5

8

After determining the Z-values at the corner points (i.e. A, B, C and D), the solution is found to be:

$$X=2, \quad Y=3, \quad Z=52$$

3. The solution for the maximization problem using the simplex method is given below.

$$\text{Maximize: } Z = 150X_1 + 80X_2$$

$$\text{Subject to: } X_1 + X_2 \leq 600$$

$$4X_1 + 2X_2 \leq 2000$$

$$X_1, X_2 \geq 0$$

After putting the equations in the standard form, the following three simplex tableaus can be constructed using the iterative procedure discussed.

Tableau I

Basis	X_1	X_2	Z	S_1	S_2	RHS
S_1	1	1	0	1	0	600
S_2	4	2	0	0	1	2000
Z	-150	-80	1	0	0	0

Tableau II

Basis	X_1	X_2	Z	S_1	S_2	RHS
-------	-------	-------	---	-------	-------	-----

S1	0	1/2	0	1	-1/4	100
X ₁	1	1/2	0	0	¼	500
Z	0	-5	1	0	37.5	75,000

Therefore, the solution is: $X_1 = 400$, $X_2 = 200$, and $Z = 76,000$

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**ASSIGNMENT FOR DEVELOPMENT PLANNING AND PROJECT
ANALYSIS I (ECON -4011)**

Name: _____

ID.No: _____

Department: _____

Center: _____

Date of submission: -----

INSTRUCTIONS

*This assignment is to be completed and send to AMU, College of Continuing &
Distance Education for Evaluation. Its maximum weight is 30% Make sure that your exam
contains nine (9) questions*

*Do not try to complete the assignment until you have covered all the lessons and
reviewed the study guide and your exercises and activities.*

Duplication from other will result total cancellation of your marks

After successfully completing this assignment, be certain to write your name,

ID. No and program on the cover page of your assignment.

PART ONE: ANSWER THE FOLLOWING QUESTIONS CLEARLY

- 1) Planning has been widely practiced in different parts of the world after the Second World War for varied reasons. What is the driving reason for planning in the developing world?
- 2) Before few years, Ethiopia has been implemented millennium development goal to bring about change. What type of planning is it?
- 3) Many people argue that planning in developing nations is not successful. Mention reasons that make planning difficult in those nations.
- 4) Ethiopia is affected by high rate of inflation and at the same time reduction of agricultural productivity is expected because of a pile of grass hopper attack. What should government do?
- 5) Mention the basic difference between financial planning and physical planning.
- 6) It has been argued among economists and others about the techniques of production. Many people suggest that these techniques should be employed based on the availability of resources (capital and labor) in the country. If so which technique is better for developing nations like Ethiopia? Do you have any different conception?
- 7) Harrod domar growth model is famous growth model till now. What are the determinants of economic development proposed by H-D?
- 8) Given the following I-O table

Sector	Agriculture	Industry	service	Final	Total
Agriculture	50	150	200	100	500
Industry	100	200	150	200	650
Service	200	100	300	150	750
Value added	150	200	100	0	450
Total input	500	650	750	450	2350

I. Calculate gross output of each sector

II. Backward and forward linkages

9. Clearly describe the main insight addressed by two gap model.