RVS AGRICULTURAL COLLEGE

(Affiliated to Tamil Nadu Agricultural University, Coimbatore - 3)

THANJAVUR – 613 402

Theory Notes (Lecture 1 to 17)

AEC 201- Farm Management, Production and Resource Economics

(1+1)

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AEC 201 Farm Management, Production and Resource Economics (1+1)

Theory

Unit 1: Production Economics and Farm Management - Nature and Scope

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.

Unit 2: Factor – Product, Factor – Factor and Product – Product Relationships

Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm. Factor-Product relationship. Meaning, Definition – Laws of Returns. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship - shut down and break-even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum. Factor – Factor relationship: Least Cost Combination of inputs; Product – Product relationship: Optimum Combination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

Unit 3: Farm Planning and Budgeting

Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting - linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Unit 4: Risk and Uncertainty in Agriculture Production

Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies**,** Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit 5: Resource Economics

Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources - Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights: Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities: meaning and types - positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions; Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns / opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crops – Estimation of costs and returns of livestock products. Preparation of farm plan and budget, farm records and accounts and profit and loss accounts. Break – even analysis- Graphical solution to Linear Programming problem. Collection and analysis of data on various resources in India.

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Theory lecture schedule

1. Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms.(1&2)
2. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.(3)
3. Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm.
4. Factor - Product relationship: Meaning, Definition – Laws of Returns: Classical production function and its characteristics. (4&5)
5. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship -shut down and break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income.
6. Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.
7. Factor – Factor relationship: Least Cost Combination of inputs.
8. Product – Product relationship: Optimum Combination of Products – Principle of Equi –Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.
9. **Mid Semester Examination.**
10. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.
11. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.
12. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting - linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.
13. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies.
14. Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.

15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources.
16. Natural Resources Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights – Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities: meaning and types - positive and negative externalities in agriculture,
17. Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical Schedule

1. Preparation of farm layout. Determination of cost of fencing of a farm.
2. Computation of depreciation and cost of farm assets: Valuation of assets by different methods.
3. Application of equi - marginal returns / opportunity cost principle in allocation of farm resources.
4. Determination of most profitable level of inputs use in a farm production process.
5. Determination of least cost combination of inputs.
6. Selection of most profitable enterprise combination.
7. Application of cost principles including CACP concepts in the estimation of cost of cultivation and cost of production of agricultural crops.
8. Estimation of cost of cultivation and cost of production of perennial crops / horticultural crops.
9. Estimation of cost of returns of livestock products.
10. Preparation of farm plan and budget.
11. Farm records and accounts: Usefulness, types of farm records: farm production records and farm financial records.
12. Preparation of Cash flow statement
13. Preparation and Analysis of Net worth Statement and Profit and Loss statement
14. Estimation of Break – even analysis.
15. Graphical solution to Linear Programming problem.
16. Collection and analysis of data on various resources in India.
17. **Final Practical Examination.**

Agricultural Production Economics: Basic Concepts

1. **Farm:** It is a piece of land, where crop and livestock enterprises are taken up under a single management and his specific boundaries.
2. **Production:** The process through which some goods and services called inputs are transformed into other goods called products or output.
3. **Production Function:** A systematic and mathematical expression of the relationship among various quantities of inputs or input services used in the production of a commodity and the corresponding quantities of output is called a production function.
4. **Continuous Production Function:** This function arises for those inputs which can be divided into smaller doses. Continuous variables can be known from measurement, for example, seeds and fertilizers, etc.
5. **Discontinuous or Discrete production function:** This function arises for those inputs or work units which cannot be divided into smaller units and hence are used in whole numbers. For example, number of ploughings, weedings and harvestings, etc.
6. **Short Run Production period:** The planning period during which one or more of the resources are fixed while others are variable resources. The output can be varied only by intensive use of fixed resources. It is written as Y=f (X1, X2 / X3…..Xn) where Y is output, X1, X2 are variable inputs and X3…..Xn are fixed inputs.
7. **Long Run Production period:** The planning period during which all the resources can be varied. It is written as Y=f (X1, X2 ,…..Xn)
8. **Technical Coefficient:** The amount of input per unit of output is called technical coefficient.
9. **Resources:** Anything that aids in production is called a resource. The resources physically enter the production process.
10. **Resource Services:** The work done by a person, machine or livestock is called a resource service. Resources do not enter the production process physically.
11. **Fixed Resources:** The resources that remain unchanged irrespective of the level of production are called fixed resources. For example, land , building, machinery. These resources exist only in short run. The costs associated with these resources are called fixed costs.

12. **Variable Resources:** The resources that vary with the level of production are called variable resources. These resources exist both in short run and long run. For example, seeds, fertilizers, chemicals, etc. The costs associated with these resources are called variable costs.
13. **Flow Resources:** The resources that cannot be stored and should be used as and when these are available. For example, services of a labourer on a particular day.
14. **Stock Resources:** The resources that can be stored for use later on. For example, seeds. Defining an input as a flow or stock depends on the length of time under consideration. For example, tractor with 10 years life is a stock resources if we take the services of tractor for its entire useful life of 10 years. But it also provides its service every day, therefore it is a flow resources.
15. **Production Period:** It is the time period required for the transformation of resources or inputs into products.
16. **Farm Entrepreneur:** Farm entrepreneur is the person who organizes and operates the farm business and bears the responsibility of the outcome of the business.
17. **Farm Business Manager:** Person appointed by the entrepreneur to manage and supervise the farm business and is paid for the services rendered. He/she carries out the instructions of the entrepreneur.
18. **Productivity:** Output per unit of inputs is called the productivity.
19. **Technical Efficiency:** It is the ratio of the physical output to inputs used. It implies the using of resources as effectively as possible without any wastages.
20. **Economic Efficiency:** It is the expression of technical efficiency in monetary terms through the prices. In other words, the ratio of value of output to value of inputs is termed as economic efficiency. It implies maximization of profits per unit of input.
21. **Allocative Efficiency:** It occurs when no possible reorganization of resources/production can make any combination higher yielding without making other combination less yielding. It refers to resource use efficiency.
22. **Optimality:** It is an ideal condition or situation in which costs are minimum and/or profits maximum.

23. **Cost of Cultivation:** The expenditure incurred on all inputs and input services in raising a crop on a unit area is called cost of cultivation. It is expressed as rupees per hectare or rupees per acre.
24. **Cost of Production:** The expenditure incurred in producing a unit quantity of output is known as cost of production, for example, Rs./kg of Rs./quintal.
25. **Independent Variable:** Variable whose value does not depend on other variables and which influences the dependent variable, is termed as independent variable, for example, land, labour and capital.
26. **Dependent Variable:** Variable whose value depends on other variables is termed as dependent variable, for example, crop output.
27. **Slope of a line:** It represents the rate of change in one variable that occurs when another variable changes. Slope varies at different points on a curve but remains same on all points on a given line. It is the rate of change in the variable on vertical axis per unit change in the variable on horizontal axis and is expressed as a number.
28. **Total Physical Product:** Total amount of output obtained by using different units of inputs measured in physical units, for example, kg, tonnes, etc.
29. **Average Physical Product (APP):** Output per unit of input on an average is termed as APP and is given by Y/X.
30. **Marginal Physical Product:** Addition to total output obtained by using the marginal unit of input and is measured as $\Delta Y/\Delta X$.

Lecture 1: Meaning and Concept of Farm Management, Objectives and Relationship with Other Sciences. Meaning and Definition of Farms, its Types and Characteristics, Factors determining types and size of farms.

Farm Management

Meaning

Farm Management comprises of **two words i.e. Farm and Management.**

Farm means a **piece of land where crops and livestock enterprises are taken up under common management and has specific boundaries.**

Farm is a socio economic unit which not only provides income to a farmer but also a source of happiness to him and his family. It is also a decision making unit where the farmer has many alternatives for his resources in the production of crops and livestock enterprises and their disposal. Hence, the farms are the micro units of vital importance which represents centre of dynamic decision making in regard to guiding the farm resources in the production process.

The welfare of a nation depends upon happenings in the organisation in each farm unit. It is clear that agricultural production of a country is the sum of the contributions of the individual farm units and the development of agriculture means the development of millions of individual farms.

Management is the **art of getting work done out of others working in a group.**

Management is the process of designing and maintaining an environment in which individuals working together in groups accomplish selected aims.

Management is the key ingredient. The manager makes or breaks a business. Management takes on a new dimension and importance in agriculture which is mechanised, uses many technological innovations, and operates with large amounts of borrowed capital.

The prosperity of any country depends upon the prosperity of farmers, which in turn depends upon the rational allocation of resources among various uses and adoption improved technology. Human race depends more on farm products for their existence than anything else since food, clothing – the prime necessaries are products of farming industry. Even for industrial prosperity, farming industry forms the basic infrastructure. Thus the study farm management has got prime importance in any economy particularly on agrarian economy.

Definitions

Various authors defined farm management in different ways as presented below:

- *Farm management is defined as the science that deals with the organisation and operation of the farm in the context of efficiency and continuous profits.* ***(J.N.Efferson)***
- *Farm management is defined as the science of organization and management of farm enterprises for the purpose of securing the maximum continuous profits.* ***(G.F. Warren)***
- *The art of managing a Farm successfully, as measured by the test of profitableness is called farm management.* ***(L.C. Gray)***
- *Farm management is defined as the art of applying business and scientific principles to the organization and operation of the farm* ***(Andrew Boss).***
- *Farm management is the decision making process whereby limited resources are allocated to a number of production alternatives to organize and operate the business in such a way to attain some objectives* ***(Ronald D.Kay)***
- *Farm management is a branch of agricultural economics which deals with wealth earning and wealth spending activities of a farmer, in relation to the organization and operation of the individual farm unit for securing the maximum possible net income.* ***(Bradford and Johnson)***
- ***L.A. Moorehouse and W.J. Spillman*** *defined farm management "as a study of the business phase of farming".*
- *Farm management, as the sub-division of economics, which considers the allocation of limited resources within the individual farm, is a science of choice and decision making and thus a field requiring studied judgment* ***(Heady and Jensen).***

The most acceptable definition of farm management is given below

Farm Management is a science that deals with the organization and operation of a farm as a firm from the point of view of continuous maximum profit consistent with the family welfare of the farmer.

Thus, in an environment where a farmer desires to achieve objectives like profit maximization and improvement of family standard of living with a limited stock of factors of production which can be put to alternative uses, farm management is an essential tool.

Nature of Farm Management

Farm management deals with the business principles of farming from the point of view of an individual farm. Its field of study is limited to the individual farm as a unit and it is interested in maximum possible returns to the individual farmer. It applies the local knowledge as well as scientific finding to the individual farm business.

Farm management in short called as a **science of choice or decision making.**

Scope of Farm Management

Farm Management is generally considered to be **MICROECONOMIC** in its scope. It deals with the allocation of resources at the level of individual farm. The primary concern of the farm management is the farm as a unit.

Farm Management deals with decisions that affect the profitability of farm business. Farm Management seeks to help the farmer in deciding the problems like what to produce, buy or sell, how to produce, buy or sell and how much to produce etc. It covers all aspects of farming which have bearing on the economic efficiency of farm.

The subject of farm management includes farm management research, training and extension.

a) Farm Management Research

It involves recording and analyzing data on farm, activities. It facilitates to identify the constraints and opportunities in efficient functioning of the farm. Farm efficiency at a particular point of time is applicable only to the given socioeconomic situation at the point of time. Since the socioeconomic situations are dynamic in nature, continuous research in farm management is needed to identify emerging problems and finding solutions. The important areas of farm research are:

i) Delineation of homogenous areas like agro-climatic zones to facilitate research and extension.
ii) Generation of input-output coefficients and working out comparative economics of various farm enterprises.
iii) Formulation of standard farm plans and optimum cropping patterns for different areas and types of farming.
iv) Developing suitable models of mechanization and modernization and
v) Evaluation of agricultural policies.

b) Farm Management Teaching

With the advent of technological innovations in agriculture, decisions making become more complex. Farmers have many choices with regard to crops, varieties, carrying out operations, marketing etc. In this context to help **farm managers to take right decisions, farm management teaching is very much essential.** In this wake of liberalization of the economy the subject has become more relevant than ever before.

c) Farm Management Extension

It is necessary to help the farmers to take decisions like what to grow, how much to grow, when and where to buy and sell etc. **Farmers need to be trained to adopt the results of farm management research to increase the efficiency of farm operations.**

Thus research, teaching and extension will together improve the ability of farmers to make desirable changes in the utilization of scarce resources at the farm in a better way. Ultimately it will lead to higher income and better standard of living to the farmers and farm families.

Objectives of Farm management

1. To examine the production pattern and resource use on the farm.
2. To identify, factors responsible for present production pattern and resource use in the farm.
3. To determine the conditions of optimality, in the resource use and the production pattern.
4. To analyze the extent of sub-optimality in the resource use on the farm.
5. To suggest ways and means in getting the present use of resources to optimality on the farm.

Relationship of Farm Management with Other Sciences

The Farm Management integrates and synthesises diverse piece of information from physical and biological sciences of agriculture.

The physical and biological sciences like Agronomy, animal husbandry, soil science, horticulture, plant breeding, agricultural engineering provide input-output relationships in their respective areas in physical terms i.e. they define production possibilities within which various choices can be made. Such information is helpful to the farm management in dealing with the problems of production efficiency.

Farm Management as a subject matter is the application of business principles n farming from the point view of an individual farmer. It is a specialised branch of wider field of economics. The tools and techniques for farm management are supplied by general economic theory. The law of variable proportion, principle of factor substitution, principle of product substitution are all instances of tools of economic theory used in farm management analysis.

Statistics is another science that has been used extensively by the agricultural economist. This science is helpful in providing methods and procedures by which data regarding specific farm problems can be collected, analysed and evaluated.

Psychology provides information of human motivations and attitudes, attitude towards risks depends on the psychological aspects of decision maker.

Sometimes philosophy and religion forbid the farmers to grow certain enterprises, though they are highly profitable. For example, islam prohibits muslim farmer to take up piggery while Hinduism prohibits beef production.

The various pieces of legislation and actions of government affect the production decisions of the farmer such as ceiling on land, support prices, food zones etc.

The physical sciences specify what can be produced; economics specify how resources should be used, while sociology, psychology, political sciences etc. specify the limitations which are placed on choice, through laws, customs etc.

Economic Principles applied to Farm Management

The outpouring of new technological information is making the farm problems increasingly challenging and providing attractive opportunities for maximizing profits. Hence, the application of economic principles to farming is essential for the successful management of the farm business.

Some of the economic principles that help in rational farm management decisions are:

1. **Law of Variable Proportions or Law of Diminishing Returns:** It solves the problems of how much to produce? It guides in the determination of optimum input to use and optimum output to produce. It explains the one of the basic production relationships viz., factor-product relationship
2. **Cost Principle:** It explains how losses can be minimized during the periods of price adversity.
3. **Principle of Factor Substitution:** It solves the problem of 'how to produce? It guides in the determination of least cost combinations of resources. It explains factor-factor relationship.
4. **Principle of Product Substitution:** It solves the problem of 'what to produce?' It guides in the determination of optimum combination of enterprises (products). It explains Product-product relationship.
5. **Principle of Equi-Marginal Returns:** It guides in the allocation of resources under conditions of scarcity.
6. **Time Comparison Principle:** It guides in making investment decisions.
7. **Principle of Comparative Advantage:** It explains regional specialisation in the production of commodities.

Farm

Meaning

Farm means a piece of land where crops and livestock enterprises are taken up under common management and has specific boundaries.

Definition

Farm can defined as specified area of land used for crop and animal husbandry.

Types

On the basis of purpose, degree of independence and size of farm can be classified in to six types:

Type 1: Small subsistence-oriented family farms.

Type 2: Small semi-subsistence or part-commercial family farms, usually of one half to two hectares, but area is not a good criterion: the same basic structure can be found on much larger 20- to 30-hectare farms as in the Punjab, Sind, and North West Frontier Provinces of Pakistan.

Type 3: Small independent specialized family farms.

Type 4: Small dependent specialized family farms, often with the family as tenants.

Type 5: Large commercial family farms, usually specialized and operated along modified estate lines.

Type 6: Commercial estates, usually mono-crop and with hired management and absentee ownership.

Each of the six farm types is discussed below.

I. Small subsistence-oriented family farms

This can be subcategorized in two types:

(a) Simple: Having single component one or two crops or livestock.

(b) Mixed: Having one or two crops with one or two livestock.

- This type of farm is rarely self sufficient
- Farm produces mainly used for family consumption.

II. Small semi-subsistence or part-commercial family farms

The farm producing mainly for self-consumption but also selling a certain part of the production in which the “surplus” part that is sold has a degree of regularity and consistency.

III. Small independent specialized family farms

This type can further classified in three classes

(a). Commercial: farm produce is used for selling to generate income.

(b). Part-commercial: farm produce is used for dual purpose mainly for family consumption some part for selling to generate income.

(c). Near-subsistence: Farm produce is mainly used for family consumption, barter good (Exchanging produce with other to get other usable good which can't be produced or purpose) and very little part is used for selling to generate income.

IV. Small dependent specialized family farms

This is similar to type 3 in all except high degree of activity specialization and the lack of real decision-making power possessed by the farm family due to the following factors.

a) **Terms of tenancy:** Tenant farmers are often obliged to produce one or more specific crop or livestock products, as dictated in a landlord-tenant agreement.
b) **Structural integration:** In this situation small family farms are integrated more or less closely as the production arm of some larger farming cum processing system.
c) **Debt:** Some agro-industrial units (such as milk processing plants) often provide farmers with input factors (such as cattle, feed and technical assistance) in order to achieve a regular or higher quality supply of their needed raw material (e.g., milk).
d) **Government policy directives:** In some countries, farmers' lack of independence in production decision making is the result of government power to issue production directives.
e) **Lack of alternative market outlets:** Absence of any real independence in management can also be due to lack of alternative market outlets, especially when the product is too bulky or fragile to be transported far from the farm.

V. Large commercial family farms

Primary beneficiaries are family member rather than shareholders and objective is profit or utility maximization through market sales. This is most dynamic of the six farm types discussed here.

They fall into two subtypes.

The first consists of **mono-crop farms** which are at the fringe of the estate sector proper and which are usually dependent on this estate sector for research, availability of new crop varieties and often for processing and marketing facilities.

The second subtype consists of either **mono-product or mixed farms** which are not part of any estate sector but are organized along commercial lines, e.g., using hired labour, being dependent on purchased rather than farm-produced inputs and, except in the case of tree-crop farms, adjusting the activity or activity mix according to commercial opportunity.

VI. Commercial estates

Commercial estates are generally mono-crop in nature. They are largely a colonial legacy, first established to provide cheap raw materials (and later some food and beverage products) to the industries of Europe and North America.

The chief characteristics of this farm type are as follows:

Crops: The main crops on which Type 6 farms were initially based are rubber, sugar, cinchona, cacao, tea, coffee, cinnamon, cloves, nutmeg, coconut and the coarse fibres.

On-estate processing: Primary processing is an integral part of the operation of most estates (e.g., tea manufacture, sheet and crepe rubber production, copra curing). This requires a high level of capital investment which, to be fully utilized, requires a flow-type of operation rather than a batch-type.

Size: Estate size is commonly from 200 to 2000 hectares but area itself is not an important criterion.

Marketing: Marketing plays a very important role in estate operations. Most estates are jealous of their product reputation or 'mark' and make deliberate attempts at product differentiation. They also maintain close contact with buyers and monitor demand trends.

Management: Management play important role in resource allocation in multiproduct commercial estate system in most beneficial manner to maximize benefit of stake holder than in case of small family operated farm so commercial estate are more complex than other small farm.

Size of farm

1. **Marginal** **:** Below one hectare
2. **Small** **:** Between 1 to 2 hectares
3. **Semi-medium** **:** Between 2 to 4 hectares
4. **Medium** **:** Between 4 to 10 hectares
5. **Large** **:** 10 hectares and above

Factors Influencing types and Size of Farm

1. **Population:** Density of the population affects the size of the farm i.e., pressure of population reduces the size of farm. In India as population is increasing the size of farm is decreasing. Thereby affecting the viability of the very farm business.
2. **Availability of funds:** farmers with greater amount of funds can not only run the farms successfully, but are in a position to acquire additional land through purchase.
3. **Climate:** Congenial nature of climate facilitates diversification of farming which increases the size of farm business.

4. **Managerial abilities:** farmers with good management skills can operate large farms. Size of the farm is affected by the managerial skills.
5. **Land ceilings:** Ceilings on land impose limits on the size of holdings as indicated by the state laws.
6. **Availability of Irrigation Water:** Under the irrigated conditions generally large farms can be operated. Between tank and canal irrigated farms against well irrigated farms, the farmer can run be run economically from the point of view of pumping costs. When these two sources of irrigation are compared, relatively large areas can be put under cultivation in the areas served by canals and tanks.
7. **Extensive and intensive cultivation:** In extensive cultivation, large areas can be put under plough; while in intensive cultivation the size of farm is small.
8. **Technology to be adopted:** In land saving technology, the size of holding declines as the given land is distributed among children.
9. **Perishability and Durability of commodities:** Perishability of the commodities limits the area under cultivation as in the case of vegetables, while durability of the commodities encourages large scale farming.
10. **Law of Inheritance:** Because of law inheritance, the size of holding declines as the given land is distributed among children.

Agricultural Production Economics

Agricultural production economics is a field of specialization with in the subject of agricultural economics. ***It is concerned with the selection of production pattern and resource use efficiency, in order to optimize the objective function of farming community or the nation within the framework of limited resources.***

The goals of Agricultural Production Economics are:

1. To provide guidance to individual farmers in using their resources most efficiently.
2. To facilitate most efficient use of resources from the stand point of economy.

Definition:

Agricultural production economics is an applied field of science where in the **principles of choice are applied to the use of capital, labor, land and management resources in the farming industry.**

Nature and Scope of Production Economics:

Agricultural production economics involves analysis of production relationships and principles of rational decisions in order to optimize the use of farm resources on individual farms and to rationalize the use of inputs from nation's point of view. The primary interest is to apply economic logic to problems that occur in agriculture.

Agricultural production economics is concerned with productivity of inputs; **as a study of resource productivity, it deals with resource use efficiency, resource combination, resource allocation, resource management and resource administration.**

The subject matter of production economics involves topics like factor – product relationships, size of farm, returns to scale credit and risk uncertainty.

Production economics is concerned with two broad category of decisions in the production process:

1. How to organize resources in order to maximize the production of a single commodity, i.e., choice making among various alternative ways of using resources.
2. What combination of different commodities to produce?

Objectives:

1. To determine and outline the conditions, which are the optimum use of the capital, labor, land and management resources, in the production of crops and livestock.
2. To determine the extent to which the existing use of resources deviates from optimum use.
3. To analyze the forces which condition the existing production pattern and resource use.
4. To explain, means and methods, in getting from the existing use to optimum use of resources.

Agricultural Production Economics (Versus) Farm Management

Following are the differences between agricultural production economics and farm management.

S.No	Agricultural Production Economics	Farm Management
1.	It is a science in which the principles of choice are applied to the use of land, capital, labour and management of resources in the farming industry	It is a science of organization and operation of farm with a view to earn continuous profit
2.	It is a specialized branch of agricultural economics	It is an integral part of agricultural production economics
3.	It is microeconomic in its scope as it deals with the problems of farming industry	It is microeconomic in its scope as it is concerned with the problems of individual farms
4.	It deals with allocative efficiency of the use of resources in agriculture	It deals with economic efficiency at the farm level
5.	It is an inter-farm study	It is an intra-farm study

Lecture 2: Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming

Farming may be classified on the basis of similarity in (a) crop production and livestock rearing and (b) the mode of economic and social functioning.

Based on the above factors, farming is classified into two groups:

1. Types of farming
2. Systems of farming

According to Johnson the ***type of farming*** refers to the when farms in a group are quite similar in the kinds and proportions of the crops and livestock that are produced and the methods and practices followed in production.

According to Johnson the ***system of farming*** refers to the combination of products on a given farm and the methods or practices that are used in the production of the product.

Types of Farming: Farming is classified into the following types based on the enterprise and income.

1. Specialised farming
2. Diversified farming
3. Mixed farming
4. Ranching
5. Dry farming

I. Specialised Farming:

When a farm business unit derives more than 50 per cent of its income from a single enterprise it is called as specialized farm. This means that among the possible crops or livestock enterprise taken up by a farmer, one particular crop or livestock enterprise contributes more than 50 per cent of the income. The reasons for specialized farming are; 1) assured income from the enterprise; 2) its suitability to the area; 3) its relative probability, etc. The examples that can be cited are paddy farming, sugarcane farming, etc., among crop enterprises and poultry, sheep farming, fish farming, etc., among livestock enterprises.

Advantages:

1. Better use of land: It is more profitable to grow a crop on a land best suited to it.
2. Better marketing: It allows better assembling, grading, processing, storing,

transport and financing of the produce.

3. Better management: The fewer enterprises on a farm are liable to be less neglected and sources of wastage can easily be detected.
4. Efficiency and skill are increased.
5. Costly and efficient machinery can be kept.
6. Less equipment and labour are needed

Disadvantages:

1. There is a greater risk of failure of crop and market together ruining the farmer.
2. Productive resources are not fully utilized.
3. Soil fertility cannot be maintained
4. By products cannot be fully utilized for lack of sufficient livestock on the farm.
5. Income is received once or twice in a year
6. Knowledge about enterprises becomes limited.

II. Diversified Farming:

It is also known as general farming. Here farming is diversified i.e., a number of enterprises are taken up on the farm at the same time. When a farm is organized to produce several products (commodities), each of which is itself a direct source of income, the farm business is said to be diversified. In diversified farming, no single enterprise contributes 50% of the total farms income.

Advantages:

1. Better utilization of productive resources.
2. Reduction of risks.
3. Regular and quicker returns.
4. Proper utilization of by-products.

Disadvantages:

1. Market in insufficient unless the producers arrange for sale of the produce.
2. Supervise only limited number workers.
3. Expensive implements and machinery for each enterprise in not possible.
4. Changes of the leaks of farm business may remain undetected.

III. Mixed Farming:

It represents a type of farming in which crop production and livestock production are combined to sustain and satisfy as many needs of the farmer as possible. There are limits specified regarding contribution of livestock production, poultry, fisheries, bee

keeping, etc., to the gross income on the farm. These enterprises are supposed to contribute at least 10 per cent of gross income. However, this contribution should not exceed 49 per cent.

Advantages:

1. Maintenance of soil fertility
2. Proper use of by products
3. Facilitates intensive cultivation
4. Higher income
5. Milch cattle provide drought animals.
6. Employment of labour.

IV. Ranching:

The practice of grazing animals on public lands is called **ranching.** Ranch land is not used for rising of crops. Ranching is followed in Australia, America and Tibet.

V. Dry farming: Cultivation of crops in regions with annual rainfall of less than 750 mm. Crop failure is most common due to prolonged dry spells during crop period. **Dry land farming:** Cultivation of crops in regions with annual rainfall of more than 750mm. Moisture conservation practices is necessary for crop production. **Rain fed farming:** Cultivation of crops in regions with an annual rain fall of more than 1150 mm.

Factors affecting Types of Farming:

I. Physical factors: Climate, soils, topography.

II. Economic factors:

1. Marketing cost
2. Relative profitability of enterprises
3. Availability of capital
4. Availability of labour
5. Land values
6. Cycles over and under production
7. Competition between enterprises
8. Personal likes and dislikes of farmer
9. Prevalence of pest and diseases, etc.

III. Social Factors: The kind of people in the community and the provision of protection of crops against the hazards of bird and animal ravages may influence the farming community to change the pattern of cropping. The co-operative spirit in providing security to crops, benefits resulting from low transport costs through collective sale and better marketing facilities permit

farmers to expand some enterprises like fruit farming, dairying or poultry rearing.

Systems of Farming:

The system of farming refers to the organizational set up under which farm is being run. It involves questions like who is the owner of land, whether resources are used jointly or individually and who makes managerial decisions.

Systems of farming, which are based on different organizational set up, may be classified into five broad categories:

1. Capitalistic farming
2. State farming
3. Collective farming
4. Peasant farming
5. Co-operative farming

1. Capitalist or Estate farming:

In what is known as capitalistic or estate or corporate farming, land is held in large areas by private capitalists, corporations or syndicates. Capital is supplied by one or a few persons or by many, in which case it runs like a joint stock company. In such farms, the unit of organization is large and the work is carried on with hired labour; latest technical know-how used and extensive use of machines is are made and hence they are efficient. Examples of this type of farming are frequently found in USA, Australia, Canada and few in India too. Such types of farms have been organized in the states of Bombay, Madras and Mysore for the plantation of coffee, tea and rubber and sugarcane.

The advantages of such farming are good supervision, strong organizational set up, sufficient resources etc. Their weaknesses are that it creates socio-economic imbalances and the actual cultivator is not the owner of the farm.

2. State farming:

State farming as the name indicates is managed by the government. Here land is owned by the state. The operation and management is done by government officials. The state performs the function of risk bearing and decision making, which cultivation is carried on with help of hired labour. All the laborers are hired on daily or monthly basis and they have no right in deciding the farm policy. Such farms are not very paying because of lack of incentive. There is no dearth of resources at such farms but s sometimes it so happens that they are not available in time and utilized fully.

3. Collective farming:

The name, collective farming implies the collective management of land where in

large number of families or villagers residing in the same village pool the resources eg: land, livestock, and machinery. A general body having the highest power is formed which manages the farms. The resources do not belong to any family or farmer but to the society or collective.

Collective farming has come into much prominence and has been adopted by some countries notably by the Russia and China. The worst thing with this system is that the individual has no voice. Farming is done generally on large scale and thereby is mostly mechanized. This system is not prevalent in our country.

4. Peasant farming:

This system of farming refers to the type of organization in which an individual cultivator is the owner, manager and organizer of the farm. He makes decision and plans for his farm depending upon his resources which are generally meager in comparison to other systems of farming. The biggest advantage of this system is that the farmers himself is the owner and therefore free to take all types of decisions. A general weakness of this system is that the resources with the individual are less. Another difficulty is because of the law of inheritance. An individual holding goes on reducing as all the members in the family have equal rights in that land.

5. Cooperative farming:

Co-operative farming is a voluntary organization in which small farmers and landless laborers increase their income by pooling land resources. According to planning commission, Co-operative farming necessarily implies pooling of land and joint management. The working group on co-operative farming defines a co-operative farming society as “a voluntary association of cultivators for better utilization of resources including manpower and pooled land and in which majority of the members participate in farm operation with a view to increasing agricultural production, employment and income.”

A co-operative farming society makes one of the following four forms

I. Co-operative better farming

II. C-operative Joint farming

III. Co-operative tenant farming

IV. Co-operative collective farming

I. Co-operative better farming:

These societies are based on individual ownership and individual operation. Farmers who have small holdings and limited resources join to form a society for some specific purpose eg: use of machinery, sale of product. They are organized with a view to introduce improved methods of agriculture. Each farmer pays for the services which

he receives from the society. The earnings of the member from piece of land, after deducting the expenses, his profit.

II. Co-operative Joint farming:

Under this type, the right of individual ownership is recognized and respected but the small owner's pool their land for the purpose of joint cultivation. The ownership is individual but the operations are collective. The management is democratic and is elected by the members of the society. Each member working on the farm receives daily wages for his daily work and profit is distributed according to his share in land.

III. Co-operative tenant farming:

Such societies are usually organized by landless farmers. In this system usually land belongs to the society. The land is divided into plots which are leased out for cultivation to individual members. The society arranges for agricultural requirements eg: credit, seeds, manures, marketing of the produce etc. Each member is responsible to the society for the payments of rent on his plot. He is at liberty to dispose of his produce in such a manner as he likes.

IV. Co-operative collective farming:

Both ownership and operations under this system are collective. Members do not have any right on land and they cannot take far Ming decisions independently but are guided by a supreme general body. It undertakes joint cultivation for which all members pool their resources. Profit is distributed according to the labour and capitals invested by the members.

System of farming		**Type of ownership**	**Types of Operation**
I	**Co-operative farming**	**-**	**-**
a	Co-operative better farming	Individual	Individual
b	Co-operative joint farming	Individual	Collective
c	Co-operative tenant farming	Collective	Individual
d	Co-operative collective farming	Collective	Collective
II	**Collective farming**	Society/state	Society/State
III	**Capitalistic farming**	Individual	Individual
IV	**State farming**	State	Paid Management
V	**Peasant farming**	Individual	Individual

Lecture 3: Principles of Farm Management: Concept of Production Function and its characteristics and its type, use of production function in Decision-Making on a Farm.

Production function

The mathematical expression or technical relationship between input and output is known as production function.

It indicates the amount of output obtained from a given amount of input, at a given level of technology during given period of time. Since the amount of output depends on the quantities of input(s), the output is a dependent variable and inputs are independent variables.

For example, the output of rice depends on the area under rice (land), quantity of seeds (plants), water, manures, fertilizers, human labour, and other inputs applied during the production process.

The relationship between rice yield and the inputs can be written as.

R= f (L, S, W, M, F, H)

Where, R = rice output, L,S,W,M,F and H represent the input-land, seeds, water, manures, fertilizer and human labour, respectively. **Traditionally the alphabet 'Y' is used to denote output and 'X' to denote input**

$$Y= f(X_1, X_2, X_3, X_4, X_5 ……..Xn)$$

Types of Production Function

Short Run Production function (vs) Long Run Production function

Short run production function is obtained when at least one input is held at constant level ie., one input is fixed.

In the production function Y= f (X_1, X2, /X_3), the inputs before/ie X_1 and X_2 are variable and X_3(land) is fixed. This means that the output 'Y' can be increased by increasing labour and capital inputs when land areas is held at constant level.

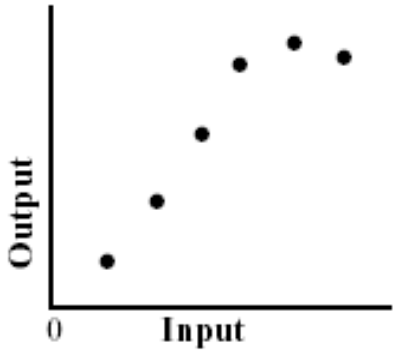
The **long run production function** is one in which all inputs are variable. In the long run, producers can increase the output by increasing all inputs.

Continuous (vs) Discontinuous Production Function

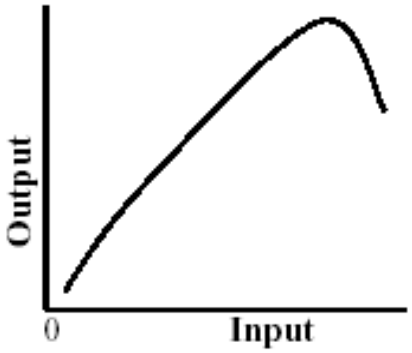
Continuous function: The doses or levels of input and output can be split up into small units.

Eg. Fertilizers or Seed can be applied to a hectare of land in quantities ranging from a fraction of a kilogram up to hundreds of kilogram.

Discontinuous or Discrete function: Such a function is obtained for input or factors or work units which are used or done in whole numbers such as one ploughing or a number of ploughings.



Discrete Production Function



Continuous Production Function

Forms of Production Function: The technical functional relationship between resources/inputs and product can be expressed by a functional form, a few of which are given below:

1) Linear Production Function: The simplest form of linear production function is

$Y = a_0 + bx_n$ with **one variable input** and

$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + ... + b_nX_n$ **with n variables.**

Symbolically, $Y = a + \sum_{i=1}^{n} b_i x_i$

Where,

Y is output,

a = constant,

b_i = unknown parameters which are to be estimated (Coefficients/Marginal products) and

X_i = variable inputs.

The function shows the constant rate of return. Inputs are perfect substitute, so elasticity of substitution is infinite.

For Example - The estimated equation is:

- $Y = 1300 + 5 X$ (**Single variable)**

This shows that 1300 kg of product can be produced without applying input. And the output increases by 5kg for every increase of 1kg of input.

- $Y = 0.2151 + 0.0412X_1 - 0.0002X_2 + 0.0752X_3 - 0.0066X_4 - 0.0880X_5$ (**Multi variable)**

R^2 = 0.64; F = 3.56.

The values of X_i's indicate the rate of change in Y due to one unit change in X_i's. For example, an unit change in X_1 results in 0.0412 units increase in Y, and an unit change in X_2 results in 0.0002 unit decrease in Y.

2) Cobb-Douglas Production Function (or) Power Function or Double log production function or Log-log production function or Log linear production function

The power production function is a non-linear production function which is more commonly known Cobb-Douglas production function, after the names of persons who first applied it for empirical estimation.

General form with one variable is,

$$\mathbf{Y = ax^b}$$

Where, Y is output, a is constant, b is transformation ratio when x is at different magnitudes and x is variable resources.

The exponent or 'b' coefficient is the elasticity of production and can be used directly. This equation is estimated in logarithmic form is given by

$$\mathbf{\log Y = \log a + b \log x.}$$

General form with n variable resources,

When parameters are to be estimated for more than one variable resources, the same algebraic restraints exist for n variables. The power function below has the same characteristics as that of $Y = ax^b$.

$$\mathbf{Y = a\, x_1^{b1}\, x_2^{b2} \ldots\ldots\, x_n^{bn}}$$

The regression coefficients b_1 and b_2 derived with the observations in logarithms are the production elasticities of individual resources. Their sum indicates the returns to scale. In log form, the equation is expressed as

$$\mathbf{\log Y = \log a + b_1 \log x_1 + b_2 \log x_2 + \ldots\ldots\ldots\ldots\, b_n \log x_n}$$

This function allows constant, increasing or decreasing marginal productivity. It does not allow an input-output curve embracing all three.

Advantages of Cobb-Douglas production function

1) It is popularly used in agricultural economics research because of its simple functional form which provides for easy computation.
2) It gives theoretically consistent and significant estimates for most of the variable used in the analysis of agricultural data.
3) Elasticities are directly measured

4) The estimates of this function are mostly consistent with the principle of law of diminishing returns i.e. marginal productivity decreases as the input use increases.
5) Returns to scale are directly estimated.
6) The inverse relationship that exists between marginal rate of substitution and factor proportions is easily computed from cobb-douglas function.

3) Quadratic form

The quadratic equation $\mathbf{Y = a + bx - cx^2}$, with a minus before C denotes diminishing marginal returns.

It allows both a declining and negative marginal productivity, but not both increasing and decreasing marginal products. A maximum total product is defined where input magnitude or x is equal to 0.5 bc^{-1}. The elasticity is not constant, as in the power function, but declines with input magnitude as indicated by elasticity equation.

$$Ep = \frac{bx-2cx^2}{a+bx-cx^2}$$

If there are two inputs the function will be

$$\mathbf{Y = a + b_1x_1 + b_2 x_2 - b_3 x_1^2 - b_4 x_2^2 + b_5 x_1 x_2}$$

Diminishing marginal returns exists for either factor alone but there is positive interaction between the two factors. Negative or Zero interaction also may exist, where diminishing marginal returns hold true for both factors.

The special properties of the quadratic production function are as under:

(i) The minus sign in the last term denotes diminishing marginal returns.
(ii) The equation allows for decreasing marginal product but not for both increasing and decreasing marginal products.
(iii) The elasticity of production is not constant at all points along the curve as in a power function, but declines with input magnitude.
(iv) The equation never allows for an increasing marginal product.
(v) When X = 0, Y = a. This means that there is some output even when no variable input is applied.
(vi) The quadratic equation has only one bend as compared with a linear equation which has no bends.

Use of production function in Decision Making

Production function can be used for following purposes

- **Returns to Scale:** We may know whether a firm or an industry enjoys in increasing or diminishing returns to scale.
- **Allocative efficiency** is a state of the economy in which production represents consumer preferences; in particular, every good or service is produced up to the point where the last unit provides a marginal benefit to consumers equal to the marginal cost of producing.
- **Returns to a factor** relate to the short period production function when one factor is varied keeping the other factor fixed in order to have more output, the marginal returns of the Variable factor diminish. On the other hand, **returns to scale** relate to the long period production function when a firm changes its scale of production by changing one or more of its factors.
- **Substitution:** A fundamental principle of economic behavior is the tendency to substitute at the margin changes in the relative prices of inputs encourages corresponding substitution in the use of inputs by firms. We may know the extent to which substitution between inputs is possible. The degree of substitutability between inputs as measured by elasticity of substitution is crucial to the distribution of total output between different inputs.
- **Income shares:** distribution of national income between income classes i.e. wages and profits. The pioneering econometric estimation of a production function by Cobb and Douglas was undertaken for this purpose. The starting point was observed income shares of wages and profits in total income leading to a search for a production function in terms of output and inputs which would explain these observed shares.
- **Economic Growth:** An aggregate production function has been used to provide empirical explanations of inter-temporal differences in economic growth of GNP.

Lecture 4: Factor - Product relationship: Meaning, Definition – Laws of Returns: Classical production function and its characteristics.

The Concept of Marginalism

The words marginal, additional, incremental, rate of change or slope are often used to denote changes in inputs, outputs, costs, revenue etc. the symbol Δ is used to denote marginal changes. The term 'margin' deals with changes in variables with respect to unit change in other variables. The marginalism principle is very much useful in deciding the enterprise combination (what to produce), combination of inputs-selecting the technology (how to produce) and the level of output (how much to produce).

Types of Input – Output Relationship/Laws of Returns

There are three types of input – output relationship in the production of commodity one input is varied and the quantities of all other inputs are fixed. The following are the three types of relationship between single input and single output. They are i) Constant rate of return ii) Increasing rate of return and iii) Decreasing rate of return. The marginal productivity of the variable input determines the type relationship.

i. Law of Constant Returns/Constant Rate of Return/Constant Marginal Productivity

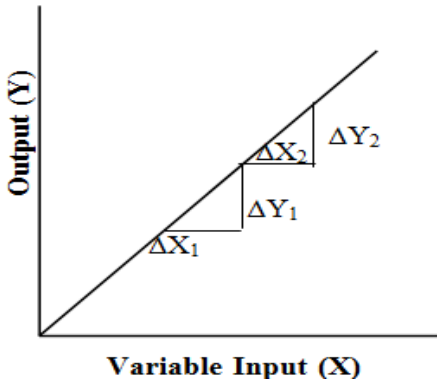
Every additional or marginal unit of input adds an **equal** amount to the total product than the previous unit; i.e., addition to total product is at **constant** rate.

Constant rate of return

X	Y	Δ X	Δ Y	Δ Y/Δ X
0	0	-	-	-
1	5	1	5	5/1=5
2	10	1	5	5/1=5
3	15	1	5	5/1=5
4	20	1	5	5/1=5
5	25	1	5	5/1=5

When the variable input (X) is increased by equal amount the total output (Y) increases at constant rate. In the given example, each successive unit of variable input adds 5 units of output to total product. The marginal product (Δ Y/Δ X) of each unit of input is same ie. **5 units**. ie, at the rate of 5 units/unit of input. It has limited application in agriculture example each addition of one acre of land will add the same amount of product. This constant relationship can be illustrated with a graph below; the production

function is a straight line having the same slope throughout its entire range. This relationship can also be expressed as:



$$\frac{\Delta Y_1}{\Delta X_1} = \frac{\Delta Y_2}{\Delta X_2} = \ldots = \frac{\Delta Y_i}{\Delta Xi} = \ldots = \frac{\Delta Yn}{\Delta Xn} = k$$

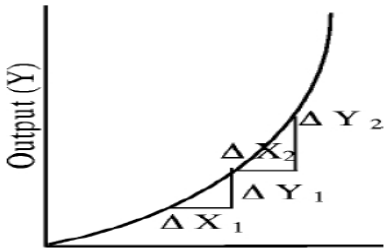
ii. Law of Increasing Return/Increasing Rate of Return/Increasing Marginal Productivity

Every additional or marginal unit of input adds **more** to the total product than the previous unit; i.e., addition to total product is at an **increasing** rate.

Increasing rate of return

X	Y	Δ X	Δ Y	Δ Y/ Δ X
0	0	-	-	-
1	5	1	5	5/1=5
2	11	1	6	6/1=6
3	18	1	7	7/1=7
4	26	1	8	8/1=8
5	35	1	9	9/1=9

In the above example, each unit of input (X) adds more to the total output than the previous unit. The total output increases at increasing rate. The marginal product of the first unit of input is 5 while the additional output produced by 2nd, 3rd, 4th and 5th units of input are 6,7,8 and 9 respectively indicating increasing marginal physical product. This increasing relationship can be illustrated given below graph, the shape of the curve will go steeper and steeper with the added inputs i.e., slope gets convex to the origin. This relationship can also be expressed as:



Law of Increasing returns

$$\frac{\Delta Y_1}{\Delta X_1} < \frac{\Delta Y_2}{\Delta X_2} < \ldots < \frac{\Delta Y_i}{\Delta Xi} < \ldots < \frac{\Delta Yn}{\Delta Xn}$$

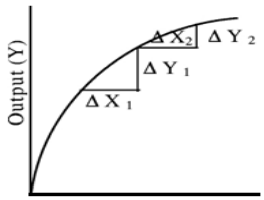
iii. Laws of Decreasing Returns/Diminishing Rate of Return/Decreasing Marginal Productivity

Every additional or marginal unit of input adds **less** to the total product than the previous unit; i.e., addition to total product is at **Decreasing** rate.

Diminishing rate of return

X	Y	Δ X	Δ Y	Δ **Y/** Δ **X**
0	0	-	-	-
1	6	1	6	6/1=6
2	11	1	5	5/1=5
3	15	1	4	4/1=4
4	18	1	3	3/1=3
5	19	1	1	1/1=1

If each successive units of input (X) adds less and less to the total product than the previous unit, the relationship is termed as diminishing rate of return. The MPP of each successive unit of input decreases, i.e. the total output increases at diminishing rate. It could be seen from table that the first unit of input adds 6 units of output whereas the 2nd adds 5 units; the 3rd, 4th and 5th units produce an additional output of 4, 3 and 1 unit, respectively. This Decreasing relationship can be illustrated with a graph.



Law of Decreasing Return

$$\frac{\Delta Y_1}{\Delta X_1} > \frac{\Delta Y_2}{\Delta X_2} > \ldots > \frac{\Delta Y_i}{\Delta Xi} > \ldots > \frac{\Delta Yn}{\Delta Xn}$$

In agricultural production, the type of input output relationship, generally, observed is the diminishing rate of return.

Law of Diminishing Marginal Return (LDR)

The law of diminishing marginal return relates to many biological and physical relationships. In agriculture the maximum amount of output that can be produced from an activity (crop or livestock) depends on the quantity of inputs used and the efficiency with which the inputs are transformed in to output.

The law of diminishing return concerns with the efficiency of input use and thus determines the maximum amount of output that can be produced from an activity, for a given technology. Though LDR explains the technical relationship between input and output it has economic implications.

Alfred Marshall states **"an increase in the capital and labour applied in the cultivation of land causes in general a less than proportionate increase in the amount of produce raised, unless it happens to coincide with an improvement in the art of agriculture**".

As more and more units of labour and capital are applied to a fixed area of land, the additional output produced by each successive unit of labour and capital declines, i.e. the total output increases at diminishing rate unless there is an improvement in the production technology. Technological improvement will improve the productivity of inputs and the operation of LDR can be postponed. Though Marshall considered land as the fixed input, any input(s) can be held at fixed level. In more general terms, the LDR can be defined as follows. When successive units of one variable input is added to a fixed level of other inputs, beyond certain level, the additional output added by each unit of input (MPP) declines. **The LDR is also known as Law of Variable Proportion** since when a variable input is increased keeping the other inputs at fixed level, the proportion between variable and fixed input changes.

The Classical Production Function

The production function exhibiting three stages of production, has been the traditional or standard approach for studying the economics of production and hence it is termed 'Classical production function". But, it may not be always possible to find all the three stages of production in the experimental data unless the variable input is a crucial one (i.e., which is a must for production, eg: seeds) there may not be a zero production.

For the analysis of the production function Marginal Physical Product (MPP) and Average Physical Product (APP) are derived from the Total Physical Product (TPP).

TPP: It is the quantity of physical output (Y) obtained at different levels of variable input (X).

MPP: It is the additional output from each successive unit of variable input or it is the change in the TPP (ΔY) with respect to one unit increase in variable input (ΔX) ie $\Delta Y / \Delta X$.

MPP is the slope of TPP curve. It indicates the rate at which TPP increases when variable input increases. When the MPP (slope) is calculated between two points on the TPP, it is known as average of two slopes. On the other hand, the slope (MPP) at a particular point on TPP is called exact MPP. The value of average MPP are written midway between two successive TPP values.

APP: It is the average amount of output produced per unit of input at a particular level of input. It is expressed as a ratio of output to input (Y/X) and calculated by dividing the TPP by the number of units of variable input used to produce that output. APP indicates the average efficiency with which a variable input is transformed in to output.

Elasticity of Production (E_P).

It refers to the percentage change in output in response to a percentage change in variable input.

$$\text{Ep} = \frac{\%\ change\ in\ output}{\%\ change\ in\ input}$$

computed as: $\text{Ep} = \dfrac{\left[\dfrac{\Delta Y}{Y} \times 100\right]}{\left[\dfrac{\Delta X}{X} \times 100\right]} = \dfrac{\left[\dfrac{\Delta Y}{Y}\right]}{\left[\dfrac{\Delta X}{X}\right]} = \dfrac{\Delta Y}{\Delta X} \times \dfrac{X}{Y}$. Therefore, $\text{Ep} = \dfrac{\Delta Y}{\Delta X} \times \dfrac{1}{Y/X} = \dfrac{\mathbf{MPP}}{\mathbf{APP}}$

Though MPP and APP are expressed in physical units, Ep is a mere number without any unit. The classical production function can be divided in to three regions.

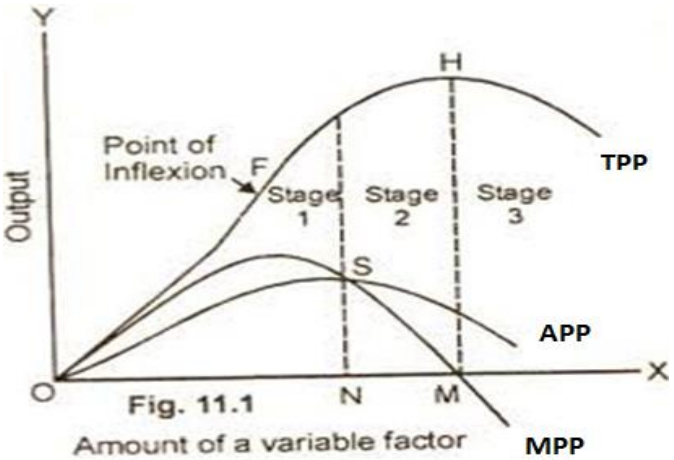


Fig. 11.1

Characteristics of TPP, MPP & APP

Product curve	I Region	II Region	III Region
TPP	Increases at increasing rate and then increases at decreasing rate	Increases at decreasing rate	Decreases
MPP	Increases and then decreases but > APP	Decreases and positive but < APP	Negative
APP	Increases but> MPP reaches the maximum when intersects MPP	Decreases and positive but >MPP	Decreases positive
Ep	>1	<1 but positive	< 0
Optimum Input	MVP > MIC	MVP = MIC	MVP < MIC
Optimum output	MR > MC	MR = MC	MR < MC

- **Region –I:** It starts from origin extends to the input level which results in the maximum **APP, (0 to MPP = APP).** ***Irrational or Sub Optimal stage of production.***
- **Region –II:** It extends from the input denoting maximum **APP** to the input unit corresponding to maximum **TPP (MPP = APP to MPP = 0).** ***Rational of Optimal stage of production.***
- **Region –III:** It extends from the input denoting maximum **TPP** to all inputs having negative **MPP** (beyond **MPP**=0). ***Irrational or Supra optimal stage of production.***

Relationship between TPP, MPP and APP

Since both MPP and APP are derived from TPP, they are closely related.

TPP and MPP: As long as MPP increases, TPP increases at increasing rate, when MPP declines but positive, TPP increases at decreasing rate. When MPP is 0, TPP reaches its maximum, when MPP is negative TPP decreases.

MPP and APP: The average efficiency of variable input (APP) depends on the productivity (MPP) of each successive units of the variable input. As long as the MPP > APP, APP is increasing, when MPP = APP, APP is at its maximum when MPP is < APP, APP declines.

Rational and Irrational regions of the production function:

In the first region, the average productivity of the variable input increases continuously as more and more input units are added. So when the average productivity increases it is not rational to limit the input application in this region. Hence region I is considered as **irrational region for decision making.**

In the third region, the total physical product declines because of the negative marginal productivity of the inputs. It is not rational to add input units when the TPP decreases, even if the input is free of cost. Application of input in the third stage results in double loss due to increased input cost and loss due to reduced value of output.

The second region is the rational region or decision making region. Information on input and output prices is necessary to decide the optimum level of input. The particular level of input which maximizes the profit is the optimum amount of input and the corresponding level of output is the optimum output.

Technical efficiency and economic efficiency

Technical efficiency is measured by the physical ratio of output to input. The greater the ratio, the greater the degree of technical efficiency.

Economic efficiency is related to the objective relevant to the economic unit (Farm). If profit is the main objective then economic efficiency is achieved when resources are used to give maximum profit.

Technological change and Production

Technological change in production refers to improvement in knowledge applied to the production process. Technological change improves the efficiency of conversion of input in to output ie., from the same amount of input more output can be produced or to produce a given amount of output lesser amount of inputs are required because of improvement in productivity.

Certain technologies are **yield increasing while some are factor saving**, where as some others are both yield increasing and factor saving. For example, high yielding varieties of crops respond to higher doses of fertilizer and give more yield than local varieties ie., the production function is shifted upwards. It also saves land. Improved animal is an example for yield increasing technology.

Some technologies save scarce resources and a given amount of output can be produced with lesser amount of these resources. For example as compared to ordinary method of irrigation, drip irrigation saves about 50 per cent of irrigation water without reducing the yield. Improved methods of application save fertilizers.

Lecture 5: Meaning and Concept of cost, Types of costs, Cost Curves - and their inter-relationship -Shut down and Break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income.

Cost

The concept of cost of production is very significant in economics because it influences the production, supply, sales and the determination of price in the market.

It means cost of production is a function of total costs in relation to price to guide the firm in deciding whether to expand or contract output and also whether to leave or enter an industry.

In the cost theory, economists use different names for cost concepts under different contexts. They are

Nominal costs or Money costs

Nominal cost is the money cost of production. It is also called expenses of production. These expenses are important from the point of view of the producer. These expenses are paid out by him to the factors he employs or for the raw materials he uses in production. Expressed in current market prices.

Real Cost

The real cost of production for a business typically includes the value of all tangible resources such as raw materials and labor that are used in the production process. Expressed in constant market prices.

Opportunity Cost

Opportunity cost is defined as the returns that are sacrificed from the next best alternative activities. Opportunity cost is also known as **real cost or alternate cost.**

Economic Cost

- **Implicit cost** - Entrepreneurs do not pay for use of own resources. Costs of self-owned and self-employed resources are known as implicit costs.
- **Explicit cost**- Payments made by the entrepreneurs for purchasing and hiring of inputs and input services. They also called as paid out costs or cash costs.

Deflated Cost

Costs is deflated by general price index are called deflated costs. By doing so the effect of inflation in an economy is taken out. Example: Real cost of commodities.

Social Costs

These are also called as externalities. Firms incur both implicit and explicit costs in the production of goods and services. Their sum constitutes total cost of production. These costs we name as private costs, but from the point of view of society, these firms will rise to some additional costs to the society in the form of environmental degradation, water, air or noise pollution etc., in the areas where goods are produced by private firms. In the absence of well-drained system, irrigation projects bring problems to the command area of the project in the form of new diseases. Such costs are called social costs.

Separable costs

Separable costs are costs which can exclusively be attributed to production of output separately. Common costs are those which cannot be separated to the production of the output. **So they are called joint costs.** The costs are involved in the production of several products. For example, electricity generation, ground water etc..

Historical costs and Replacement costs

Historical costs are those costs involved in the purchase of durable goods like land, buildings, machinery, equipment etc. Purchase price of the asset should be considered as price of the asset and hence it is considered as historical cost in analysis.

Replacement costs refer to the difference between the purchase price of asset and the current price of the same asset.

Establishment cost

Construction of plant in any business activity entails some costs. Such construction costs are called establishment costs in the business analysis.

Cash cost are incurred when resources are purchased and used immediately in the production process. Eg. Fertilizers, casual labour, fuel oil, etc.

Non-cash cost consist of depreciation and payments to resources owned by the farmer. E.g. depreciation on tractor, equipment, buildings, payment made to the farmer himself or family labour.

Types of Costs and Curves

Costs are usually computed as a function of output. The cost function shows the relationship between costs and output.

In Short Run Cost Function: it is the one in which certain costs are fixed.

$$C = f(Y) + K,$$

Where

C- Total Cost,

Y- Output,

K- Fixed Cost

In Long Run Cost Function is one in which all costs are variable.

$C = f(Y)$

Short Run Cost Curves

i. **Total cost.** It is the total cost of producing a given level of output. It consists of fixed and variable costs.

ii. **Fixed costs:** Costs which **do not vary with the level of output** during a given production period is known as fixed costs. Since certain inputs are fixed during the production period, the costs associated with them do not vary. Total fixed cost (TFC) is the sum of the monetary values of fixed inputs. If F_1 and F_2 are fixed inputs, then TFC = F_1. PF_1+F_2. PF_2, where PF_1 and PF_2 ae the price / unit of F_1 and F_2, respectively. In agriculture, rent for land, land revenue, interest on fixed investments, depreciation are generally, considered as fixed costs since the value of land, buildings, machineries, implements, tools and animals do not change in the short run.

iii. **Variable cost:** Costs which **vary with the level of output** is known as variable cost. Variable costs in total (TVC) vary directly with the level of output, ie., increases when output increases and decreases when output decreases. Variable cost is also known as prime cost, direct cost or operating cost. Total variable cost is the sum of the monetary values of variable inputs. If X_1 and X_2 are variable inputs, then the total variable cost is X_1. Px_1 + X_2. Px_2, where Px1 and Px2 are price per unit of X_1 and X_2 respectively. Value of seed, manures, fertilizers, chemicals, irrigation, labour, fuel etc. are examples of variable costs. Total cost curves are presented in Figure 3.1

iv. **Average Fixed cost (AFC):** It refers to fixed cost per unit of output. It is obtained by dividing the total fixed cost by total amount of output.

$AFC = TFC/Y$

Since TFC is a constant the AFC decreases as output increases forming a rectangular hyperbola and never shows an upward movement since it is irrational to produce in the III region of the production function.

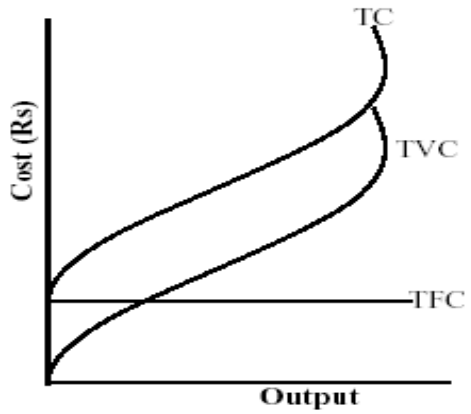


Fig 3.1 Total Cost Curves

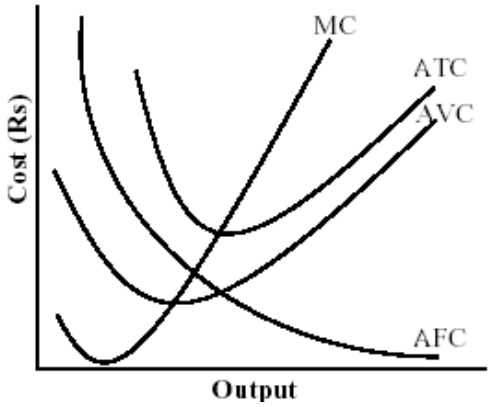


Fig 3.2.Average Cost Curves

v. **Average variable cost (AVC):** it is the variable cost per unit of output. It is computed by dividing the TVC by the corresponding level of output.

AVC = TVC/Y. AVC is inversely related to APP, when APP increases, AVC decreases, when APP decreases, AVC increases and when APP is at its maximum AVC is at its minimum.

vi. **Average cost (AC) or Average total cost (ATC):** It is the per unit cost of producing the output, consisting of average fixed and average variable costs. ATC is computed by adding average fixed cost and average variable cost or by dividing TC by the corresponding level of output.

$$AC = TC/Y \text{ or } TFC/Y + TVC/Y = AFC + AVC$$

In response to increase in output the average cost curve decreases, reaches its minimum and then goes upwards. **AC curve reaches its minimum at a higher level of output** than the output at which AVC curve reaches its minimum since the rate of fall in AFC is more as compared to the rate of increase in AVC. Once the rate of fall in AFC is lesser than the rate of increase in AVC, the AC curve starts rising.

vii. **Marginal cost (MC):** It is the cost of producing an additional unit of output. It refers to the change in TC in response to a unit change in output. It is the slope of TC curve. It is computed by dividing the change in total cost (Δ TC) by the corresponding change in output (Δ Y).

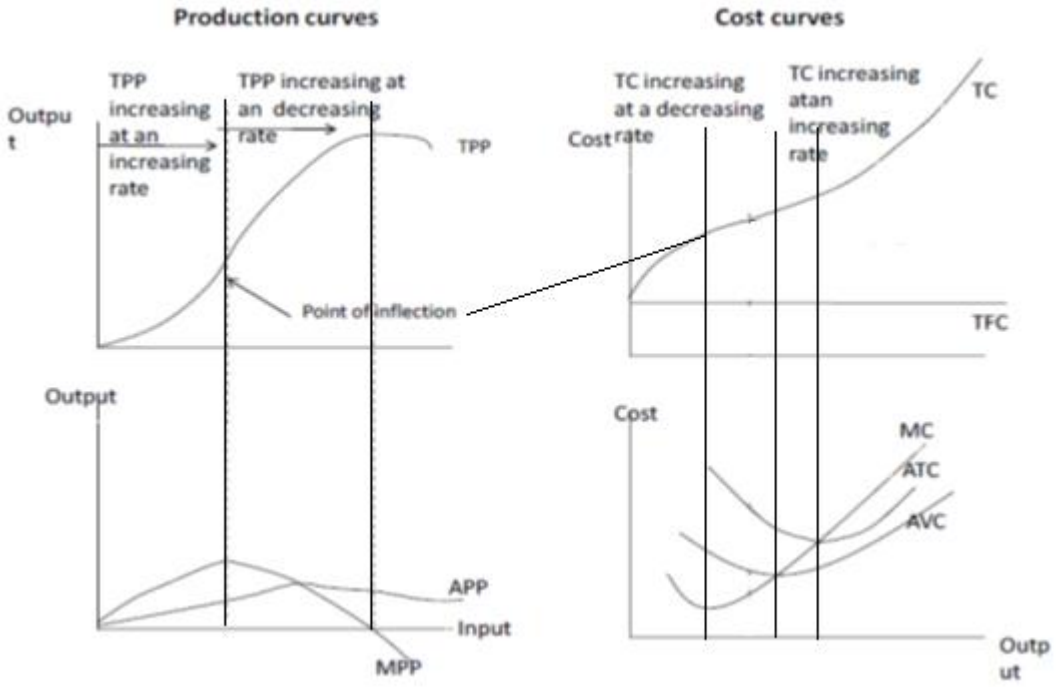
MC = Δ TC / Δ Y. MC can also be worked out by dividing the change in variable cost (Δ TVC) by the change in output (Δ Y) because the change in TC is equal to the change in TVC at a given level of Fixed Cost. MC is inversely related to MPP. When MPP increases MC decreases, when MPP is maximum MC reaches its minimum and when MPP decreases MC increases.

Relationship between MC and Average Cost curves

Average and marginal cost curves are presented in Figure 3.2 MC intersects AVC and AC curves from below. As long as the MC is below AVC and AC, AVC and AC decreases, when MC is equal to AVC and AC, AVC and AC reaches their minimum and when MC is above AVC and AC, AVC and AC increase. (**MC intersects AVC and AC curves from below at its minimum**).

Production curves and cost curves.

Cost curves are mirror images of the production curves when the TP is increasing at increasing rate. TC is increasing at a decreasing rate and vice versa. Similarly the inverse relationship can be observed in the case of AP and MP curves, and MC and AC curves as shown in the figure.



Optimum level of output: Production of an additional unit of output is always profitable as long as MC < MR, because less is added to TC than is added to TR. **The profit is maximized when Marginal Revenue (MR) is equal to the Marginal Cost**, MC is rising and AVC rising or TR> TVC. Marginal revenue (MR) is the change in total revenue (TR) with respect to one unit change in output. It is the amount realized by selling an additional unit of output which is equal to price / unit of that output (Py). It is also the average revenue (AR).

Long-Run Cost Curve

All costs are variable in the long run. So we do not distinguish between AVC, AFC and ATC as in the SR. in the LR there is only long run average costs (LRAC)

because in the LR all factors are variable. It is also called as planning curve, envelope curve or scale curve. Each point in LRAC corresponds to a point in short-run cost curve.

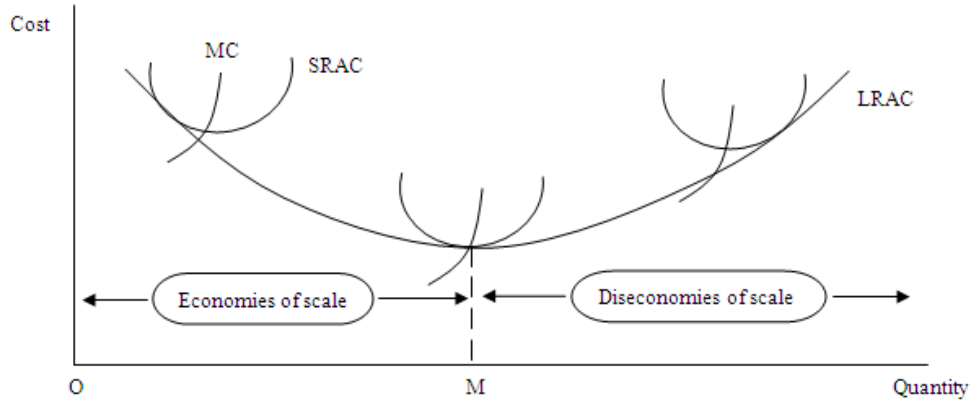


Fig.3 Long-run cost curve

LRAC is U shaped. The point corresponding to the output M is called optimum plant size. The expansion of output from 0 to M results in reduction in cost per unit. In other words in this region the firm experiences economies of scale or increasing returns. At point M, LRAC reaches minimum and it is optimal level of production.

The region beyond M, the firm will face increasing costs due to complexities in management. In other words this region corresponds to decreasing returns or diseconomies of scale.

Cost of Cultivation and Cost of Production

The term **Cost of production** refers to cost incurred in **production of one unit of output** and is normally associated with variable and fixed costs.

Cost of cultivation on the other hand, relates to an accounting procedure of quantifying the **costs incurred in undertaking production per unit of land.**

In India the Commission on Agricultural Costs and Prices (CACP) is involved in collecting farm level data and worked out cost of production. For easy computations, the commission categorizes the cost components as follows:

Cost Concepts

Cost A1: It includes all actual expenses in cash and kind incurred in production by the farmer. i.e.,

- Value of human labour (hired).
- Value of bullock labour (both hired and owned).
- Value of machine power (both hired and owned).
- Value of seeds (both owned and purchased).
- Value of insecticides and pesticides
- Value of manure (both owned and purchased)

- Value of fertilizers
- Depreciation on farm implements and farm buildings.
- Irrigation charges
- Land revenue, cess and other taxes.
- Interest on working capital.
- Miscellaneous expenses (electricity charges, etc)

Cost A2: Cost A1 + rent paid for leased in land

Cost B1: Cost A1 or A2 + Interest on value of owned capital assets (excluding land)

Cost B2: Cost B1+ rental value of owned land less land revenue+ rent paid for leased in land

Cost C1: Cost B1+ Imputed value of family labour

Cost C2: Cost B2+ Imputed value of family labour

Cost C3: Cost C2 + 10% of cost C2 (10% of cost C2 added to cost C2): This is a recently added concept to provide allowance for managerial functions undertaken by the farmer.

From the above classification certain cost components and various income measures are derived as follows:

Cost of Production = (Cost C3- value of by product) / yield.

Concepts of Farm Income

Farm income refers to profit and losses incurred through the operation of farm. A farm income statement (sometimes called a farm profit and loss statement) is a summary of income and expenses that occurred during a specified accounting period. This period is usually the calendar year for farmers.

Types and Method of Estimation of Farm Income

- **Gross Cash Income**: the sum of all receipts from the sale of crops, livestock and farm-related goods and services, as well as any direct payments from the government.

  It can be estimated by adding gross value of output in the various farm produce plus direct payment from government in form of subsidies, incentives etc**..**
- **Gross Farm Income**: the same as gross cash income with the addition of non-money income, such as the value of home consumption of self-produced food.

  It can be estimated by adding non cash income in gross cash income.
- **Net Cash Income**: the gross cash income less all cash expenses, such as for feed, seed, fertilizer, property taxes, interest on debt, wagers, contract labor and rent to non-operator landlords.

It can be estimated by deducting all direct expenses from gross cash income**.**

- **Net Farm Income**: the gross farm income less cash expenses and non-cash expenses, such as capital consumption and farm household expenses.

It can be estimated by deducting all indirect expenses from net farm income**.**

- **Family Labour Income:** It represents the return to all unpaid labour (Farmer and his spouse, non principal partners, directors and their spouse and family workers).
- **Farm Business Income:** Financial return to all unpaid labour (family workers) and on all their capital invested in the farm business including land and buildings.
- **Farm Investment Income:** Return on all capital invested in the farm business whether borrowed or not, to risk and to entrepreneurship. It is a general measure of the profitability of farming as an activity rather than of a particular business. It is derived by adding net interest payments to farm corporate income.
- **Farm Corporate Income:** It represents the return on own capital invested in the farm business, to risk and to entrepreneurship. It is derived by deducting unpaid labour both manual and managerial from farm business income.
    - Farm business income = Gross return – Cost A1
    - Owned farm business income = Gross return – Cost A2
    - Family labour income = Gross return – Cost B2
    - Net income = Gross return – Cost C3
    - Farm investment income = Farm business income – imputed value of family labour.

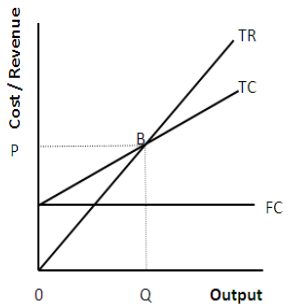
Break Even Point

The important management decision, as to when to leave or abandon one practice and start another, i.e., effect a change in the system is answered by the break-even point refers to that volume of business, at which the farmer is indifferent between two alternatives, i.e., **he is neither better-off nor worse-off irrespective of the choice he makes.** Break-even point is a point of indecision or the crucial point, on the scale of production.

The break-even level is given by the point where the fixed costs are covered and only beyond that, the farmer make profits.

$$Q = \frac{FC}{P - V}$$

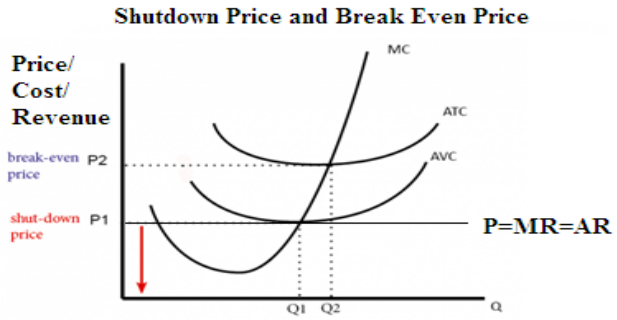
Where Q = Quantity of Output.
FC = Annual Fixed Cost.
P = Custom Charges per unit of Output.
V = Variable Cost per unit of Output.



Shut Down Point or Price

The shutdown price are the conditions and price where a firm will decide to stop producing. It occurs where AR <AVC

- The shutdown price is said to occur, where price (average revenue AR) is less than average variable costs (AVC).
- At this price (AR<AVC), the firm is making an operating loss. The total revenue is less than operating (variable) costs.
- A firm can keep producing, even if AR < ATC (average total costs) because they are making a contribution towards fixed costs which have been paid anyway.



- The shutdown price is P1 or less.
- Between P1 and P2, the firm is making an economic loss but will continue in the short term.

Evaluation of shut-down price

In the real world, there are circumstances where firms will continue to produce – even if AR < AVC.

- For example, if there is a temporary fall in demand, due to a recession, a firm may prefer to keep producing – so they don't lose long-term customers.
- If a firm can gain access to credit (loan) or if it has high savings, it can afford to run an operating loss for a short time.
- If a firm sees AR<AVC, they may respond – not by shutting down, but trying to cut costs and/or increase the prices.
- It is possible, a firm will shut down, even if the price is greater than average variable costs. For example, the firm may be pessimistic about the growth of this particular market and feel there is a high opportunity cost to staying in a declining industry.
- In the real world, it may take time for a firm to realise they are making an operating loss.

Lecture 6: Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.

Economies of Scale

The scale of production influences the cost of production. In general, larger the scale of production, the lower is the average cost of production. **The term 'economies' means 'advantages' and the term 'scale', here, means 'large-scale production'. Thus, economies of scale refer to the advantages of large-scale production. Economies of scale can be categorized into (a) Internal economies and (b) External economies of scale.**

A. Internal Economies of Scale

Internal economies are those economies in production (those reductions in production costs), which occur in the farm (firm) itself when it expands its output or enlarges its scale of production. Internal economics are those advantages that are exclusively available to a particular firm, as a result of its own expansion in the scale of production. The internal economies are dependent on the resources of the individual house of business, on their organization and the efficiency of their management. Internal economies are of the following five types: a) Technical economies, b) Managerial economies, c) Marketing economies, d) Financial Economies, and e) Risk bearing economies.

i. Technical Economies

A large-scale production unit can use large and modern or sophisticated machines so as to reduce production costs. A large establishment can prevent wastage by utilizing the by-products efficiently. Latest technologies can be used in larger units to reduce the cost of production.

(E.g.) A big vegetable oil mill can have a cattle feed industry and a big dairy unit.

ii. Managerial Economies

These economies arise from the creation of special (separate) departments for different functions like production, maintenance, purchase, sales etc. In a small factory, a manager is a worker, organizer and salesman. Much of his time is wasted on things of little economic importance. In a big concern, such jobs can be allotted to junior employees and the manager can concentrate on jobs which bring more profits. Such kind of division of labour is possible in large units. Thus, the job can be done more efficiently and more economically in large units.

iii. Marketing Economies

They arise from the purchase of materials and sale of goods. Large business firms have better bargaining advantages and are provided with a preferential treatment by the firms they deal with. They are able to secure freight concessions from railways and road transport firms, prompt delivery and careful attention from all dealers. A large firm can employ expert purchase managers and sales managers. In selling, it can cut down selling costs and in purchasing, it can have a wider choice.

iv. Financial Economies

A big firm has better credit facilities and can borrow on more favourable terms. It encourages prospective investors with incentives and higher returns and therefore, its shares have a wider market. A big firm can issue its shares and debentures more easily than an unknown small firm.

v. Risk Bearing Economies

A big firm can spread risks and can often eliminate them. It can diversify the output. It can also establish wider marketing network for its products. If demand for any one of its products slackens in any one market, it may increase it in other markets. Thus, it can reduce the risk of fluctuations in the demand for its product.

B. External Economies of Sclae

External economies are those economies, which are available to each member firm as a result of the expansion of the industry as a whole. Expansion of industry may lead to the availability of new and cheaper raw materials, machineries and to the use of superior technical knowledge. External economies are advantages available to all the firms. For instance, construction of a new railway line benefits all firms set up in that locality and not to any particular firm alone. Various types of external economies are given below:

i. Economies of Concentration

These economies arise from the availability of skilled workers, the provision of better transport and credit facilities, benefits from subsidiary units and so on. Scattered firms cannot enjoy such economies. Concentration of firms enables the transport system to reduce the cost. **ii. Economies of Information**

All big-sized units can join together to publish trade journals and also to set up research and development facilities, which would benefit all firms.

iii. Economies of Disintegration

When an industry grows, it becomes possible to split up some of the processes which are taken up by specialist firms. This may be beneficial to all the firms.

Examples are spare parts manufacturing units/assembling units.

Diseconomies of Scale

It is opposite to Economies of Sclae. It is a proven fact as the size of farm expands, the unit cost comes down. However, expansion beyond certain point results in increased unit cost of production owing to managerial problem and other factors which is termed as “Diseconomies”.

Increase in production (or) large scale production may lead to increase in cost due to following **reasons**.

i) Over-worked Management: A large – scale producer cannot pay full attention to every detail. Cost often rises due to the dishonesty of the employees or waste of materials by them. This is due to lack of supervision.

ii) Individual tastes: If the consumers are not satisfied because large scale production is meant for mass. This leads to loss of customers.

iii) No personal Element: Large scale firms are managed by paid employees. Due to lack of personal touch between the owner and employers there may be frequent misunderstanding. Which lead to strikes and lock- outs. This is harmful to the business.

iv) Possibility of depression: Large scale production leads to over production. Production is more than the demand. It is not easy to dispose a large quantity in a profitable manner.

v) Lack of adaptability

Large farms find difficulty in switch over from one enterprise to another enterprise. If there are more number of farms it leads to competition for labour, raw materials which in turn increases higher cost, wages and cost of operation and hence less profit. Sometimes, due to scarcity farms use inferior or less efficient factors which also lead to increase in cost.

Economies of Size

A study on economies of size would be useful to assess the optimum size of the plant. The collection of all durable assets owned by a farm is called the plant and this term, therefore, includes land, machinery, buildings and other durable assets found on farms. An increase in any one of these durable assets would increase plant size.

The long run average cost curve has the same shape as the short run ATC curve. (But, long run cost has no fixed cost). When the firm is small, expansion of output usually increases efficiency, and average costs per unit of output will fall. The reasons for this decrease include specialization of labour and capital.

As the size of the business increases, the manager may be able to purchase inputs at a discount, thereby gaining market economies. Expansion of the firm enables workers to specialize and use more advanced or efficient technologies. Eventually, the long-run average curve will turn up; costs per unit of output begin to increase as output is expanded.

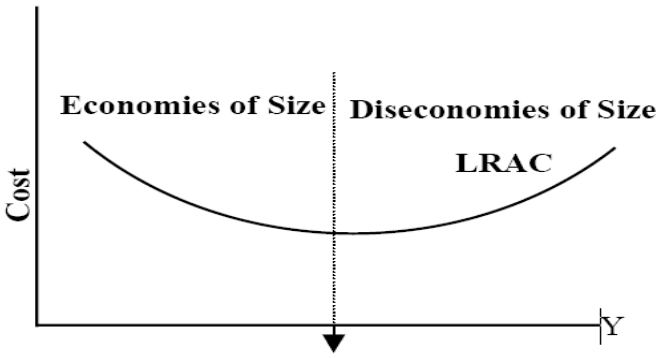


Fig.11.7 Economies of Size

As firm size increases, the manager encounters increasing difficulty in maintaining control of his organization, communications and coordination become more difficult, mistakes are both more frequent and more costly. As a result, costs rise. When LRAC are falling, the firm is experiencing economies of size. The minimum point on the LRAC curve indicates the optimum plant size. A plant of this size will produce the product at the lowest possible cost. Diseconomies of size occur where the LRAC curve is rising.

Returns to Scale

Returns to scale measures the change in output resulting from a proportionate change in all inputs. It describes the technical economies of scale and is a long-run concept, when none of the inputs is fixed. Returns to scale in increasing, constant or decreasing depending on whether a proportionate increase in all the inputs increases the output by a greater, same or smaller proportion. If the proportionate change in output is lesser than the proportionate change in inputs, diseconomies of scale result. If the change in output is equal to the proportionate change in inputs, constant returns to scale exist. If the change in output is greater than the proportionate change in inputs, economies of scale exist. This concept can be expressed with an homogeneous production function $Y = f(X_1, X_2...Xm)$ where, Y is output and $X_1, X_2,...,Xm$ are inputs used in the production process. Let K denote the amount by which each input will be changed (1<K), i.e., K is any positive real number. The returns to scale will be defined by n where,

$$Y^{n}K = f(KX_1, KX_2, \ldots, KX_m)$$

The factor Kn represents the change in output when all inputs are changed by the factor K. For example, if n equals one, the change in output is equal to the changes in the inputs and the returns to scale are constant. If n is greater than one, the change in output exceeds the proportionate change in all the inputs and returns to scale are increasing. Conversely, if n is less than one, the returns to scale are decreasing. In case of constant returns to scale, the distance between successive isoquants is constant, i.e., AB=BC=CD (Fig. 11.10 (a)). The distance goes on widening between isoquants when diminishing returns operate, i.e., AB<BC<CD (Fig.11.10 (b)). Finally, in case of increasing returns to scale, the distance between the successive isoquants becomes smaller and smaller as we move away from the origin on the isoquant map i.e., AB>BC>CD (Fig.11.10 (c)).

Returns to scale must be measured along a scale line that is a straight line, passing through the origin. Proportionate input changes are possible only on such a line or ray. Thus, economies (diseconomies) of size are the same as economies (diseconomies) of scale only when the long long-run expansion path is a straight line passing through the origin. In most agricultural production situations, input proportions representing least cost combinations vary with the level of output. Therefore, strict interpretations of scale concepts are probably not of great value in agriculture.

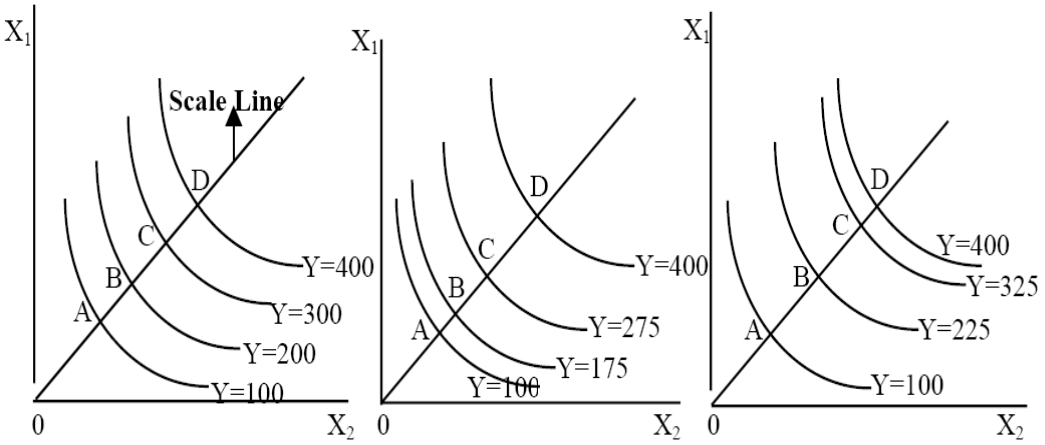


Fig.11.10 (a) Constant Return to Scale *Fig.11.10 (b) Decreasing Return to Scale* *Fig.11.10 (c) Increasing Return to Scale*

Decision rule for Profit Maximization

Determination of Optimum Level of Input:

Having identified stage II as rational stage, the extent of variable resource use needs to be studied. This is done by working out and comparing marginal value product (MVP) and Marginal input cost (MIC).

Marginal Value Product (MVP) of Input:

It is the additional income received from using an additional unit of Input. It is computed using the following formula.

$$\text{MVP} = \frac{Change\ in\ the\ total\ value\ product}{change\ in\ input\ level} = \frac{\Delta\ \mathbf{TR}}{\Delta\ \mathbf{X}}$$ (or) MPP x P_y.

MFC- Marginal Factor Cost or Marginal Input Cost (MIC):

MIC is defined as the change in the total input cost by using an additional unit of input. It is expressed as

$$\text{MIC} = \frac{Change\ in\ the\ total\ input\ cost}{change\ in\ input\ level} = \frac{\Delta\ \mathbf{TC}}{\Delta\ \mathbf{X}}$$ *i.e.* Price per unit of input.

The optimum level of input use determined where MVP equals MIC. This can be seen in second stage of production i.e. Rational or optimal stage of production.

Decision Rules:

1. If MVP is greater than MIC, additional profit can be made by using more input.
2. If MVP is less than MIC, more profit can be made by using less input.
3. Profit maximizing or optimum input level is at the point where MVP=MFC

Determination of Optimum Level of Output:

Apart from identifying the profit maximizing input level, it is pertinent to find out the level of output, which maximizes profit. To carry on this analysis, it is essential to work out and compare marginal revenue (MR) and Marginal cost (MC).

Marginal Cost (MC):

MC is defined as the additional cost incurred for producing an additional unit of output. The expression is as follows:

$$\text{MC} = \frac{Change\ in\ the\ total\ input\ cost}{change\ in\ total\ physical\ product} = \frac{\Delta\ \mathbf{TC}}{\Delta\ \mathbf{Y}}$$

Marginal Revenue (MR):

MR is defined as the additional income obtained from producing one more unit of output. It is expressed as:

$$\text{MR} = \frac{Change\ in\ the\ total\ income}{Change\ in\ total\ physical\ product} = \frac{\Delta\ \mathbf{TR}}{\Delta\ \mathbf{Y}}$$

The optimum level of output is determined where MR equals MC. This can be seen in second stage of production i.e. Rational or Optimal stage of production.

Decision Rules:

1. If Marginal Revenue is greater than Marginal Cost, additional profit can be made

by producing more output.

2. If Marginal Revenue is less than Marginal Cost, more profits can be made by producing less output.
3. The profit maximizing output level is at the point where MR=MC

Physical Optimum (Maximum Yield)

Based on the principle of diminishing marginal productivity the analysis of input-output relationship via production is useful to find out the level at which farmer can get maximum yield or it will reveal how the farmers are currently operating and how much extra unit is needed to reach the level at which the output is maximum, this referred as physical optimum.

Physical optimum/ agronomic optimum level of production by applying variable input up to **MPP=0 or TPP is Maximum.**

Economic Optimum (Maximum Profit)

Which aims for maximum profit is more important, particularly when input has a price. Economic optimum level of input use occurs when marginal value of output is equal to the input price.

The economic optimal level of input use can be found out by equating the Marginal Value Product (MVP) and the Marginal Cost of input use (MIC): **MVP = MIC**

Lecture 7: Factor – Factor Relationship: Least Cost Combination of Inputs

In **Factor-Product relationship** we have seen the relationship between single resource/input/ factor with single product/output.

That is, $Y = f(X_1 / X_2, X_3 \ldots\ldots X_n)$

But the producers use more than one resource in the production of a product. **For example,** in the production of rice crop the farmers use different type and brands of fertilizers, pesticides, machines, human labour – both hired and owned seeds, etc...

Here production function can be expressed in this case as **$Y = f(X_1, X_2 / X_3, X_4 \ldots\ldots X_n)$**

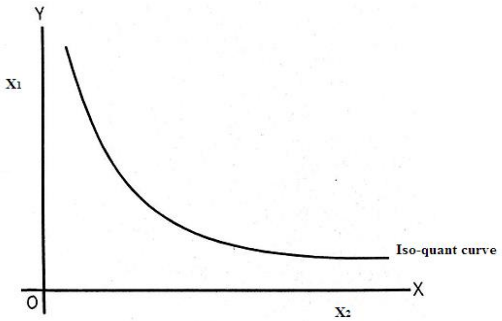
(or) $Y = f(X_1, X_2)$

Where, Y is the Product or Output

X_1 and X_2 are the Variable resources or Input or Factor.

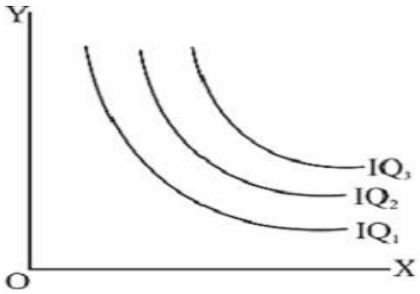
Isoquant or Iso Product Contour:

Isoquant is a curve showing all possible combinations of two inputs that result in equal amount of output. It is also known as Iso-Product Curve or Equal Product Curve. Iso means equal and quant means quantity.



Isoquant Map:

It is a family of isoquants i.e. when a number of isoquants are drawn on a graph it is known as isoquant map.



Properties of Isoquants:

1. It slopes downwards from left to right.
2. It is convex to the origin.
3. They do not intersect each other.
4. Isoquant far away from the origin represents higher level of output.
5. The slope of Isoquant denotes the rate of substitution between two resources.

Marginal Rate of Technical Substitution: ***(Slope of Isoquant)***

It is the ratio of the number of units of an input that must be reduced for one unit increase in another input to maintain the given level of output.

$$\text{MRTS} = \frac{\text{No. of Units of replaced input}}{\text{No. of Units of added input}}$$

$$\text{MRTS of } X_2 \text{ for } X_1 = \frac{\Delta X1}{\Delta X2} \qquad \text{MRTS of } X_1 \text{ for } X_2 = \frac{\Delta X2}{\Delta X1}$$

Explanation:

The concept of MRTS can be explained easily with the help of the table and the graph, below:

Schedule:

Factor Combinations	Units of Labor	Units of Capital	Units of Output of Commodity X	MRTS of Labor for Capital
A	1	15	150	-
B	2	11	150	4:1
C	3	8	150	3:1
D	4	6	150	2:1
E	5	5	150	1:1

It is clear from the above table that all the five different combinations of labor and capital that is A, B, C, D and E yield the same level of output of 150 units of commodity X, As we move down from factor A to factor B, then 4 units of capital are required for obtaining 1 unit of labor without affecting the total level of output (150 units of commodity X).

The MRTS is 4:1. As we step down from factor combination B to factor combination C, then 3 units of capital are needed to get 1 unit of labor. The MRTS of labor for capital 3:1. If we further switch down from factor combination C to D, the MRTS of labor for capital is 2:1. From factor D to E combination, the MRTS of labor for capital falls down to 1:1.

Diagram/Graph:

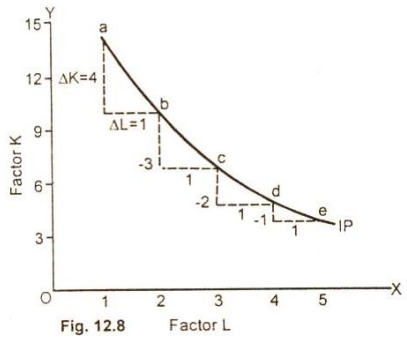


Fig. 12.8

The points A, B, C, D and E are joined to form an isoquant. The iso-product curve shows the whole range of factor combinations producing 150 units of commodity X. It is important to point out that ail the five factor combination of labor and capital on an iso-product curve are technically efficient combinations. The producer is indifferent towards these, combinations as these produce the same level of output.

Elasticity of Factor Substitution (E_S)

The elasticity of substitution is the relative change, by which factors combine in producing a constant output on a production contour and can be defined as the percentage change in one factor, divided by the percentage change in the other factor, i.e.

$$E_S = \frac{\Delta X_1}{\Delta X_2} \times \frac{X_2}{X_1}$$

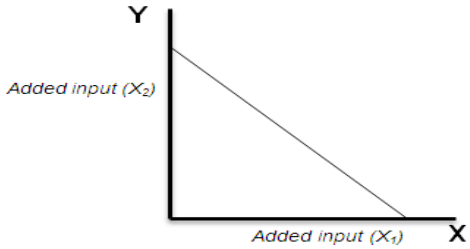
- Elasticity is always negative for substitute resources and indicates how fast the slope of a product contour changes.

Types of Iso-quants

Substitutes: Factors of production substitute for each other, to produce the same level of output. The marginal rate of technical substitution is negative.

- **Perfect substitutes:** When two inputs are completely interchangeable, then they are called perfect substitutes. In this case, iso-quants are linear and negatively sloped.

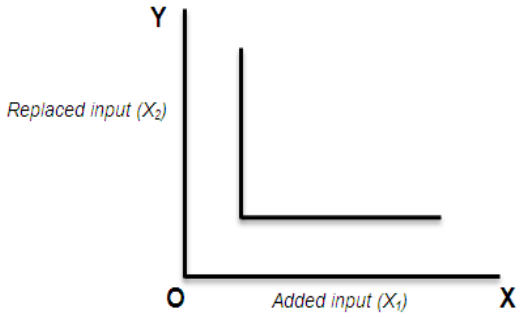
  For eg: Family and hired labour, Owned bullock labour and Hired labour, Farm produced and purchased input.
- **Also called as *linear iso-quant***



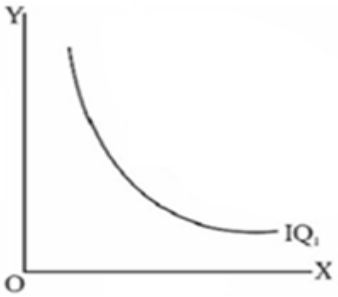
Perfect substitutes

Complements: Inputs which increase the output only when combined in a fixed proportion are known as complements. Marginal rate of technical substitution is Zero.

- **Perfect Complements:** Resources which are used together in fixed proportion are called perfect complements. The iso-quants are 'L' shaped.
  For eg: Tractor and driver, a pair of bullocks and human labour.



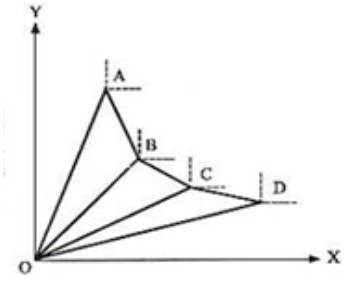
Imperfect Substitution: The two inputs are imperfect substitutes, MRTS declines and the isoquant is convex. It fairly represents the real world situation.



Imperfect substitute

- **Also called as *Smooth convex iso-quant or Convex Iso-quant***

Kinked Isoquant: When there is limited substitutability between the two inputs, the isoquant is a kinked one. That is, there is only limited number of processes for producing a commodity. Each process is represented by a straight line and passes through the origin. Substitution between the inputs is possible only at the kinks.



Kinked Iso-quant

Factor intensity:

The term factor intensity refers to the relative proportion of the various factors of production used to make a given product. In other words, factor intensity looks at how much an enterprise uses capital, for instance, as opposed to labor. You can compare the factor intensity of various kinds of enterprises with one another.

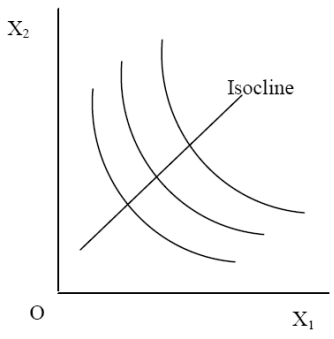
As an example, we would say that agriculture is land-intensive relative to manufacturing. Another way to say this is that it has higher factor intensity for land than it does for things like labor and capital. That means that each unit of agricultural product requires more land than each unit of manufacturing product. By contrast, a highly mechanized industry in a developed country will have higher factor intensity for capital than a less mechanized industry in a less developed country.

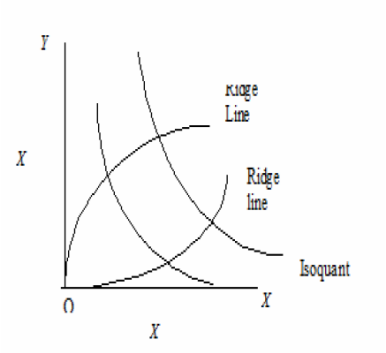
Isoclines:

These are lines pass through points of equal MRTS in the isoquant map, ie. A particular isocline passes through all isoquants on points where they have the **same slope**.

Ridge line:

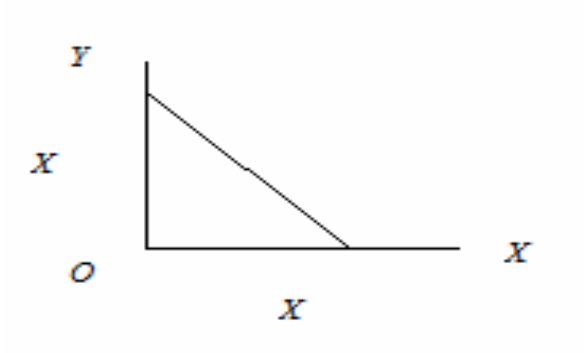
An isocline passes through points of **zero MRTS on the isoquant map** is known as ridge line. Also known as boundary lines, it demarcates the boundaries beyond which substitution between inputs is not possible.





Iso-cost line (Budget line)

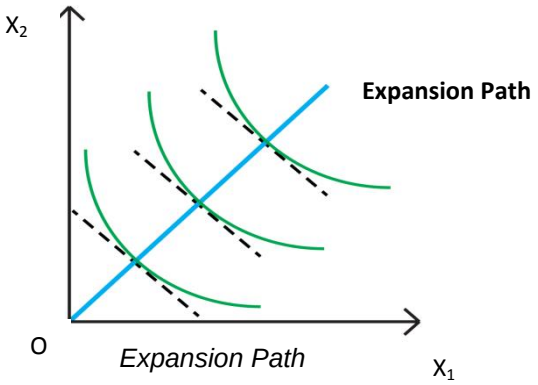
The line showing all possible combination of two inputs that can be purchased with given amount of money is known as iso-cost line. Slope of iso-cost line is called the price ratio.



Iso-cost line

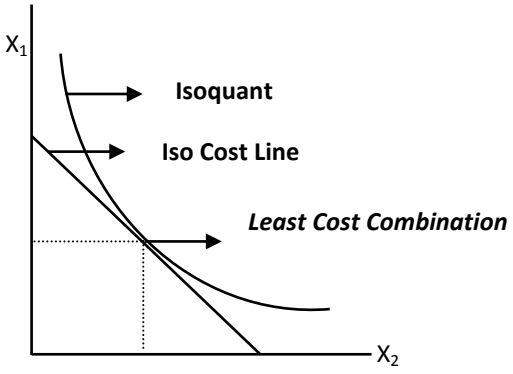
Expansion path

Isoclines that passes through the least-cost combinations of input in an iso-quant map is called as expansion path. Change in input prices shift the expansion path to a new isocline. In other words there is an expansion path for each price ratio as there is an isoquant for each production level.



Least cost combination

The problem here is to find out a combination of inputs, which should cost the least, i.e., minimization of cost. The tangency of isocost and isoquant would indicate the least cost combination of X_1 and X_2, i.e., slope of isoquant = slope of isocost.



a) Longhand Method (Tabular Method)

Longhand method or traditional method of solving this problem is based on calculating cost incurred for purchase of input (X_1 and X_2), finding the total cost (Cost of X1 + Cost X2). From the various combinations, which combination of inputs incurred least cost for producing output.

b) Algebraic method

Procedure for finding out least cost combination as follows

1. Compute Marginal Rate of Technical Substitution of X_2 for X_1: MRTS (X_2 X_1)

$$\text{MRTS} = \frac{Number\ of\ replaced\ input\ units}{Number\ of\ added\ input\ units} = \frac{\Delta X_1}{\Delta X_2}$$

2. Compute inverse **Price Ratio**= $PR = \frac{Px_2}{Px_1}$

3. Least cost combination is obtained by equating MRTS and PR $= \frac{\Delta x_1}{\Delta x_2} = \frac{Px_2}{Px_1}$

c) Graphical Method

The point at which the slope of isoquant (i.e. MRTS) equals the slope of iso-cost line (i.e. inverse price ratio) is the point of least cost combination.

Principle of factor substitution

This economic principle explains one of the basic production relationships viz., factor- factor relationship. It guides in the determination of least cost combination of resources. It helps in making a management decision of how to produce. Substitution of one input for another input occurs frequently in agricultural production. For example, one grain can be substituted for another or forage for grain in livestock ration, chemical fertilizers can be substituted for organic manure, machinery for labour, herbicides for mechanical cultivation etc. the farmer must select that combination of inputs or practices which will produce a given amount of output for the least cost. In other words, the problem is to find the least cost combination of resources, as this will maximize profit from producing a given amount of output. The principle of factor substitution says that go on adding a resource so long as the cost of resource being added is less than the saving in cost from the resource being replaced.

MRS		Price Ratio	Substitution Principle
$\Delta X_2 / \Delta X_1$ $Px_2 . \Delta X_2$	= =	Px_1 / Px_2 $Px_1 . \Delta X_1$	Least cost combination
$\Delta X_2 / \Delta X_1$ $Px_2 . \Delta X_2$	> >	Px_1 / Px_2 $Px_1 . \Delta X_1$	Cost of producing given output can be reduced by increasing X_1 and reducing X_2 (i.e. least cost combination)
$\Delta X_2 / \Delta X_1$ $Px_2 . \Delta X_2$	< <	Px_1 / Px_2 $Px_1 . \Delta X_1$	Cost of producing given output can be reduced by increasing X_2 and reducing X_1 (i.e. least cost combination)

Expansion Path and Profit Maximization

The expansion path traces out the least cost combination of inputs for every possible output level. The question now arises; which output level is the most profitable? Conceptually, this question is answered by proceeding out the expansion path that is increasing output until the value of the product added by increasing the two inputs along the expansion path is equal to the combined cost of the added amount of two inputs. Viewed from the input side, this is same as saying that the VMP of each input must equal the unit price of that input; viewed from the output side, it is the same as saying the marginal cost must equal marginal revenue. Thus, while all points on an expansion path represent least cost combinations, only one point represents the maximum output level. All variable inputs must be earning as much as they cost on the margin. i.e. MR = MC under perfect competition.

Lecture 8: Product – Product relationship: Optimum Combination of Products – Principle of Equi –Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

Product – Product relationship

The basic resources of farming viz., land, labour and capital are scarce. However theses scarce resources have many alternative uses. Scarce resources can be used in producing different crops and livestock enterprises.

Therefore, the farmers are faced with the management problem of **what to produce**.

Product-product relationship deals with the allocation of resources among different crop and livestock enterprises.

The objectives of Product-product relationship are?

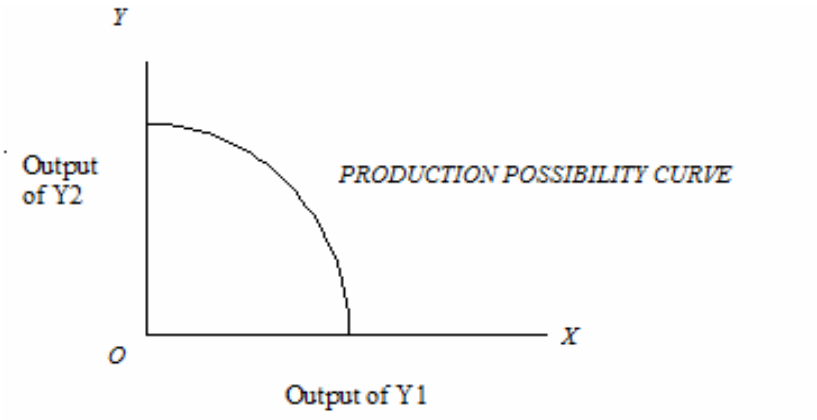
1. Profit maximization with a given resource allocation, when two or more products are being produced.
2. To determine the best combination of products for a given outlay of resources.

Algebraically this relationship can be written as $Y_1 = F(Y_2)$; When more than two products involved $Y_1 = f(Y_2, Y_3, Y_4 \ldots Y_n)$. ($Y_1$ is the function of Y_2, Y3, Y_4 and Y_n). Here resources are fixed in quantity.

Production Possibility Curve (Iso-Resource Curve):

The production possibility curve or product transformation curve represents all the possible combinations of two products that can be produced from a given quantity of resources or inputs.

It also known as transformation curves, Iso-resource curves, Iso-factor curves, Iso-cost curves, Iso-outlay curves or Production possibility frontier.



Characteristics or Properties of PPC

1. It is concave to the origin.
2. Slope of PPC is MRPS and
3. Change in input levels, shifts the production possibility curve.

Marginal Rate of Product Substitution or Marginal Rate of Product Transformation (MRPS/MRPT) :

The marginal rate of product substitution means the rate of change in quantity of one output as a result of unit increase in the other output, given that the amount of the input used remains constant. It is the slope of production possibility curve.

$$\text{MRPS} = \frac{\text{Amount of replaced product}}{\text{Amount of added product}}$$

MRPS of Y_2 for $Y_1 = \Delta Y_1/\Delta Y_2$ MRPS of Y_1 for $Y_2 = \Delta Y_2/\Delta Y_1$

Enterprise Relationship

The basic product relationships can be: joint, complementary, supplementary and competitive.

a) **Competitive Products:** Products are termed competitive when the output of one product can be increased only by reducing the output of the other product. Outputs are competitive because they require the same inputs at the same time.
For Example: the manager can expand production of one output only by diverting inputs-land, labour, capital and management-from one enterprise to another.

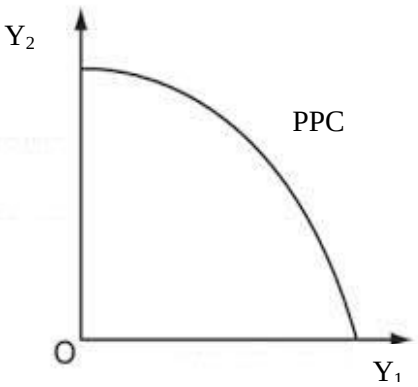
The Marginal Rate Product Substitution between the products is Negative.

b) **Complementary Products:** Two products are complementary, if an increase in one product causes an increase in the second product, when the total amount of inputs used on the two are held constant. Complementary usually occurs when one of the products produces an input used by the other product.

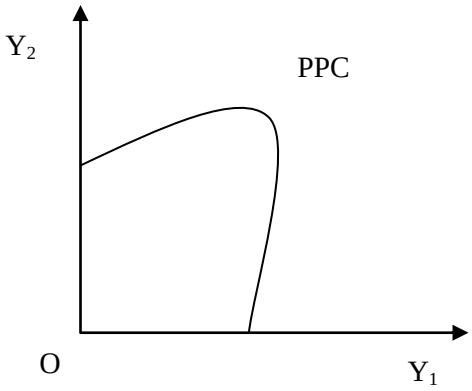
An example that can be cited here is rice succeeding a legume crop. The legume fixes nitrogen thereby improving the soil fertility for the next crop. Similarly, paddy and livestock are complementary as Paddy provides straw to

livestock and livestock in turns makes the availability of farmyard manure to the paddy crop. Here these two contribute to their mutual production.

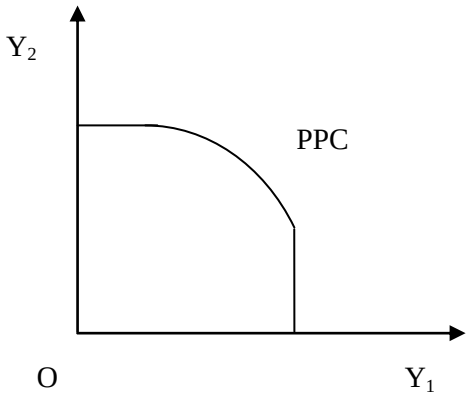
The Marginal Rate Product Substitution between the products is Positive.



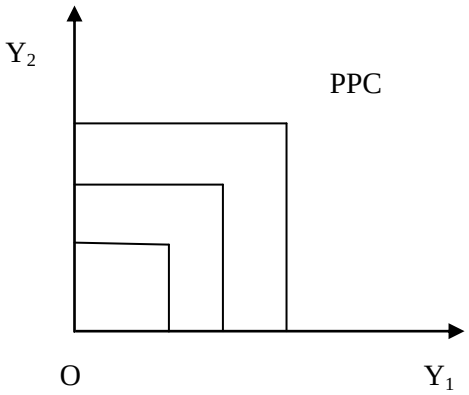
a) Competitive products



b) Complementary products



c) Supplementary products



d) Joint products

c) **Supplementary Products:** Two products are called supplementary, if the amount of one can be increased without increasing or decreasing the amount of the other. Supplementary enterprises arise through time or when surplus resources are available at a given point of time. Once purchased, a tractor is available for use throughout the year. Its use in one month does not prevent its use in another month. Thus, a tractor purchased to plough and plant may be put to a lesser use during the off-season. If two crops were harvested at the same time, however, the relationship would be competitive-use on one could reduce the amount of use on the other.

d) **Joint Products:** are produced through a single production process and one of the products cannot be produced alone but must be accompanied by one or more of other products.

For Example: paddy and straw, mutton and wool, cotton lint and seed, milk and manure from cattle etc...

e) **Antagonistic Enterprises:** Antagonism is expressed when the production function for two independent products changes as the two enterprises are produced in the presence of each other. Antagonism is the opposite of complementary relationship. When this is true, only one of the products should be produced. Eg: Aqua culture and paddy cultivation

Summary of Enterprise relationships:

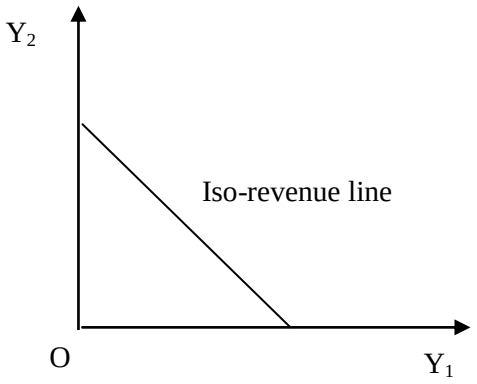
1. **MRPS is less than Zero it means the enterprise is Competitive.**
2. **MRPS is equal to Zero it means the enterprise is Supplementary.**
3. **MRPS is greater than Zero it means the enterprise is Complementary.**

Iso Revenue Line

It is the line which defines all possible combinations of two commodities which would yield an equal revenue or income. Iso revenue line indicates the ratio of prices for two competing products. The slope of the iso revenue line is determined by the output prices.

Thus, the output price ratio is the slope of the iso revenue line. The negative sign means that the iso revenue line slopes downward to the right.

The iso revenue lines are used for revenue optimization, while iso cost lines are used for cost minimization.



Characteristics or properties of Iso-revenue line:

1. Straight line

2. If total revenue increases, the IRL shifts upwards and moves away from the origin
3. IRL is parallel to each other.
4. Slope of IRL indicates the inverse price ratio.

Determination of optimum product combination

For profit maximization, a rational producer should operate in the range where two products are competitive and within this range, the choice of products would depend upon the marginal rate of product substitution and output price ratio.

a) Longhand method (Tabular method)

In this method total returns from each combination of products is calculated and the combination which gives the maximum revenue is selected. This method is feasible only for small number of calculations. But in a production possibility curve there are numerous combinations of output.

b) Algebraic method

1. Work out the marginal rate of product substitution (Signs ignored) = $\frac{\Delta y_1}{\Delta y_2}$

2. Work out the inverse price ratio = $\frac{Price\ of\ y_2}{Price\ of\ y_1}$

3. Equate MRPS with Inverse price ratio

Marginal rate of product substitution (Signs ignored) = $\frac{Price\ of\ y_2}{Price\ of\ y_1}$

i.e. $\Delta y_1 / \Delta y_2 = P.y_2 / P.y_1$

c) Graphical method

At optimum product combination, MRPT will be equal to the inverse price ratio. This point is determined by the point of tangency of MRPT curve with the iso-revenue line. In other words at optimum product combination, slope of MRPT equals the slope of iso-revenue line.

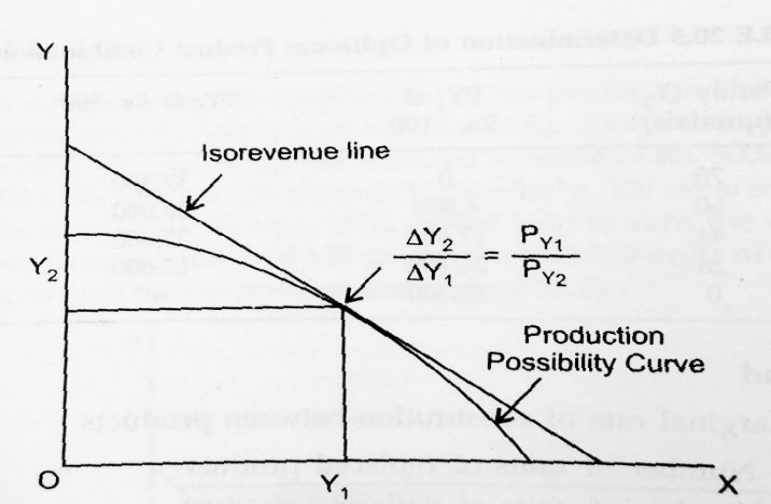


Figure 20.9 Optimum combination of products.

Summary of Three Basic Production Relationships

Criterion	**Factor – product**	**Factor- factor**	**Product- product**
Concern	Resource use efficiency	Resource Combination/ substitution	Resource allocation
Objective	Optimization of resource	Cost minimization	Profit maximization
Management problem	How much to produce	How to produce	What to produce
Decision	1. Determination of optimum input use 2. Determination of optimum output	Least cost combination of resources	Optimum enterprise/ product combination
Choice indicator	Price ratio	Substitution ratio & price ratio	Substitution ratio & price ratio
	Single variable production function	Outputs is constant and inputs are varied	Inputs are constant and products are varied
Explained by	law of diminishing returns	principle of factor substitution	principle of product substitution and law of equimarginal returns

Principles of Equi-Marginal Returns

Cultivator has limited capital and his main objective is to maximise net profit. Farmer is having several alternatives for his available capital. He should spend the amount, in such a way that he will get maximum profit. This can be achieved by using the principle of **equi-marginal returns**. The equi-marginal return principle helps us to understand how to achieve maximum return by allocating the available capital to the different enterprises.

The law of equi-marginal return states that "the profits are maximized by using the resource in such a way that the marginal returns from the resources are equal in all cases."

Farmers reach maximum return when he allocates every additional amount of capital so as to get equal marginal return. Thus, the producer will be in equilibrium when the following equation holds good:

$$\frac{MRx}{Cx} = \frac{MRy}{Cy} = \frac{MRz}{Cz} = MR\mathrm{m}$$

Where MR = marginal return in each enterprise and C is cost/investment in each enterprise.

This principle can be illustrated with the help of following example. Suppose, farmer is having Rs.50,000 for investing. His locality is favourable to take crop enterprise, dairy enterprise and poultry enterprise. It is observed from the table that, when all the amount was invested in any one enterprise net profit from crop enterprise, dairy enterprise and poultry enterprise is obtained as Rs. 26,000, Rs.22,000, and Rs. 28,000 respectively.

S.No.	Investment pattern (Rs)	Return realized per Rs 10000		
		Crop	Dairy	Poultry
1	First 10000	20000	19000	21000
2	Second 10000	19000	18000	19000
3	Third 10000	15000	15000	15000
4	Fourth 10000	12000	11000	12000
5	Fifth 10000	10000	9000	11000
	Total Realized Return	**76000**	**72000**	**78000**
	Total amount invested	**50000**	**50000**	**50000**
	Net Profit	**26000**	**22000**	**28000**
	Average return per rupee investment	**1.52**	**1.44**	**1.56**

However, if the same amount is spent according to principle of **equi-marginal returns**, total net profit will be as shown below in the table given below.

Order of Investment	Amount	Enterprise	Marginal Return
I	10000	**Poultry**	21000
II	10000	**Crop**	20000
III	10000	**Crop**	19000
IV	10000	**Dairy**	19000
V	10000	**Poultry**	19000
	Total Realized Return		**98000**
	Total amount invested		**50000**
	Net Profit		**48000**
	Average return per rupee investment		**1.96**

It is observed from the above table that cultivator is getting total net profit of Rs. 48000 which is more than profit from any single enterprise. Thus, for maximum net profit cultivator should invest Rs.20000 in crop enterprise, Rs.20000 in poultry enterprise and Rs. 10000 in dairy enterprise. It is observed from the above table that marginal returns from all the three enterprises are equal i.e. Rs.19000. Thus, it can be stated that amount should be invested in such a way that marginal returns should be equal in all the alternatives.

What is practical utility of the Principle of Equi–Marginal Returns

a. It guides the farmer to plan his budget for the preparation of his cropping scheme and fitting there in his livestock programme.
b. It enables him to determine enterprise relationship – complementary or competitive.
c. It provides guidance to the adoption of diversified or specialized farming, as there is a profitable limit for each enterprises as well as most profitable enterprise.

Opportunity cost

In agriculture, resources are limited and have alternative uses. When resource is put to one use opportunities of other alternatives are lost. John A. Perrow defined "opportunity cost is the amount of the next best produce that must be given up (using the same resources) in order to produce a commodity." The concept was first developed by an Austrian economist, Wieser.

Opportunity costs are calculated by two methods:

(a) On gross income basis-when cost of production are equal.

Enterprises	Gross Income	Cost of Production	Net Income
Tobacco Yield 12 qtl @ Rs.3000/qtl	36000	10000	26000
Potato yield 140 qtls @ Rs.400/qtl	56000	10000	46000
In this case, it is better to grow potatoes than tobacco. The opportunity cost of growing tobacco is the gross income of Rs.56000 which was sacrificed by not producing potato.			

(b) On net income basis-when cost of production are not equal.

Income	Tobacco	Potato	Wheat (HYV)
Gross Income	36000	56000	70000
Cost of Production	10000	10000	18000
Net Income	26000	46000	52000
In this case net income generated by the three crops, tobacco, potato ad wheat are Rs 26, 46 and 52 thousand respectively. It is therefore, wise to grow wheat at it gives the highest net income. The Opportunity cost of growing potato is the net income of Rs. 52000 which was sacrificed by not growing wheat.			

Opportunity cost is the return, the resource can earn when it is put into its next best alternative use.

Minimum Loss Principle

In the short run, since a producer does not have any control over the fixed cost he has to consider only the variable cost which can be altered. A producer has to continue production as long as the AR (Py) is greater than the AVC, even if AR is less than ATC, to minimize the loss in the short run. The loss would be higher if production is not carried out in the short run if TC >TR >TVC. In the long run, when all costs become variable, TR>TC or AR > AC to continue the production.

Example:

Suppose a farmer has incurred a cost of Rs.5000 to raise one ha of rice till harvesting stage. Because of severe pest attack, he expects a grain yield of only 10 quintals and a straw yield of 3 tonnes. The expected price is Rs.300/q of paddy and Rs.200/tonne of straw. The cost of harvesting and threshing would be Rs.2000/ha. Now the farmer has to decide whether to harvest or not to harvest the crop. The minimum loss principle guides the farmer in taking an appropriate decision.

Whether he harvests the crop or not, the cost already incurred (Rs.5000) up to harvesting stage cannot be altered. The only cost under his control is the cost of harvesting (Rs.2000). Let us consider the economic consequence of the two alternative decisions.

Illustration of Minimum Loss Principle

S.No	Cost/Return	Decision I (Not Harvesting)	Decision II (Harvesting)
1	Total FC	5000	5000
2	Total VC	0	2000
3	Total Cost	5000	7000
4	Total Revenue	0	3600
5	**Profit / Loss**	**-5000 (Loss)**	**-3400 (Loss)**

In the given example, the TR is Rs.3600 which is >TVC but < TC. If the crop is not harvested the loss would be Rs.5000, if it is harvested the loss would be reduced to Rs.3400. Hence the rational decision is harvesting the crop to minimize the loss.

Principle of Comparative Advantage

Certain crops can be grown in only limited areas because of specific soil and climatic requirements. However, even those crops and livestock enterprises which can be raised over a broad geographical area often have production concentrated in one region. Farmers in Punjab specialize in wheat production while farmers in Andhra Pradesh specialize in paddy production. These crops can be grown in each state. Regional speciation in the production of agricultural commodities and other products can be explained by the principle of comparative advantage.

While crops and livestock products can be raised over a broad geographical area, the yields, production costs, profits may be different in each area. It is relative yields, costs, and profits which are important for the application of this principle.

Statement of the principle

Individuals or regions will tend to specialize in the production of those commodities for which their resources give them a relative or comparative advantage.

The following example illustrates the principle of comparative advantages.

Crop account per acre	**Region A**		**Region B**	
	Wheat	**Groundnut**	**Wheat**	**Groundnut**
Total Revenue (Rs.)	500	225	225	220
Total Cost (Rs.)	425	200	210	200
Net Revenue (Rs.)	75	25	15	20
Returns per rupee	**1.18**	**1.13**	**1.07**	**1.10**

Region A has greater absolute advantage in growing both wheat and groundnut than Region B because the net incomes per acre are Rs. 75 and Rs. 25 respectively which are higher than the net incomes from wheat and groundnut in Region B. Farmers of Region A can make more profits by growing both the crops. But they want to make the greatest profits and this can be done by having the largest possible acreage under wheat alone as it is the question of relative advantage. Similarly farmers of Region B have relative advantage in growing groundnut.

Lecture 10: Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises

Farm Business Analysis

The main objective of farm business analysis is to examine.

i. How does the business fare at a certain time
ii. Where are the weakness and
iii. What improvements are possible.

There is some subsidiary objective too, such as providing background information for farm policies and for getting credit facilities etc.

The following are the three steps or stages of farm business analysis:

i. Proper recording of accounts and activities
ii. Analysis and interpretation of results and
iii. Presentation of results.

Recording of Data

Proper recording of the data in the relevant columns of suitable record books is very essential. The daily transactions need to be recorded neatly and correctly in the appropriate columns meant for the purpose. Making summaries an analyzing the recorded data becomes very difficult if systematic method of making the entries is not followed and sometimes all the time and effort put in a haphazard record are lost. It is, therefore, necessary to select suitable types of record books.

Analysis and interpretation

Raw data in the farm financial records kept by farmers will have little value unless they are properly summarized, tabulated and analyzed. The second stage of farm accounting begins with determination of the proper measures of income and the computation of management and efficiency factors for the farm.

Finally tabulations and charts are made to show the factors which affect the farm success and failure so that an individual farmer, by comparing his performance with these measures or standards, may be able to recognize his weak points and take necessary steps for improvements.

Present Position in Farm Record keeping

A farm record or an account is simply another farm management tool. This tool is developed and used for the same purpose like any other farm equipment is used on the farm to aid farmer in obtaining greater profits or making larger savings in the operation of his business. These records besides making the farmer plan-minded also provided valuable facts to be used in future planning.

Profitability

Profitability measures how well the farm business uses the resources available to generate income and profit. Profit and profitability are not the same. As mentioned before profit is the amount of money earned after total costs are deducted.

Two farmers may show the same profits but may not be equally profitable. This could be a result of the way farmers use their resources. In order to compare these farms, we need to see exactly how the farmers make use of their resources to generate profits.

Using profitability as a basis for comparison instead of profit means that one can compare like with like. To compare profitability and performance, a farmer can use common measures such a gross margin, enterprise profit and farm profit. Profitability is linked to efficiency and this in turn depends on the wise management and use of inputs and resources.

Tips for analyzing farm enterprise profitability:

- Conduct a problem analysis for selected enterprises.
- Assist farmers in understanding market costs and margins in calculating the farm gate price.
- Understand the reasons why prices change in both the short and long term
- Analyse market information over the season.
- Draw up gross margin or enterprise budgets for different farm enterprises.

Efficiency

Efficiency is the careful use of the resources available to the farmer. While the farm business may generate profits and be profitable, an important question to ask is whether or not the farm business is efficient. A farm that is efficiently run is more likely to be profitable than a farm that is not. There are two forms of efficiency – technical efficiency (producing the highest possible output from a given set of inputs) and economic (the financial returns from resources used).

Technical efficiency occurs when the maximum amount is provided given a set of inputs. There is usually more than one way to grow crops or raise livestock. It impossible to produce farm products by farming a small quantity of land very intensively, combining a lot of labour and capital. It is also possible to produce the same product by farming the same land area extensively, with only small amounts of labour and capital. Technical efficiency is producing farm products with the best combination of resources or inputs.

Technical efficiency is measured by the physical ratio of output to input. The greater the ratio, the greater the degree of technical efficiency.

Technical efficiency indicators of crop enterprise:

- Yield per hectare

- Yield per person day
- Yield per tree
- Fertilizer use per hectare
- Crop yield index
- Cropping intensity

Technical efficiency indicators of livestock enterprise:

- Birth and Death rates for livestock (%)
- Live weight gain per head
- Number of draught cattle per ha.
- Litres of milk per cow
- Litres of milk produced per kilogram of feed
- Number of eggs per layer
- Kilograms per broiler
- Number of pigs per litre

Economic efficiency measures the financial returns on resources used. Economic efficiency looks at the cost of using resources to produce a given level of output. If profit is the main objective then economic efficiency is achieved when resources are used to give maximum profit.

Economic efficiency indicators of farm enterprise

- Feed cost per kilogram of production gain
- Value of crop production per cultivated area
- Rate of capital turnover
- Input costs

Lecture 11: Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.

Farm Records and Accounts

Management of a farm business requires a wide range of information on physical and financial performance. Farm book-keeping is known as a system of records written to furnish a history of the business transactions, with special reference to its financial side (Adams). Records and accounts helps in evaluating the performance of the farm business, obtaining credit from financial institutions, filing tax returns, evaluation of investment alternatives etc.

Advantages of farm records & accounts

The various advantages of keeping systematic farm records can be described as under:

1. Means to higher income

To obtain higher income, farmers must have exact knowledge about present and potential gross income and operating costs.

2. Basis for diagnosis and planning

Diagnosis of management problems is the pre-requisites of sound planning. Records and accounts provide the basic information needed for such a diagnosis.

3. Way to improve managerial ability of the farmer

The farmer gets a better insight into the working of his business, and farmer can avoid mistakes and losses.

4. Basis for credit acquisition and management

Properly kept records and accounts can demonstrate and authenticate the production and income potentials and credit worthiness of the farmer.

5. Guide to better home management

Records and accounts provide information on farm-household economy. Analysis of farm records provides good guides for the allocation of resources between production improvement and immediate family welfare.

6. Basis of conducting research in Agricultural Economics and production economics

Research requires precise and correct data which is possible only proper records and accounts are maintained on the farm.

7. Basis for government policies

The farmers need to continuously feed the facts for state and nation, farm policies such as land policies, price policies, and crop insurance, etc.

A good system of accounts for any farm is one that enables recording information that the farmer needs and also permits the desired analysis of the information recorded.

Systems of Book-Keeping

There are two systems of farm accountancy: *(i)* double entry system, and (ii) single entry system.

Double Entry System

It is a method of recording each transaction in the books of accounts in its two fold aspects, i.e. two entries are made for each transaction in the same set of books, one being a debit entry and the other a credit entry.

Single Entry System

This is the system which ignores the double effect of transactions. Only personal accounts of debtors and creditors are kept and impersonal accounts are ignored altogether.

Farm records are usually of the following types:

(i) Farm inventory; (ii) Physical farm records; (iii) Financial farm records

There are many different kinds of farm records and accounts, each of which can be adopted for a given purpose on a particular farm situation.

Farm inventory refers to the listing down the items possessed by the farm on a specified date which includes inventory of crop and livestock, inventory of farm machinery, and farm building.

Physical Farm Records

Physical records are related to the physical aspects of the operation of a farm business. They do not indicate financial position or the outcome of the farm business, but simply record the physical efficiency or performance of the farm.

Physical farm records normally include the following records:

- Farm map, soil map and contour map, Stock register.
- Charts on physical efficiency,
- Land utilization record,
- Farm production and disposal record, Input registers,
- Labour records, daily work diary and machinery use records.
- Feed records
- Store register

Financial Farm Records which deals with the financial transactions can be recorded in four main types of accounts.

- Farm cash or farm financial record
- Capital asset and sale register
- Cash sale register
- Credit sale register
- Purchase register
- Wage register
- Funds borrowed and repayment register
- Non-farm income records

Supplementary records

- Sanction register
- Auction register
- Rainfall register
- Hire register
- Stationary register

Farm Inventory

The list of the physical property of a business along with their values at a specific point of time is called farm inventory. Inventory for a business is taken at two points of time in a year i.e. at the beginning of the agricultural year at the end of the year. It constitutes cash assets, depreciable assets and non-depreciable assets. The difference in the inventory at the two points of the time indicates the changes in the inventory.

Farm inventory from the basis for the preparation of income statement, balance sheet, measures of income, etc. The loss in the value of asset due to depreciation can be worked out from the farm inventory

As per the sub-items, inventory is presented like cash assets, depreciable assets and nondepreciable as present in below table:

S.N.	Particulars	Beginning of the year 01.07.2017 Quality as/Kg or no.	Value in Rs.	End of the year 30.06.2018 Quality/Q /kg/no.	Value in Rs.
I	**Cash assets**				
	Cash on hand				
	Saving in bank etc				
	Sub total				
II	**Depreciable assets**				
	Land (ha)				
	Farm building				
	Machinery & equipment				
	Implements				
	Dairy cattle				
	Bullocks				
	Sheep's & goats				
	Poultry bird				
	Sub total				
III	**Non-depreciable assets**				
	Grain ready for disposal				
	Fodder &feed				
	Livestock products				
	Seeds				
	Fertilizers				
	Pesticides & fungicides				
	Sub-total				
	Total of all assets				

Change in the inventory is found out by taking the difference of the value of assets during the two periods. As evident from the table that the items that need to be included in the farm inventory are, the number of various assets along with their values. As for as recording the number of items are concerned it can be done by visual verification. The relevant weight and measures are also noted for the corresponding items of assets.

The preparation of farm inventory involves physical verification of the assets. Physical verification of the items does not cause a problem to the farmer. Problem arises while valuing the assets since improper evaluation leads to erroneous farm decisions.

Balance sheet or Net worth statement:

A balance sheet statement shows what a business owns (assets) what it owes (liabilities) and what investment the owners have in the business (Owners claim). It can be likened to a snap short that shows the financial make up and the condition of the business at a particular point in time.

Assets:

The possessions of the farm business that have monetary value are called assets. Assets are usually listed on the top or on the left hand side of the balance sheet.

Classification of assets:

Assets are classified into fixed assets, working assets and current assets. The classification is based on the criterion of liquidity of the assets – which implies the length of time required to convert them into cash.

A. Current assets: Assets that can be converted to cash during one normal operating cycle of the business *i.e.,* within the account in year. The value of current assets bears a significant relationship to the stability of the business because it represents the amount of cash that might be raised quickly to meet current obligations.

The major current asset items may include the items *viz.,* cash on hand, bills receivable, account deposits in banks, cash register money, petty cash, prepaid expenses etc. and inventory – items that are held for sale *i.e.,* crop and livestock produce and those items to be consumed in the process of producing crop and livestock products to be sold *i.e.,* seed, fertilizers and manures, feed and fuel, lubricants, pesticides and insecticides, weedicides etc. Marketable securities – shares and bonds etc.

B. Intermediate / Working Assets: They are mainly used during the life of business to produce future income. They are more liquid then fixed assets. Eg: Farm machineries, equipment and breeding livestock.

C. Fixed assets: Fixed assets which are difficult to convert into cash to meet any current obligation. Eg: Land, Building, cattle sheds, pump sheds, storage structures, pump sets, wells.

Liabilities:

The amounts that the business owes to creditors is called liabilities. These are the dues/loans/borrowings of business/credit outstanding *etc*. Liabilities are generally located in the middle section or on the right side of the balance sheet. Legally creditors of the business would have first claim against any of its assets.

Classification of liabilities:

A. Current liabilities: Current liabilities are those outsiders claimed on the business that will fall due within one normal operating cycle, usually one year. These are accounts/bills payable i.e., items purchased on credit, short term loans, notes payable, accruals-taxes payable, wages payable, specific portion of any long term and debt that will come due within a year, crop loans *etc.* (less than 1 years)

B. Intermediate Liabilities: are those associated with intermediate assets. Eg:Medium term loans. (1- 5 years)

C. Long term liabilities: Outsiders claim against the business that do not come within one year are called long term liabilities. They include bonded indebtedness, mortgages, long term loans, cattle loans, pump sets loans, poultry loans, tractor loans, orchard development loans, land development loans etc. matches the total assets value figure (Long term Loans – more than 5 years)

Owners Claim:

The value of the assets over and above the liabilities can justifiably be called the owners claim against the assets or owners' equity. Owner's equity is often referred to as **Net worth**. The networth section usually appears just below the liability section.

Owner's equity consists of

1. Owners original investment to the business is listed as a separate entry called common stock.
2. Retained earnings represents net profits on owner's original investment, the owners have chosen to leave in the business as additional contributed capital.

The balance sheet is set up to portray two aspects of each entry or event recorded on it. For each thing of value or asset, there is an offsetting claim against that asset.

The recognition of this concept leads to the fundamental balance sheet formula.

Assets = Liabilities + Owners Equity

This formula indicates there will be a balance between assets and the claims against them (Liabilities + Owner equity). The balance sheet is well named because it always balances.

Owners Equity = Assets - Liabilities

This is a balancing figure that the owners receive whatever the assets are left after the liability claims have been recognized.

Summarized form of Balancesheet:

Balance sheet of farmer (Name ……) as on date:

A	Assets	Value (Rs.)	B	Liabilities	Value (Rs.)
a)	Current Assets		e)	Current Liabilities	
b)	Intermediate Assets		f)	Intermediate liabilities	
c)	Fixed Assets		g)	Long term Liabilities	
d)	Total Assets (a+b+c)		h)	Total Liabilities (e+f+g)	
			i)	**Networth = (d – h)**	

Profit and Loss Account

The function of profit and loss account is to enable the trader to ascertain the net profit or net loss resulting from the business transaction during a given period.

In farming we call profit or loss account “production or profit & loss A/C”. The profit and losses are a nominal account and are carried out it.

The gross profit as shown by the trading account would be transferred to the credit side of the profit and loss A/C. On the credit side of the profit or loss account would also be shown other items of miscellaneous income such as interest, commission, discount, dividend, profit on exchange, rent received etc.

On the debit would be set out the entire expenses incidental to the carrying on the business, such as office rent, scariest, insurance, advertising, printing and such other expenses or losses as may have arisen in the courage of earning the above income.

The balance or differences of debit and credit is the final results of the farmer’s operations for the period and it is either net profit or net loss, which is carried to the capital account. The net loss is carried to the debit side of the capital account, as the capital account by an entry debiting profit and loss account and crediting capital account, as the capital is increased by the amount of profit.

Point’s imperative for profit & loss account:

1. That only such item of income and expenses, which properly belong to the business are included on each side of account.
2. That the items include pertaining to treading period under review.
3. The each items of income or expenditure is shown under its appropriate head.
4. That there is proper grouping and classification of items.
5. That the whole account is constructed up or a consistent basis from the year so as to admit of useful comparison.

Forms of profit and loss account: It various with the nature of the business, information sought. The account should be so alarm up as to disclose the fullest information at the glance, as also to enable the easy comparison to be made of the various expenses and the source of income with similar items of the previous year's records.

Uses of the profit and loss accounts:

1. Financial results are ascertained for the working year.
2. The true nature & extent of expenses or loss arranged under various heading and the various sources of income are known.

Considerable points for profit & loss account:

1. All operating expenses (other than investment) whether actually paid or out.
2. All the farm income (other than receipts from the sale of articles which formed the part of the equipments) that is farm produce, dairy produced, poultry produce, fisheries produces etc. increase in the value of livestock during the given period or year, whether actually received or not.
3. The profits from the sale of farm produce held over from previous year.
4. The estimated value of goods produced & still held for future sale or use on the farm.
5. The value of farm produce supplied to the household of the farmer.
6. The value of farm produce of the current year given as wages or fed to livestock during the year, it is also shown into account.

Lecture 12: Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting - linear programming, appraisal of farm resources, selection of crops and livestock's enterprises

Farm Planning

Definition

Farm planning is the deliberate process of thinking, the organized foresight and the vision based on facts and past experience that is needed for intelligent action on the farm.

Objective

The short term objective of farm planning is to maximise the net income through improved resource use planning.

The long term objective of farm planning is to improve the standard of living of the farmer through higher income.

Importance or Advantages or Why farm planning is necessary?

1. It helps the farmer to collect details on alternative methods and practices.
2. Given his past experience and resource position, farm planning helps him to select from different alternative enterprises and methods, which will fit in his situation the best.
3. It helps him in identifying various supply needs for his alternative plan like seeds, fertilizers, machinery, etc.
4. Farm plans give an idea about the expected income which will help the farmer in better financial management.
5. To avoid wastages that occur in the resource use

Characteristics of a good farm plan

1. Provisions should be made for efficient use of farm resources like labour, power, machinery etc.
2. Crop plan should be balanced in such a way that,
    a) There is optimum combination of food, cash and fodder crops.
    b) It helps to maintain and improve soil fertility.
    c) It helps in increasing and stabilizing farm income.
    d) There is proper spread in the use of labour, water, etc.
3. Avoid excessive risks.
4. Provides flexibility for modification

5. Makes best use of the skill, knowledge and training of the farmers and takes into account his likes and dislikes.
6. Provision for getting, using and repayment of credit.
7. Gives consideration to efficient marketing of farm production.
8. Gives provision for use of modern agricultural methods and practices.

Techniques of farm planning

There are a number of tools and aids used in farm planning. These techniques vary in perfect knowledge situation and imperfect knowledge situation.

Some of these techniques include production function models, linear programming models, probabilistic models, game theory models, demand and supply projections, farm budgeting and market research.

Types of farm plans

Farm plans are categorized into two sub-groups viz., simple farm plan and complete farm plan. Simple farm plan implies planning for minor changes or for a particular enterprise. Complete farm planning envisages more number of changes in the existing organization. It is adopted for the farm as a whole.

1. **Simple farm planning** is adopted for either for a part of land or one enterprise or to substitute one resource by another.
2. **Complete farm planning** envisages farm planning for the whole farm, i.e. for all enterprises on the farm or far a change in the farm structure and organization.

Farm Budgeting

Expression of the farm plan in monetary terms through costs and prices is called budgeting. In other words farm budgeting is a process of estimating costs, returns and net profit of a farm.

a) Partial Budget

It refers to estimating the costs and prices of only a part of the business (i.e. one or a few activities in the farm). Partial budgets are used to estimate the effects or outcomes of changes like introduction of a new variety or implement in the farm.

The main **advantage** is that it is simple and easy.

Disadvantage

It fails to consider all factors in maximizing net returns to the farm as a whole. It doesn't take into account complementary and competitive relationship between different

enterprises and will not explain the allocation of joint costs between different enterprises. A combination of partial budget may not necessarily add to a total budget.

The format for partial budget is:

Debit (Rs.)	Credit (Rs.)
Added cost 1) 2) **Reduced return** 1) 2)	**Added return** 1) 2) **Reduced cost** 1) 2)
(A) Total added cost and reduced returns	(B) Total added return and reduced cost
	Net change in Income = B - A

b) Enterprise Budget

Enterprise budgets are used to estimate input required, costs involved and returns expected from a particular enterprise. The data needed for enterprise budget are:

a) Physical input data (Seed, fertilizer, insecticide, etc.)

b) Field output data (at different levels of input use)

c) Costs and prices for inputs and outputs.

c) Complete Budget or Whole farm budget

It considers the farm as a whole. It considers all the enterprises in the farm, different production methods and estimate costs and returns for the farm as a whole.

Advantages: Complete budgeting brings progressive changes in income because:

i) It considers resource availability and all enterprises simultaneously.

ii) It considers complementary, supplementary and competitive relationships among enterprises.

iii) It allows substitution between resources for maximum returns.

Disadvantage

The main disadvantage of complete budgeting is it requires more data, time and efforts.

d) Cash Flow Budget

An estimation of the cash inflows and outflows for a business or individual for a specific period of time is known as cash flow budget. Cash budgets are often used to assess whether the entity has sufficient cash to fulfill regular operations and/or whether too much cash is being left in unproductive capacities.

A cash budget is extremely important, especially for small businesses, because it allows a company to determine how much credit it can extend to customers before it begins to have liquidity problems.

For individuals, creating a cash budget is a good method for determining where their cash is regularly being spent. This awareness can be beneficial because knowing the value of certain expenditures can yield opportunities for additional savings by cutting unnecessary costs.

Advantages

This tool helps determine whether cash balances remain sufficient to fulfill regular obligations and whether minimum liquidity and cash balance requirements stipulated by banks or internal company regulations are maintained.

It also helps a company determine whether too much cash is retained that could be otherwise used in productive activities. Companies that borrow from banks need to monitor their cash coverage ratio and preparing a cash budget constitutes the first step in calculating this ratio.

Companies use cash budgets to make plans for optimal utilization of cash. The goal is to retain only the minimum required working capital, investing the surplus cash in productive ventures, such as making profitable investments, expanding production capacity, purchasing raw materials in bulk and in using cash to obtain favorable discounts.

Disadvantages

- Cash budgets may also cause distortions. Cash inflows do not equate to profit.
- Cash budgets are susceptible to manipulation.
- A bigger disadvantage is the reliance on estimates. Cash budgets use cash flow one year to allocate cash for the next year, when there is no guarantee that cash flow levels, or revenue and expenditure levels, will remain the same.
- At times, non-financial factors have a major impact in decisions. For instance, a product might not generate much cash flow, or generate negative cash flow.

Steps in whole farm planning and budgeting

1. Setting of goals

The identification of family and business goals is very important. Family goals are influenced by family values (religious belief, social value system etc) and family circumstances (age, health, skill, education level etc.) Business goals are influenced by business values (high profitability, growth, liquidity etc) and business circumstances (existing social, economical, technological and institutional conditions).

The family goals that coincide or do not conflict with business goals are the relevant family business goals which can be used in planning.

2. Inventory of Resource availability

Inventory of resources such a land, labour, capital (building, machinery, liquid capital etc) will help to assess the resource limitation and production capabilities of the farm. The possibilities of renting, hiring and borrowing of resources may also be considered.

3. Identification and selection of alternatives to be analysed

In forward planning, analysing alternatives is of great importance. Lack of information and knowledge limit the alternatives one might consider. It is based on land, soil and water.

4. Selection of input information to be used in the analysis process

Once the alternatives have been selected the next step is to specify the input – output relationships. It is concerned with the quantity, the quality of inputs needed to achieve a certain level of output. It is important to consider the fundamental economic concepts in deciding the input and output levels.

5. Selection of prices to be used in the analysis process

Once the input relationships have been established, price must be considered to evaluate the economic consequences of the proposed alternative or adjustment. Product prices may be somewhat more difficult to estimate that input prices because of wide fluctuations.

6. Analysis of various alternatives

In this final step of forward planning each of the alternatives under consideration is analyzed. Analysis involves selecting the appropriate analysis technique and evaluating the positive and negative aspects of each alternative. Partial and whole farm budgeting can be used to analyze the alternatives.

7. Comparing the alternative plans

The alternative plans are compared and the best one is chosen considering sustainable and long development of the farm.

Linear Programming

Linear Programming is that branch of mathematical programming which is designed to solve optimization problems where all the constraints as well as the objectives are expressed as linear function. It was developed by George B. Denting in 1947. Its earlier application was solely related to the activities of the Second World War. However soon its importance was recognized and it came to occupy a prominent place in the industry and trade.

Linear programming is a mathematical method of analysis, which finds the “best” or optimal combination of business activities to meet a certain objective. Three components are needed to solve a problem with linear programming technique. They are:

1) a desire to maximize or minimize some objective,
2) a set of activities or processes available to accomplish this objective and
3) a set of constraints or restrictions that limit one's ability to achieve this objective.

Basic assumptions of Linear Programming

i. **Proportionality or linearity:** Linear relationship exists between activity and resource. For example, if one acre requires 30 man days, 100 Kgs of nitrogen and Rs.60 of other variable expenses to produce 20 quintals of maize output, then 10 acres of maize would require exactly 10 times of each resource to produce 200 quintals of output.

ii. **Additivity:** The total amount of resources used by several enterprises on the farm must be equal to the sum of resources used by each individual enterprise. Hence no interaction is possible. The same is true for the products also.

iii. **Divisibility:** Fractions can be used and enterprises can be produced in fractional units. Resources and products are infinitely divisible.

iv. **Non-negativity:** None of the activity is negative.

v. **Finiteness:** Number of activities and constraints are finite.

vi. **Certainty:** Almost all planning techniques assume that resources, supplies, input - output coefficients and prices are known with certainty.

Concepts used in Linear Programming

i. **Solution:** A solution refers to any set of activities X_j, j = 1, 2, 3, ..., n, which satisfies a system of inequality constraints. There may be innumerable solutions to a given linear programming problem.

ii. **Feasible Solution:** Any solution to a linear programming problem is said to be feasible, if none of the X_j is negative.

iii. **Infeasible Solution:** It refers to a solution, where some of the variables, X_j, appear at a negative level.

iv. **Optimum Solution:** One of the feasible solutions is optimum, provided a feasible solution exists. Such a feasible solution, which optimizes the objective function, is called an optimum solution. The set of Xj in this case satisfies the set of constraints and non-negativity restrictions and also maximizes the objective function.

v. **Unbounded Solution:** Many a time, faulty formulation of a linear programming problem may result in an arbitrarily large value of the objective function and the problem has no finite maximum value of profit. It represents a case of unbounded solution to a linear programming problem.

Graphical Method

Linear Programming Problem involving only two variables can be effectively solved. Graphical method provides pictorial representation of the problems and its solution. It is simple and easy to understand. The redundant constraints are automatically eliminated. Multiple solutions, unbounded solutions and infeasible solutions get highlighted very clearly.

Procedure to solve a Linear Programming Problem by Graphical Method

1. Consider inequality constraints as equations. Draw the straight lines in the XOY plane corresponding to each equality and non-negativity constraints.
2. Find the permissible region for the values of the variables which is the region bounded by the lines drawn in step one.
3. Find the points of intersection of the bounded lines by solving the equations by the corresponding lines.
4. Find the values of Z at all vertices of the permissible region.
5. a) For maximization problem, choose the vertex for which the value of Z is maximum.

   b) For minimization problem, choose the vertex for which the value of Z is minimum.

Advantages of Linear Programming

1. **Scientific Approach to Problem Solving.** Linear Programming is the application of scientific approach to problem solving. Hence it results in a better and true picture of the problems-which can then be minutely analysed and solutions ascertained.
2. **Evaluation of All Possible Alternatives.** Most of the problems faced by the present organizations are highly complicated - which cannot be solved by the traditional approach to decision making. The technique of Linear Programming ensures that'll possible solutions are generated - out of which the optimal solution can be selected.
3. **Helps in Re-Evaluation.** Linear Programming can also be used in re-evaluation of a basic plan for changing conditions. Should the conditions change while the plan is carried out only partially, these conditions can be accurately determined with the help of Linear Programming so as to adjust the remainder of the plan for best results.
4. **Quality of Decision.** Linear Programming provides practical and better quality of decisions' that reflect very precisely the limitations of the system i.e.; the various

restrictions under which the system must operate for the solution to be optimal. If it becomes necessary to deviate from the optimal path, Linear Programming can quite easily evaluate the associated costs or penalty.

5. **Focus on Grey-Areas.** Highlighting of grey areas or bottlenecks in the production process is the most significant merit of Linear Programming. During the periods of bottlenecks, imbalances occur in the production department. Some of the machines remain idle for long periods of time, while the other machines are unable toffee the demand even at the peak performance level.

6. **Flexibility.** Linear Programming is an adaptive & flexible mathematical technique and hence can be utilized in analyzing a variety of multi-dimensional problems quite successfully.

7. **Creation of Information Base.** By evaluating the various possible alternatives in the light of the prevailing constraints, Linear Programming models provide an important database from which the allocation of precious resources can be don rationally and judiciously.

8. Maximum optimal Utilization of Factors of Production. Linear Programming helps in optimal utilization of various existing factors of production such as installed capacity, labour and raw materials etc.

Limitations of Linear Programming

i) Computational difficulties are enormous (unbounded solution may occur).

ii) It does not take into account the time.

iii) Several real world situations are non-linear and in Linear Programming, only linear equations are solved.

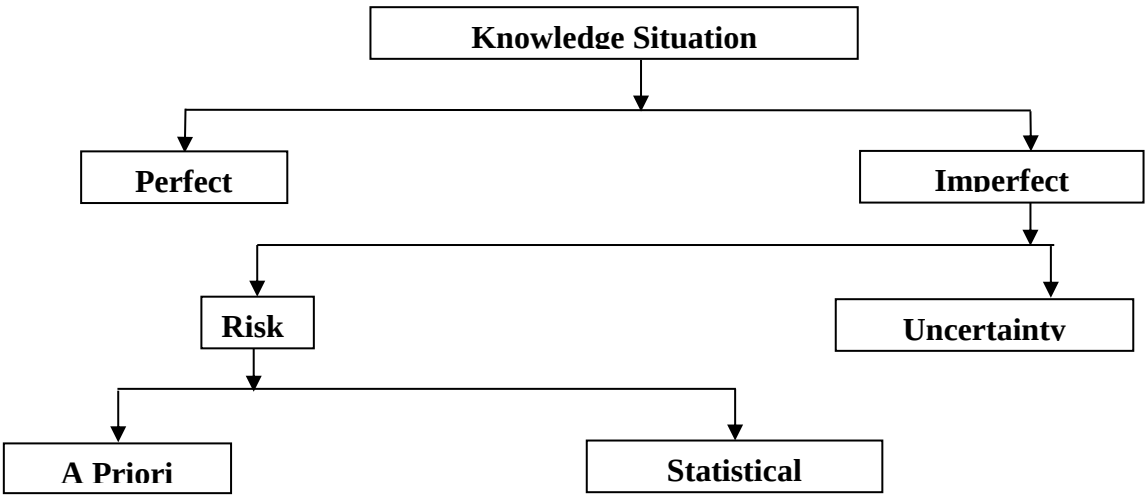
iv) Application of Linear Programming to the macro model is very difficult. Rounding up of the solutions of variable will alter the value of optimal solution.

v) Multiplicity of Goals. The long-term objectives of an organization are not confined to a single goal.

Lecture 13: Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies

Agriculture depends on climatic factors like rainfall, sunlight, humidity, etc., and always not easy to predict. Knowledge on various aspects that affects the crop and how to overcome these situations would enable the decision maker to manage the farm in an efficient manner.

Frank knight classified the knowledge situation into the following logical possibilities.



A situation is said to be risky, if the occurrence of future events can be predicted by the specified level of probability. Risk represents less imperfection in knowledge that does uncertainty. A priori risk means based on advance information about the occurrence of an event can be predicted.

A priori – risk prevails when sufficient information is available about the occurrence of an event. Eg. tossing a coin. Contrary to this, a statistical risk can only be predicted on the basis of occurrence of several observations in the past. Mortality tables of insurance companies provide good examples of statistical risk. Because of the quantification of imperfect knowledge under a risk situation, the event can be insured.

Uncertainty

It is a situation in which the occurrence of future event cannot be predicted with certain probability level.

Decision. If the future is so uncertain, farmers will not commit any of his resources to a production plan such a decision itself is a farmer's reaction to the imperfect knowledge situation.

It is very difficult to (classify) or differentiate above two situation – risk and uncertain – hence in most of the literatures it is used interchangeably.

Types of Risks and Uncertainties: Risks and uncertainties can be classified into the following five categories.

a. **Economic Uncertainties:** In general, farmers in most countries face differences in price for the inputs and outputs from what they might have anticipated at the time of preparing farm plan.
b. **Biological Uncertainties:** Rain or storm, drought and also by increased incidence of pest and diseases may all affect the yield in agriculture directly or indirectly.
c. **Technological Uncertainties:** Technological improvement necessarily implies that the same level of input can now produce larger quantity of produce. The upward shift in the production function signifies that more output can be produced at each level of input after technological progress. This effect would be due to the delayed operation of the law of diminishing marginal returns. Thus, improvement of knowledge or technological progress, which is a continuous phenomenon, may render some techniques less efficient and finally obsolete.
d. **Institutional Uncertainties:** Institutions like government, bank, etc may also cause uncertainties for an individual farmer. Crop cess, credit squeeze, price supports, subsidies, etc. may be enforced or withdrawn without taking an individual farmer into confidence. This type of uncertainty may also result in non-availability of resources in appropriate quantity and at the appropriate time and place.
e. **Personal Uncertainties:** The farm plan may not be executed or delayed because of some mishap in the farmer's household or in his permanent labour force.

Safeguards against Risks and Uncertainty

Some farmers take more risk than others. However, all farmers use one or more measures of different types to safeguard themselves against risks and uncertainties on their farms. The various measures generally used to counter risks and uncertainties in agriculture are as follows:

1) **Selection of enterprises with low variability:** There are certain enterprises where the yield and price variability are much lower than for others. For example, rice has relatively much less variability in its yields and prices than tomato. Thus, the inclusion of enterprises with low variability in the farm plans provides a good way to safeguard against risks and uncertainties.
2) **Discounting Returns:** At this stage, we refer to discounting only as a function of risk and uncertainty, and not time. In terms of the profit maximization condition of VMP = Px, discounting means that either the output price (Py) is decreased or input price

(Px) is increased by some proportion or it can be of both. Thus, the profit maximization level of the variable input X_1 may now be lower with discounting than otherwise.

3) **Insurance:** Insurance covers the cost to some extent so as to minimize the loss.
4) **Forward Contracts:** They reduce the future prices of both inputs and outputs into certainty. Pre-harvest contracts of mango, share cropping, i.e., forward contract in kind are some examples for this.
5) **Flexibility:** This refers to the convenience with which the organization of production on a farm can be changed.
    a. **Time Flexibility:** Time flexibility may be introduced either through proper selection of products or production methods or partly by both. Orchard plantation is a relatively rigid enterprise than annual crops. A short-lived farm structure is more flexible that the durable.
    b. **Cost flexibility**: Wherever time flexibility is of limited use, cost flexibility becomes important. Cost flexibility refers to variations in output within the structure of a plant of a longer life. Extension or concentration of output, whenever desired by favourable prices or yields can be brought about at lower cost for a given farm (plant). Owning rather than custom hiring a power tiller may have more cost flexibility.
    c. **Product flexibility:** Product flexibility aims at changes in production in response to price changes. In this category, machines, farm structure, etc, can be readily shifted from one product to another.
6) **Liquidity:** This refers to the case with which assets in a farm can be converted into cash, the most “liquid” of all assets. If some of the assets are held in the form, which can be easily converted, into cash, it provides a safeguard to the farmer by enabling him to make necessary adjustments in response to risks and uncertainties of various types.
7) **Diversification:** It is a means of stabilizing income rather than profit maximizing technique relating to receive benefits of complementarity or supplementarity. Under risky environment, a farmer may not specialize in a single enterprise over a period of time even if substitution and price ratios may so dictate as discussed under product-product relationship. Instead, he may choose several enterprises in some proportion overtime, so as to distribute the risk factor. Like flexibility, it has no provision to reap large gains due to high prices or yields over time, but serves as a good method to prevent heavy losses. However, the diversification of farm activities may deprive the entrepreneur of all the advantages of specialization.
8) **Maintenance of resources in reserve:** Many a time, there is a risk or uncertainty about the availability of the right inputs, in the required quantity at the right time and

place and at a reasonable price. This may be due to the imbalance between demand and supply of the resources. To overcome this problem, the best way is to maintain sufficient stocks of such inputs. Maintenance of sufficient stocks depends on the availability of funds, his ability to forecast prices and the availability of resources and storage facilities in the farm.

9) **Adjustment to uncertain of Inputs:** When a resource is not available, the best way the farmer can safeguard against such risk and uncertainty is by exploring the use of some other resource as a substitute. If a farmer is uncertain about the availability of inputs, he would do better by choosing the best alternatives, i.e., sowing the second best variety, using the second best fertilizer, using the second best method of harvesting etc.

Lecture No. 14. Crop/ Livestock/ Machinery Insurance. Weather based crop insurance – Features and determinants of compensations

Insurance

Insurance is a tool to protect you against a small probability of a large unexpected loss.

Insurance is not a tool to make money but a tool to help compensate an individual or business for unexpected losses that might otherwise cause a financial disaster.

What is Crop Insurance?

Crop insurance is an insurance arrangement aiming at mitigating the financial losses suffered by the formers due to damage and destruction of their crops as a result of various production risks.

What is Livestock Insurance?

Livestock insurance is a contract by which the Insurer agrees to identify the insured against such loss or damage as he may sustain by reasons of injury to or the death of livestock by the happening of the perils specified.

(or)

A contract to pay a certain sum of money on the death of an animal from disease or accident.

Machinery Insurance: Covers unforeseen or sudden physical damage of the insured machinery due to breakdown.

Components of Insurance

- **Declarations:** Declarations normally appear on the first page of your policy, called the declarations page, title page or policy face page. The page identifies you as the insured party, outlines the risks (such as property, life or health) to be covered, any limits of the policy, and the time period that the policy will be in force.
- **Definitions:** Ensuing pages of the policy will contain a section dedicated to definitions of common insurance terms you'll encounter when reading the policy. Make sure to familiarize yourself with these definitions, or refer to them as you review the policy.

- **Insuring agreement:** The insuring agreement is the thrust of the policy, summarizing the main premises (and promises) for which losses will be compensated and benefits paid.
- **Exclusions: Any exclusion not covered in the insuring agreement** will be included in this section, or there may be a redundant re-statement of exclusions. Either way, the exclusions generally are of three types: excluded perils or reasons for losses, excluded losses themselves, and excluded property.
- **Conditions:** The conditions included in a policy are rules of conduct, duties and obligations that specify or limit the insurance company's need or promise to pay a claim, as in the case of fraud, and includes requirements for the insured party, such as having to provide proof of loss and proof of value (receipts, for example).
- **Endorsements and Riders:** All endorsements or riders—which basically are attachments to an existing policy—supersede the original contract so long as they don't violate any laws. These modifications normally are added when the insured person adds to his property in some way.

Determinants of Compensation

- Crop: compensation for horticultural and annual crops will different.
- Premium: premium percentage paid by farmers play major role in deciding compensation.
- Season: compensation depends on season of crop eg: Rabi, kharif and zaid crop.
- Area
- Risk covered

Experimental crop insurance schemes

In reality, crop insurance had already emerged on a small-scale, experimental basis.

During 1973—76, fertilizer companies, such as Gujarat State Fertiliser Company in Gujarat and Rashtriya Chemicals and Fertilisers Company in Maharashtra, started pilot crop insurance schemes as components of agricultural extension projects. Similar experimental schemes were started in Andhra Pradesh, Karnataka, Tamil Corporation of India (GIC) from its inception in 1973 until 1976-covered cotton, wheat, groundnut and potato crops, and 2,154 farmers.

Another experimental scheme for cotton, covering 909 farmers, was operated during 1978–79 in Gujarat, Madhya Pradesh and Maharashtra. These loss-making schemes led to the realization that schemes based on individuals were not practical on a national scale.

The Pilot Crop Insurance Scheme

- Professor V. M. Dandekar, referred to as the “Father of Crop Insurance in India”, suggested an alternate “Homogeneous Area approach” for crop insurance in the mid-Seventies.
- Based on this Area approach, the General Insurance Corporation of India (GIC) introduced a Pilot Crop Insurance Scheme (PCIS) from 1979.
- The scheme covered cereals, millets, oilseeds, cotton, potato, gram and barley.
- The insurance Premium ranged from 5 to 10 per cent of the Sum Insured.
- This PCIS ran till 1984-85 by which 13 States had participated.
- The scheme covered 6.27 lakh farmers for a Premium of 1.97 crore against Claims of 1.57 crore.
- The scheme was discontinued in 1985, when CCIS was introduced.

The Comprehensive Crop Insurance Scheme (CCIS)

- CCIS was introduced in 1st April 1985 by the Government of India with the active participation of State Governments.
- The CCIS was implemented on Homogeneous Area approach and was linked to short-term crop credit.
- 15 States and 2 (Union Territory) had participated in the CCIS from Kharif 1985 to Kharif 1999.
- In this entire period, the Scheme covered 7.63 crore farmers under an area of 12.76 crore hectares, for a Sum Insured of 24,949 crore at a premium of 403.56 crore.
- CCIS was eventually discontinued after Kharif 1999.
- This scheme replaced by the “National Agriculture Insurance Scheme” (NAIS), which is being continued till date.

$$\text{Indemnity (Loss)} = \left[\frac{\text{Shortfall in the yield of the crop}}{\text{Threshold yield of the crop}} \right] \times \text{sum insured}$$

The Experimental Crop Insurance Scheme (ECIS)

- Experimental Crop Insurance Scheme (ECIS) was introduced in Rabi 1997.
- 14 Districts of 5 States are involved in this scheme.
- The Scheme was similar to CCIS.
- ECIS for all small / marginal farmers with 100% subsidy on Premium.

- The Scheme was discontinued after one season due to its many administrative and financial difficulties.
- During its one season, the ECIS covered 4,54,555 farmers for a Sum
- Insured of 168.11 crore at a Premium of 2.84 crore against which the Claims paid were 37.80 crore.

The Pilot Scheme on Seed Crop Insurance (PSSCI)

- PSSCI was introduced in Kharif 2000 season in 11 States.
- Objective to provide stability to the infrastructure State owned Seed Corporations and State Farms
- Established by the State owned Seed Corporations and State Farms, and to give a boost to the modern seed industry by bringing it under scientific principles.
- Provide financial security & income stability to the Seed Growers in the event of failure of seed crop.

The National Agricultural Insurance Scheme (NAIS)

After NAIS was introduced in Rabi 1999–2000, leading to the discontinuation of CCIS. Like CCIS, NAIS is primarily based on the area approach. It covers all farmers: loanees and non-loanees. It envisages coverage of cereals, millets, pulses, oilseeds and annual horticultural/commercial crops for which adequate yield data are available.

Salient features of NAIS:

States and areas covered: All States and Union Territories had the option of implementing the scheme.

Farmers covered: All farmers including sharecroppers and tenant farmers growing the notified crops in the notified areas were eligible for coverage. The scheme was compulsory for farmers availing crop loans and voluntary for others.

Crops covered: Food crops (cereals, millets and pulses) Oilseeds Annual commercial / horticultural crops (sugarcane, cotton, potato, onion, chilli, turmeric, ginger, jute, tapioca, annual banana and annual pineapple)

Sum insured: The minimum sum insured (SI) in case of loanee farmers is the amount of loan availed, which can be further extended up to value of 150 per cent of average yield. For non-loanee farmer, it can be up to value of 150 per cent of average yield.

Premium rates: The premium rates are 3.5 per cent for oilseeds and bajra and 2.5 per cent for cereals, millets and pulses during Kharif; 1.5 per cent for wheat and 2 per cent for other food crops and oilseeds during Rabi. The rates for annual commercial/horticultural crops are based on actuals.

Premium subsidy: Premiums for small/marginal farmers are subsidized to the extent of 50 per cent, to be shared equally between the Centre and States. The premium subsidy was to be phased out over a five-year period on sunset basis, starting with 50 per cent subsidy in the first year, which would be reduced by 10 per cent each year and was to be completely phased out in five years. However, 10 per cent subsidy continued to be given till the end.

Scheme approach: The scheme covered losses from sowing to harvesting, and operated on area approach for widespread calamities. For this purpose, a unit of insurance is defined which may be a Village Panchayat, Mandal, Hobli, Circle, Phirka, Block, Taluka, etc., to be decided by the State Government /UT. However, each participating State government/UT was required to reach the level of village panchayat as the unit within three years. The Scheme operated on an individual basis for specific localized calamities on an experimental basis.

Loss assessment, levels of indemnity and threshold yield: The threshold yield or guaranteed yield for a crop in an insurance unit was the moving average yield, based on the past three years, in case of rice and wheat, and five years' yield in case of other crops, multiplied by the level of indemnity.

Three levels of indemnity—90 per cent, 80 per cent and 60 per cent, corresponding to low-risk, medium-risk and high-risk areas—were available for all crops. The insured farmers of each unit area could also opt for higher level of indemnity on payment of additional premium. If the actual yield (AY) per hectare of the insured crop for the defined area fell short of the specified TY, all the insured farmers growing that crop in the defined area were deemed to have suffered the same amount of shortfall in their yield.

Sharing of risk: Government of India and States shared claims beyond 100 per cent of premium for food crops and oilseeds on a 50:50 basis. In case of annual commercial / horticultural crops, claims beyond 150 per cent of premium in the first three or five years and beyond 200 per cent thereafter was borne by Centre and State on 50:50 basis.

The Pilot Project on Farm Income Insurance Scheme (FIIS)

- FIIS was introduced on a pilot basis in fifteen districts of eight States during ***Rabi* 2003–04.**
- NAIS was designed to protect farmers against yield fluctuations, it does not address the **problem of price fluctuation or price risk**.
- The income of a farmer depends both on yield and market price.
- The new scheme envisaged addressing **both yield risk and price risk** so as to stabilize farmers' incomes.

Modified National Agricultural Insurance Scheme (MNAIS)

- **MNAIS was initiated during the 11th Plan from Rabi 2010–11** on pilot basis on the recommendation of the Government of India Joint Group, in 50 districts.

The salient features of MNAIS are as under:

- Subsidy for premium ranging up to 75 per cent to all farmers (Central and State government on 50:50 basis)
- Farmers of village/village panchayat level for major crops.
- MNAIS is **compulsory for loanee farmers and voluntary for non-loanee farmers**
- **NAIS was withdrawn from those area(s)/crop(s) where MNAIS was implemented.**

Weather Based Crop Insurance Scheme (WBCIS)

- The basic approach of "weather index" insurance is to estimate the percentage deviation in crop output due to adverse deviations in weather conditions.
- WBCIS envisages such weather index-based insurance products designed to offer insurance protection against losses to crop resulting from adverse weather Piloted in the Kharif 2007 season, WBCIS also operates on the concept of area approach.
- Claims are normally settled within 45 days from the end of the insurance period.
- Operated on the concept of Area approach
- The sum insured for the loanee farmer is calculated by multiplying per unit area value of inputs with crop specific acreage declared by the farmer in the loan application form submitted to the lending bank. For a non-loanee farmer, the acreage figure is expected area sown/planted under the particular crop as declared in the insurance proposal form.

National Crop Insurance Programme (NCIP)

As mentioned earlier, the Government of India has discontinued NAIS from Rabi 2013–14, with the exception of a few States for one season only, and launched NCIP from November 2013. In the new programme, WBCIS, MNAIS and Coconut Palm Insurance Scheme (CPIS) are included as full-fledged schemes with certain modifications over their pilots. Farmers are entitled to maximum premium subsidy up to 50 per cent under WBCIS and 75 per cent under MNAIS on a graded scale. Premium rates have been capped according to the type of crop and season, and in cases where the actuarial premium rates are higher than the capped limit, the sum insured for such

crops will be reduced in proportion to the cap level. The Ministry of Agriculture, GOI, has also issued operational guidelines for the schemes.

Pradhan Mantri Fasal Bima Yojana

The new Crop Insurance Scheme is in line with One Nation – One Scheme theme. It incorporates the best features of all previous schemes and at the same time, all previous shortcomings / weaknesses have been removed. The PMFBY will replace the existing two schemes National Agricultural Insurance Scheme as well as the Modified NAIS.

Objectives

- To provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests & diseases.
- To stabilise the income of farmers to ensure their continuance in farming.
- To encourage farmers to adopt innovative and modern agricultural practices.
- To ensure flow of credit to the agriculture sector.

Highlights of the scheme

- There will be a uniform premium of only 2% to be paid by farmers for all Kharif crops and 1.5% for all Rabi crops. In case of annual commercial and horticultural crops, the premium to be paid by farmers will be only 5%. The premium rates to be paid by farmers are very low and balance premium will be paid by the Government to provide full insured amount to the farmers against crop loss on account of natural calamities.
- There is no upper limit on Government subsidy. Even if balance premium is 90%, it will be borne by the Government.
- Earlier, there was a provision of capping the premium rate which resulted in low claims being paid to farmers. This capping was done to limit Government outgo on the premium subsidy. This capping has now been removed and farmers will get claim against full sum insured without any reduction.
- The use of technology will be encouraged to a great extent. Smart phones will be used to capture and upload data of crop cutting to reduce the delays in claim payment to farmers. Remote sensing will be used to reduce the number of crop cutting experiments.
- PMFBY is a replacement scheme of NAIS / MNAIS, there will be exemption from Service Tax liability of all the services involved in the implementation of the

scheme. It is estimated that the new scheme will ensure about 75-80 per cent of subsidy for the farmers in insurance premium.

Farmers to be covered

- All farmers growing notified crops in a notified area during the season who have insurable interest in the crop are eligible.

Compulsory coverage: The enrolment under the scheme, subject to possession of insurable interest on the cultivation of the notified crop in the notified area, shall be compulsory for following categories of farmers:

Farmers in the notified area who possess a Crop Loan account/KCC account (called as Loanee Farmers) to whom credit limit is sanctioned/renewed for the notified crop during the crop season. And Such other farmers whom the Government may decide to include from time to time.

Voluntary coverage: Voluntary coverage may be obtained by all farmers not covered above, including Crop KCC/Crop Loan Account holders whose credit limit is not renewed.

Risks covered under the scheme

- Yield Losses (standing crops, on notified area basis). Comprehensive risk insurance is provided to cover yield losses due to non-preventable risks, such as Natural Fire and Lightning, Storm, Hailstorm, Cyclone, Typhoon, Tempest, Hurricane, Tornado. Risks due to Flood, Inundation and Landslide, Drought, Dry spells, Pests/ Diseases also will be covered.
- In cases where majority of the insured farmers of a notified area, having intent to sow/plant and incurred expenditure for the purpose, are prevented from sowing/planting the insured crop due to adverse weather conditions, shall be eligible for indemnity claims up to a maximum of 25 per cent of the sum-insured.
- In post-harvest losses, coverage will be available up to a maximum period of 14 days from harvesting for those crops which are kept in “cut & spread” condition to dry in the field.
- For certain localized problems, Loss / damage resulting from occurrence of identified localized risks like hailstorm, landslide, and Inundation affecting isolated farms in the notified area would also be covered.

Unit of Insurance

- The Scheme shall be implemented on an ‘Area Approach basis’ i.e., Defined Areas for each notified crop for widespread calamities with the assumption that all the insured farmers, in a Unit of Insurance, to be defined as "Notified Area" for a crop, face similar risk exposures, incur to a large extent, identical cost of

production per hectare, earn comparable farm income per hectare, and experience similar extent of crop loss due to the operation of an insured peril, in the notified area.

- Defined Area (i.e., unit area of insurance) is Village/Village Panchayat level by whatsoever name these areas may be called for major crops and for other crops it may be a unit of size above the level of Village/Village Panchayat. In due course of time, the Unit of Insurance can be a Geo-Fenced/Geo-mapped region having homogenous Risk Profile for the notified crop.
- For Risks of Localised calamities and Post-Harvest losses on account of defined peril, the Unit of Insurance for loss assessment shall be the affected insured field of the individual farmer.

Livestock Insurance

The Livestock Insurance Scheme, a centrally sponsored scheme, which was implemented on a pilot basis during 2005-06 and 2006-07 of the 10th Five Year Plan and 2007-08 of the 11th Five Year Plan in 100 selected districts. The scheme is being implemented on a regular basis from 2008-09 in 100 newly selected districts of the country. Under the scheme, the crossbred and high yielding cattle and buffaloes are being insured at maximum of their current market price. The premium of the insurance is subsidized to the tune of 50%. The entire cost of the subsidy is being borne by the Central Government. The benefit of subsidy is being provided to a maximum of 2 animals per beneficiary for a policy of maximum of three years. The scheme is being implemented in all states except Goa through the State Livestock Development Boards of respective states. The scheme is proposed to be extended to 100 old districts covered during pilot period and more species of livestock including indigenous cattle, yak & mithun.

The Livestock Insurance Scheme has been formulated with the twin objective of providing protection mechanism to the farmers and cattle rearers against any eventual loss of their animals due to death and to demonstrate the benefit of the insurance of livestock to the people and popularize it with the ultimate goal of attaining qualitative improvement in livestock and their products.

Department of Animal Husbandry, Dairying & Fisheries is implementing the Centrally Sponsored Scheme of National Project for Cattle and Buffalo Breeding (NPCBB) with the objective of bringing about genetic up-gradation of cattle and buffaloes by artificial insemination as well as acquisition of proven indigenous animals. NPCBB is implemented through State Implementing Agencies (SIAs) like State Livestock Development Boards. In order to bring about synergy between NPCBB and Livestock

Insurance, the latter scheme will also be implemented through the SIAs. Almost all the states have opted for NPCBB. In states which are not implementing NPCBB or where there are no SIAs, the livestock insurance scheme will be implemented through the State Animal Husbandry Departments

Machinery Insurance.

This policy provides protection to your all-important farming companions such as tractors harvesters, reapers, threshers, chaff cutters, salvage corps vehicle, Lawn movers etc, in addition to the personal accident cover to you and your other family members who may use the vehicle. This Policy is designed to cover the compulsory Third Party Liability as required by Motor Vehicles Act, together with loss or damage to the Vehicle itself. The Policy also provides cover for:

- Personal Accident for Paid Driver/cleaner.
- For an additional Premium, provides the following:
- Additional Legal Liabilities towards Paid Driver and employee.
- Bi-fuel Kit.
- Enhanced PA cover to Owner Driver and Paid Driver.
- No Claim Bonus Protection.
- Return to Invoice.

Lecture No 15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and Agricultural Economics, unique properties of Natural resources.

Natural Resource Economics

Natural resource economics deals with the supply, demand, and allocation of the Earth's natural resources.

- One main objective of natural resource economics is to better understand the role of natural resources in the economy in order to develop more sustainable methods of managing those resources and to ensure their availability to future generations.
- Resource economists study interactions between economic and natural systems, with the goal of developing a sustainable and efficient economy.
- Natural resource economics is a trans-disciplinary field of academic research within economics that aims to address the connections and interdependence between human economies and natural ecosystems.
- Its focus is how to operate an economy within the ecological constraints of earth's natural resources.
- Resource economics brings together and connects different disciplines within the natural and social sciences connected to broad areas of earth science, human economics, and natural ecosystems.
- Economic models must be adapted to accommodate the special features of natural resource inputs. The traditional curriculum of natural resource economics emphasized fisheries models, forestry models, and minerals extraction models (i.e. fish, trees, and ore). In recent years, however, other resources such as air, water, the global climate, and "environmental resources" in general have become increasingly important to policy-making.

Natural Resource Management

Natural resource management refers to the management of natural resource such as land, water, soil, plants and animals with a particular focus on how management affects the quality of life for both present and future generations. Natural resource management deals brings together land use planning, water management, biodiversity conservation and the future sustainability of industries like agriculture, mining, fishing, etc.

Environmental and Ecological Economics

The insights into sustainability provided by mainstream economics are taken much further by environmental and ecological economists.

The main areas of contribution include the following:

- A classification of sustainability views according to assumptions about the conservation of natural resources
- Extending the analysis of externalities to provide a basis for designing antipollution policies and deciding on the resources it is desirable to devote to avoiding pollution
- A range of methodologies for evaluating the services provided by environmental assets and social capital to extend the inclusiveness of Cost Benefit Analysis.
- Models for projecting the pricing and depletion of finite resources.
- Assessments of the implications of various access regimes governing the harvesting of renewable resources.

There is considerable overlap in the subject matter of ecological and environmental economics. The key difference is one of orientation.

Environmental economics tends to embrace the Neo-classical paradigm as an analysis of the economic system and seeks to incorporate environmental assets and services.

Ecological economics gives priority to the health of complex interrelated ecological systems and consider how economic behaviour can be modified to that end.

Natural resources classification and characteristics:

Natural resources are often classified into renewable and non-renewable resources.

Renewable resources: Renewable resources are generally living resources (fish, coffee, and forests, for example), which can restock (renew).

Non- renewable natural resources: Non-living renewable natural resources include soil, as well as water, wind, tides and solar radiation, etc

Resources can also be classified on the basis of their origin i.e. biotic and abiotic.

Biotic resources: Biotic resources are derived from animals and plants (i.e- the living world). Biotic is a living component of a community; for example organisms, such as plants and animals.

Abiotic resources: Abiotic resources are derived from the non-living world e.g. land, water, and air. Mineral and power resources are also abiotic resources some are derived from nature. In biology and ecology, abiotic components are non-living chemical and physical factors in the environment which affect ecosystems.

Natural resources are also categorized based on the stage of development:

Potential Resources are known to exist and may be used in the future. For example, petroleum may exist in many parts of India and Kuwait that have sedimentary rocks, but until the time it is actually drilled out and put into use, it remains a potential resource.

Actual resources are those that have been surveyed, their quantity and quality determined, and are being used in present times. For example, petroleum and natural gas is actively being obtained from the Mumbai High Fields. That part of the actual resource that can be developed profitably with available technology is called a reserve resource, while that part that cannot be developed profitably because of lack of technology is called a stock resource.

Reserve resources: the part of actual resources which can be developed profitability in the future is called reserve resources.

Stock resources: those that have been surveyed, but cannot be used due to lack of technology (eg: hydrogen)

Resources characteristics: Resources have three main characteristics namely

1) Utility,
2) Limited availability,
3) Potential for depletion or consumption.

In economics, utility is a measure of satisfaction, referring to the total satisfaction received by a consumer from consuming a good or service.

Scarcity: Scarcity is the fundamental economic problem of having humans who have unlimited wants and needs in a world of limited resources. It states that society has insufficient productive resources to fulfill all human wants and needs.

Natural resources can be viewed in the following dimensions:

- **Quantity:** The availability of a natural resource may be infinite or finite in quantity and the relative scarcity with respect to its end use decides its importance.
- **Quality:** a resource may be available with different quality in nature. Eg: recovery of iron ore will be high or low depending upon the quality of ore.
- **Time:** Natural resource are abundant or scarce based on time.
- **Space:** availability of natural resources will be different across the regions.

Difference between Agricultural economics and Natural resource economics

Particulars	Agricultural Economics	Natural resource economics
Definition	Is an applied field of economics concerned with the application of economic theory in optimizing the production and distribution of food and fiber.	Deals with the supply, demand, and allocation of the Earth's natural resources.
Primary Objective	To maximize profitability in agriculture for the benefit of society.	Understand the role of natural resources in the economy in order to develop more sustainable methods of managing those resources to ensure their availability to future generations.
Principle objective	Agricultural economics makes use of the principles of general economics	NRE focuses on the supply, demand and allocation of the Earth’s natural resources.
Nature	Applied science	Positive and normative science
Resources	Resources are managed more intensively	Unmanaged or naturally managed resources

Importance of natural resources

Natural resources are directly consumed as in the case of fresh fish, water, outdoor recreation, and firewood; It may also be used as inputs in the intermediate processing such as iron or copper ores into smelting; It also have consumptive uses in intermediate processing such as consumption of fuels in manufacturing and transport; It is also having existence value or in situ uses like free-running rivers, parks, and wilderness areas with its rich flora and fauna. In some cases, these modes of utilization can be combined into multi-purpose natural resource systems that utilize resources simultaneously to satisfy several needs. For example, the management of forest lands to produce timber, to act as a watershed and to provide recreation.

Lecture No. 16. Natural Resource Issues – Scarcity of resources – Factors mitigating Scarcity, Property Rights – Common Property Resources (CPR's): meaning and Characteristics of CPRs – Externalities: Meaning and Types – positive and negative externalities in Agriculture

Natural Resource Issues

Resource depletion: Resource depletion is an economic term referring to the exhaustion of raw materials within a region. Resource depletion is most commonly used in reference to farming, fishing, mining, and fossil fuels.

Causes of Resource Depletion:

The major causes of resource depletion are listed below:

- **Overpopulation** – With increasing population, demands of the country increase which further results in depletion of resources.
- **Over-consumption and waste** – As the standards of living of people improves, they tend to consume more and waste even more.
- **Deforestation and the destruction of ecosystems** – Forests are cut annually, to make space for multiplexes, residential complexes etc. This not only destroys trees (and wood as a resource) but also destroys home of thousands of species of animals.
- **Mining** – Mining of Minerals and Oil-Minerals and metals are in high demand in today's world. This is a very big problem as ores are being depleted day by day.
- **Technological and industrial development** – Technology advances and so the need of resources increases.
- **Soil erosion** – Because of deforestation, soil erosion takes place. Thus, soil gets devoid of important minerals and resources.
- **Pollution and contamination of resources** – Water pollution, soil pollution is increasing at an alarming rate today due to negligent attitude of people towards the environment. Pollution has a direct effect on contamination of resources available in nature.

Effects of Natural Resources Depletion

The depletion of natural resources has widespread consequences not only on the human life but the environment too. Some of these are as listed below:

- **Resource Scarcity:** Resources like fossil fuels, timber, water and arable land become scarce because of over-consumption and degradation, mostly in the areas of tremendous population growth.

- **Rising Prices:** When natural resources become scarce, food, fuel and energy prices rise. Even the price of renewable resources increases if they need to be shipped to reach areas where these have been depleted.
- **Water Shortages:** When infrastructure development and population growth increase, water shortages occur. As of today, almost 1 billion people lack access to clean water.

Solutions to Prevent/Reduce Natural Resource Depletion

The likely solutions to reduce the resource depletion are as follows:

- **Reduced Use of Fossil Fuels:** We can conserve fossil fuels by using less gasoline and electricity. Driving less and saying yes to carpooling are simple ways to conserve gasoline. Buying a vehicle having high fuel mileage and purchasing Energy Star appliances can also contribute to conservation of fossil fuels.
- **Keep Water Clean:** Water may seem like a never-ending resource which is found everywhere, but due to population growth, the access to clean water for large populations decreases. Water can be saved by taking small steps in and around your home. Some of these include checking for water leaks and replacing or fixing leaky faucets.
- **Preserve Trees and Forests:** To satisfy the world's need for paper alone, approximately 4 billion trees are g cut down per year. Thus, preventing the deforestation is very necessary. One can greatly contribute in this context by using less paper, using more cloth towels and not paper ones or by switching to an online-only subscription of your favourite newspaper. During a visit to a local forest, one should act responsibly and make sure that campfires are safely maintained.
- **Protect Coastal Ecosystems:** Coastal ecosystems are very important for maintaining biodiversity, but they are also extremely valuable for industries like fishing and tourism industries. Seafood consumers should keep in mind how their purchasing decisions can affect the environment. Reefs are extremely sensitive to disturbances. Diving or snorkeling around a reef should be done while treating the reefs with care and respect.

Scarcity of Resources

Scarcity is the fundamental economic problem of having humans who have unlimited wants and needs in a world of limited resources. It states that society has insufficient productive resources to fulfill all human wants and needs.

Factors Mitigating Scarcity

How come a rapidly developing nation with strong economic and population growth in the present world, not facing greater scarcity of natural resource? Many factors have been at work in mitigating the scarcity and some are listed below.

1. **Technological Changes**: Technology may be of different kinds and they may be
    a. Technologies which increase the efficiency of resources use. Eg technologies meant for greater smelting recovery of metals from ores and finer wood working techniques to save wood.
    b. Technologies which increase the natural resource recovery both by leaving less in situ and also facilitating the use of lower grades Eg., tertiary petroleum recovery, long wall coal mining, pelletizing of taconite iron ores.
    c. Technologies that permit use of formerly unusable or latent resources Eg., recovery of Aluminum from non bauxite sources.
    d. Technologies that permit new products to perform old functions or to fulfill needs Eg., Solid state electronic boards for vacuum tube systems and communication conference networking for personal travel.
2. **Substitution of More Plentiful Resources for Less Plentiful**
    a. Substitutions in production processes Eg., Aluminium for copper, pre-stressed concrete for structural steel and biocides for organo - mercurials..
    b. Substitutions in consumption Eg., grains for meat, artificial fibres for natural fibres, and plastics for leather.
3. **Trade**: Improvements in transport facilities could make more remote resources economically competitive. Utilization of international sources is possible because of trade links between countries Eg., bauxite from Jamaica, iron ore from Liberia.
4. **Discovery**: Extension of traditional exploration methods for discovery of new deposits and improvements in exploration techniques may help in adding resources to the existing stock Eg., improvements in geophysical and geochemical methods and satellite reconnaissance.
5. **Recycling**: Recycling of used resources for further use is a very important option in mitigating resource scarcity Recycling is the order of the day in United States and the percentages of recycled materials derived from scrap in the case of iron is 37 percent; likewise for lead it is 37 percent; copper, 20 percent; aluminium, 10 percent; nickel, 35 percent; and antimony 60 percent.
6. **Judicious management of Natural Resources**: Existing resources should be used judiciously according to the need and it should also be conserved to ensure

continuous flow of benefits. There should be optimum utilization of resources not only for short period but also for sustained long period.

Property rights

Property rights are theoretical constructs in economics for determining how a resource is used and owned. Resources can be owned (the subject of property) by individuals, associations or governments. Property rights can be viewed as an attribute of an economic good. This attribute has four broad components and is often referred to as a bundle of rights and these are

1. The right to use the good
2. The right to earn income from the good
3. The right to transfer the good to others
4. The right to enforcement of property rights.

In economics, property usually refers to ownership (rights to the proceeds of output generated) and control over a resource or good.

Common Property Resources

Common Property Resources (CPR) are those properties owned in common by identifiable group of people. They are widely prevalent in India especially in semi-arid and arid regions, hill regions, forest and tribal regions. In semi-arid and arid regions, the area under CPRs is very low but closely integrated with well-defined institutional setup. In hill regions, the use of CPR is high but ownership rights are defined not clearly while in forest tribal regions, the use of CPR is variable. The majority of area under CPR comes under open forests, surface ground water and fisheries. The CPRs occupy a quite significant area under non-forest lands with 38 per cent, ground water with 44 per cent, fresh water ponds and tank fisheries with 80 per cent.

A Common Property Resources (CPRs) is a resource owned by a large group of individuals whose access to the resource can be limited or unlimited. Eg. forests, ocean fisheries, surface ground water, timber etc., Most of the CPRs have the properties of renewable resources. These resources have the capacity to renew or regenerate themselves.

Characteristics of CPRs

CPRs have some significant characteristics, which distinguish from Private Property Resources (PPRs) or State Property Resources (SPRs) or Open Access Resources (OPRs).

Firstly, improperly defined individual private property rights, which lead, to the usage of the resource characterize it by more number of individuals as against the capacity of the resource system to sustain.

Secondly, the CPRs are characterized by joint use among the members of the community. Whenever, resources are used jointly, members try to maximize their marginal private benefits and minimize their marginal private cost as against socially optimum benefits or costs.

Market Failure: The concept of market failure is important in case of environmental problems as in most of the cases market mechanism fails to provide a meaningful solution to environmental resource allocation. The main reasons behind such market failures can be identified as

- The environmental goods are normally not sold in market, like air, water etc
- Externalities- buyers and sellers in a market impact third parties
  - Person plays (consumes) loud music impacts the neighbors
  - A firm emitting air pollution impacts people living nearby
  - Positive - public immunizations, Gov. inoculates its people, preventing the spread of diseases
- Asymmetric information - one party in the market has more information
  - Used car salesman has more info. than the buyer
  - A person with a heart problem gets medical insurance
- Public goods - private markets have trouble supplying public goods
  - Usually police, military, inoculations, clean air, etc.
  - Expanded to include education, highways, libraries, mail delivery, etc. Markets may not supply enough of them, so government supplies them because they benefit society
- Open resource - property that is owned by everyone or absence of ownership
  - People tend to over exploit the resource
  - Tragedy of the Commons
  - Over fish in public lakes
  - Dump trash and litter on a public land

How to correct market failure?

Markets do not exist for environmental resources.

- Government can regulate the resource, traditional method
- Government creates a market for the resource, more governments are using this option

Economics is essentially concerned with the ways in which scarce resources are distributed among competing ends: if resources were not scarce, we would have no need for economics.

Externalities - The consumption or production of one individual or firm affects another person's utility or production without their consent.

(i) Positive externality - an individual's or firm's actions generate benefits for nonparticipating parties

An example for positive externality in agriculture is farm production increased by doing apiculture of the nearest farm or by the same farm.

Fixing positive externality

1. Subsidies - government provides subsidies. So producers will supply more
    - Example - government grants subsidies to producers of vaccines
    - Note - government could subsidize the consumer to take advantage of the externality
2. Government provides the good
    - Health departments give vaccines to the poor and elderly
3. Government provides legal protection
    - Patent - grants inventors exclusive right to producer their invention for 17 years in the United States
    - Some countries may not honor patents

(ii) Negative externality - an individual's or firm's choice or action negatively harms others without their consent.

An example for the negative externality in agriculture is production in textile industry which creates polluted water and passes through the irrigation canal affects the production and quality of farm products.

- Property rights are not defined well
- Not all costs are registered, therefore supply function understates the true cost of production
- Example: A firm emitting pollution will typically not take into account the costs that its pollution imposes on others.
    - Market price is too low
    - Market quantity is too high
    - The goal is to have firms pay for pollution
    - The goal is not to set the pollution to zero!
    - The pollution is in excess of the 'socially efficient' level.

Lecture No. 17. Inefficiency and welfare loss, solutions, Important Issues in Economics and management of Common Property Resources of land, water, pasture and forest resources

Inefficiency and welfare loss

All environmental and natural resource problems associated with overexploitation or under provision of public goods, arise from incompletely defined and enforced property rights, whether they be informal or formal, group or individual. Under these circumstances, private decision makers do not consider or internalize social benefits and costs in their production or investment actions. The gap between private and social net returns results in externalities – harmful effects on third parties. These include overfishing that depletes the aggregate stock, excessive air pollution that reduces overall air quality, unwarranted extraction or diversion of ground or surface water that diminishes supplies, extreme depletion of oil and gas reservoirs that lowers overall production and raises costs, as well as too little private investment in natural amenities and biodiversity.

These situations are all examples of the 'The Tragedy of the Commons. The tragedy occurs through aggregate short-term production or use levels that are too high and long-term investment in the stock that is too low. Competitors for resource rents inflict costly technological and pecuniary externalities on one another. Anticipation of these spillovers generates a damaging rush to exploit the resource. Compounding the tragedy, in the absence of recognised property rights exchange is not possible. The parties involved cannot bargain with one another in the manner described by Coase (1960) to constrain behaviour to limit dissipation and to re-allocate the resource to higher-valued uses currently or across time. Free riding is rampant. As a result, there can be no price signals to reveal opportunity costs, underwriting wasteful use decisions that are made in ignorance of such information. Finally, the tragedy is accentuated by the diversion of valuable labour and capital inputs from productive use to predation and defence. Damaging conflict and violence may follow.

The wastes associated with the common pool resources can be large, and the social savings from avoiding them provide the incentives for collective action (i) to develop informal property rights (individual or group) or if these are not feasible, (ii) to secure more official government regulation of access and resource use or (iii) to assign formal property rights for private restrictions on behaviour.

Solutions

Considering each of these options in turn, the first, group solutions or common property, can be effective if the parties involved are relatively homogeneous in costs, discount rates and production objectives, and if their numbers are comparatively small. Under these conditions, cooperative internal rules can be agreed upon and put into place to manage the resource or to provide group goods.

Exogenous factors, such as price increases or new production technologies, however, can make common property less effective. The incentives for defection among the existing group members rise, and new, more heterogeneous entrants are attracted, who are not part of the original compact, and hence have less incentive to adhere to its constraints. These conditions lead localised arrangements to collapse, especially if they do not receive recognition and enforcement from the state, which they may not if group members are not as politically influential as are the new entrants.

The second option, government regulation, involves constraints on inputs or outputs to bring production in line with more optimal levels and/or tax schemes to bring private and social use costs into closer alignment. Although central (command and control) regulation and taxes can eliminate externalities and hence, the 'Tragedy of the Commons,' the empirical history in many cases has not been particularly satisfying.

Effective regulation and taxes require that politicians and regulators have information not only about social costs and optimal levels of production, but also about the (often varying) private production and compliance costs of individual users. This is a requirement that few regulators can meet. As a result, government regulation typically relies upon uniform standards, including standardised controls on access, fixed tax levels, and similar constraints on timing of use and/or limits on technology or production capital. Uniformity reduces information demands and makes regulation appear to be equitable, making it more politically attractive.

Uniform regulations and taxes, however, do not reflect differences in production or compliance costs. Accordingly, centralised rules are unlikely to align with the incentives of actual users of the resource. Rather, the motives of the regulated or taxed parties are for evasion, raising enforcement costs. Under regulation and tax policies, users, by definition, are not 'owners' and hence, typically do not capture the increased social returns from protecting or investing in the stock

through conservation. As such, they rationally maximise private returns through cheating. The setting becomes one of agents against the state, and the resource suffers.

Finally, and critically, the decisions by all parties, regulators in implementing policies, and actual users in harvesting, extracting and emitting, take place in the absence of information about the value of alternative resource uses (opportunity costs) that market trades otherwise would generate. This condition results in wasteful misallocation.

Overall, government regulation and tax policies suffer from a variety of well-known problems including high cost, inflexibility, ineffectiveness and industry capture. Generally, no party involved – actual users, regulators, politicians – is a residual claimant to the social gains from more optimal resource management and use. Accordingly, extraction, production, investment and allocation decisions are based on other factors that are apt not to be consistent with maximising the economic value of the resource or of conserving it. Often, the amounts at stake in implementing regulatory and tax policies are large, encouraging costly rent seeking as parties attempt to mould government actions in their behalf.

Common property resource management

Common property resource management involves costs and benefits. The cost benefits affect resource management. They vary according to the temporal, spatial, tangibility, and distribution dimensions. The local institutions will be most effective in management if the benefits of Resource management accrue quickly, locally, visibly, and individually or collectively. The opposite is true if the benefits are delayed, remote, hard to identify and do not accrue to the investors of efforts.

The management of the natural resources also depends upon the characteristics of resources. The less renewable a resource is the more risk there is that poor management will have drastic consequences, and the more reason one can offer for some form of government involvement. Seasonality is another factor of great importance for resource management. Examples from Botswana, Philippines, Indonesia, and Nepal suggest that the flow of local institutional activity is generally affected by variations in the agricultural season. During wet season, water is abundant and it needs less co-operative efforts for water management and maintenance. As a result, local institutions are less active and united for its management. During the dry seasons, water is scarce, local user groups cannot

work effectively and central government's intervention is almost inevitable. Similarly, during the rainy season fodders are abundant in private lands and forest resources need less management attention, while fodders are scarce during the winter resulting in efficient management and distribution of fodder trees among the communities (Acharya 1990).

More importantly, property arrangement is an effective mechanism of resource management. There are numerous examples of communities who preferred to keep and use common property resources jointly. For example, the Rais, Limbu, Sherpa. Chepang, Lapcha, Majhis, Tamangs, Sunuwar, and Danuwar communities of Nepal owned and controlled their natural resources, such as forests and lands jointly and they are distributed in accordance with the family requirements (Regmi, 1971). Because the domestic units held individual rights to use resources not ownership, resource alienation was impossible. This system of property rights protected natural resources from fragmentation resulting in degradation.

Land Resources

Common property land resource refers to lands identified with a specific type of property rights. The common lands covered in the National Sample Survey (NSS) enquiry are panchayat lands, government revenue lands, village common lands, village thrashing lands, unclassified forest lands, woodlands and wastelands, river banks, and lands belonging to other households used as commons.

Forest & Pasture Resources

Common property resources, particularly forests and pastures are rapidly decreasing and deteriorating in developing countries like Nepal resulting in many unintended and unanticipated environmental problems. Unclassified forests, with very low productivity, are always open to use by local communities: Accordingly, both protected and unclassified forests are treated as forming a part of common property forest resources. It is, therefore, the subset of total forest area minus reserve forests to which common property rights are assumed to exist.

Water Resources

There are a variety of resources of water, which are in the public domain, and a significant part of these are included in the category of commons. Examples are flows of rivers, tanks and natural lakes, groundwater, wetland and mangrove areas, and such other water bodies. Man-made water resources such as dams and canals, tube wells, other wells, and supply of all types of potable water also fall in the

category of CPRs depending upon their property rights. Unfortunately, even after many debates about property rights (such as traditional rights, community rights, and basic need human rights), water has not yet been declared as CPR in India, though references are made in the water policy document indirectly. By and large, water resources in India are in common property regimes only. Irrigation canals are managed jointly by the government and communities. Traditionally, tanks, village ponds, and lakes - all of which are treated as CPRs -are sources of water for drinking, livestock rearing, washing, fishing and bathing, and several sanitary-related activities.