ਜਗਤ ਗੁਰੂ ਨਾਨਕ ਦੇਵ
ਪੰਜਾਬ ਸਟੇਟ ਓਪਨ ਯੂਨੀਵਰਸਿਟੀ
ਪਟਿਆਲਾ

The Motto of Our University

(SEWA)

SKILL ENHANCEMENT

EMPLOYABILITY

WISDOM

ACCESSIBILITY

JAGAT GURU NANAK DEV
PUNJAB STATE OPEN UNIVERSITY, PATIALA

(Established by Act No. 19 of 2019 of the Legislature of State of Punjab)

MASTER OF ARTS (ECONOMICS)

MAEC24302T-ECONOMICS OF AGRICULTURE

SEMESTER – III

Head Quarter: C/28, The Lower Mall, Patiala-147001
Website: www.psou.ac.in

The Study Material has been prepared exclusively under the guidance of Jagat Guru Nanak Dev Punjab State Open University, Patiala, as per the syllabi prepared by the Committee of Experts and approved by the Academic Council.

COURSE COORDINATOR AND EDITOR:

Dr. Pinky Sra

Assistant Professor in Economics

School of Social Sciences and Liberal Arts

Jagat Guru Nanak Dev Punjab State Open University, Patiala

JAGAT GURU NANAK DEV PUNJAB STATE OPEN UNIVERSITY, PATIALA

(Established by Act No. 19 of 2019 of the Legislature of State of Punjab)

PREFACE

Jagat Guru Nanak Dev Punjab State Open University, Patiala was established in December 2019 by Act 19 of the Legislature of State of Punjab. It is the first and only Open University of the State, entrusted with the responsibility of making higher education accessible to all, especially to those sections of society who do not have the means, time or opportunity to pursue regular education.

In keeping with the nature of an Open University, this University provides a flexible education system to suit every need. The time given to complete a programme is double the duration of a regular mode programme. Well-designed study material has been prepared in consultation with experts in their respective fields.

The University offers programmes which have been designed to provide relevant, skill-based and employability-enhancing education. The study material provided in this booklet is self-instructional, with self-assessment exercises, and recommendations for further readings. The syllabus has been divided in sections and provided as units for simplification.

The University has a network of 110 Learner Support Centres/Study Centres, to enable students to make use of reading facilities, and for curriculum-based counselling and practical. We, at the University, welcome you to be a part of this institution of knowledge.

Dean Academic Affairs

MASTER OF ARTS (ECONOMICS)

MAEC24302T-ECONOMICS OF AGRICULTURE

SEMESTER – III

MAX. MARKS:100

EXTERNAL:70

INTERNAL:30

PASS:40%

CREDITS:6

OBJECTIVE:

This course introduces the basic principles of public expenditure and revenue. It acquaints the students with the needs and effects of public debt and deficit financing and how a fiscal policy works under the conditions of deflation and inflation.

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER:

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any 10 questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES:

Candidates are required to attempt any two questions each from the sections A, and B of the question paper, and any ten short answer questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

SECTION A

UNIT 1- Introduction: Nature and Scope of Economics of Agriculture; Specificities of Farm Organization and Agricultural Production and Markets

UNIT 2- Agriculture and Industrial Relationship: Inter-sector Linkages of Agriculture [Backward and Forward Linkages]

UNIT 3- Role of Agriculture in Economic Development: Contribution of Agriculture to Economic Development

UNIT 4- Land Reforms in India.

SECTION B

UNIT 5- Agricultural Production: Uniqueness of Agricultural Production; Various Types of Factor Product, Factor-Factor, and Product-Product Relation.

UNIT 6- Role of Farm Size and Structure in Equilibrium, Productivity, and Return to Scale.

UNIT 7- Risk and Uncertainty in Agriculture: Nature and Types of Risks and Uncertainties in Agriculture, Public Policies and Farm Level Measures to Reduce Risk and Uncertainties.

UNIT 8- Instability in Agricultural: Types and measures for reducing instability for agriculture.

Suggested Reading:

- Katar. Singh, Rural Development: Principles, Policies and Management, SAGE
- Publications India Pvt Ltd. Publication year: 2009.
- A.R. Desai (Ed). Introduction of Rural Sociology in India.
- K.R. Gupta, Rural Development in India, Atlantic Publishers and Distributors (P) Ltd.
- M. Soundarapandian, Rural Entrepreneurship: Growth and Potentials, Kanishka Publisher.
- C.B. Mammoria, Indian Social Problems, Kitab Mahal Publisher.

MASTER OF ARTS (ECONOMICS)

SEMESTER-III

ECONOMICS OF AGRICULTURE

UNIT 1- INTRODUCTION: NATURE AND SCOPE OF ECONOMICS OF AGRICULTURE; SPECIFICITIES OF FARM ORGANIZATION AND AGRICULTURAL PRODUCTION AND MARKETS

STRUCTURE

1.0 LEARNING OBJECTIVES

After reading this chapter, the learners will be able to know:

- Meaning of Economics of Agriculture.

- Nature and scope of Economics of Agriculture.
- Basic concepts of agricultural production and agricultural markets.
- Different types of agricultural production
- different forms of agricultural markets.

1.1 INTRODUCTION

Economics of agriculture refers to the branch of economics that deals with the production, distribution, and consumption of agricultural goods and services. Broadly, it includes all aspects of farming, rural development and food systems and the problems related to them. Agricultural economics may be defined as the application of principles and methods of economics to study the problems of agriculture to get maximum output and profits from the use of resources that are limited for the well-being of society in general and the farming industry in particular. It studies how limited resources such as land, labour, capital and water are used in agriculture for the production of different food items and fiber in an efficient manner. It also takes into account how farmers make decisions, how agricultural markets function and how different domestic and international policies affect the agriculture sector. Knowledge of the economics of agriculture is important as it leads to ensuring food security, along with finding means of improving farmers' income and rural livelihood. It also focuses on sustainable development.

In 1964, Snodgrass and Wallace published a book entitled 'Agriculture, Economics and Growth' wherein they defined it as "*Agricultural economics is an applied phase of the social science of economics in which attention is given to all aspects of problems related to agriculture*." The definition has a broader scope as they call the subject as applied phase, as it is assumed to be using general economic principles like supply, demand, cost, etc, and applies them to solve the real-world agricultural-related problems. Moreover, it also indicates its evolving form towards a broad-based subject to understand agriculture development policy perspectives and structural transformation of rural economics. Therefore, the economics of agriculture is said to be concerned with the allocation, distribution, and utilization of resources for the production of different food and non-food crops. Agricultural economics is an applied field of economics concerned with the use of economic theory in optimizing the production and distribution of food and fiber. It takes the

tools of both microeconomics and macroeconomics and uses them to solve problems in a specific area.

Since economic activities include production, exchange, distribution and consumption of commodities, the subject covers them all. Specifically, it tries to find answers to the basic questions of economics like what to produce, how to produce, how much to produce, what to sell, where to sell and at what price to sell; what to distribute, among whom to distribute and on what basis to distribute; and what to consume and how much to consume, etc. Specifically, it can be stated that the economics of agriculture includes the choice of farming as an occupation, the choice between cultivator and engaging in animal husbandry, the choice of combining machinery and labour; the choice of combining various factors of production, to determine the intensity of cultivation and irrigation along with making appropriate choices concerning manuring, marketing, soil conservation, land revenues system, costs, prices, wages, profits, finance, credit, employment, etc.

1.2 NATURE OF ECONOMICS OF AGRICULTURE.

The following are the key characteristics or nature of the economics of agriculture:

1. **Applied Economics:** It uses economic theory to understand and address agricultural problems, i.e., it uses the principles of microeconomics and macroeconomics to solve problems specific to agriculture, like the nature of production activities, the efficient production system, the optimal price determination and resource allocation.
2. **Interdisciplinary:** It draws on principles from various fields, including economics, sociology, statistics, agronomy, environmental science, rural development and political economy, etc. As such, it is an interdisciplinary field that requires an understanding of how these different disciplines interact to affect the production, distribution, and consumption of agricultural products.
3. **Dependent upon natural resources:** Agriculture is heavily dependent on natural resources like land, water and climate for the production of food and fiber. Agriculture is a seasonal activity wherein the output, labour demand and resource consumption vary by season, which fluctuates income, prices and employment within the sector. Therefore, it is characterised by understanding the allocation of scarce resources in the production, distribution, and consumption of different commodities for sustainable growth.

4. **Dynamic and Evolving:** The subject is evolving with the technological advancements (like precision farming, mechanisation of agriculture, use of artificial intelligence in crop mapping, intelligent irrigation systems etc.) policy dynamics (national and international policy framework regarding subsidies, taxes, incentives, intellectual property rights, etc.) and climate concern (sustainable agriculture, optimum and efficient ulilisation of resources etc.).
5. **Welfare-oriented:** Economics of agriculture also aims to improve the welfare of farmers, consumers and the rural population. It focuses on income distribution, employment, and poverty alleviation in rural areas.
6. **Concerned with Market Structure:** It is also concerned with market structure and how it affects the production and distribution of agricultural products. Market structure refers to the number of buyers and sellers in a market, as well as the degree of competition. Agricultural economists study how market structure affects the prices of agricultural products and the allocation of resources in the industry.
7. **Relevant to Policy Making:** It has significant relevance to policy making, as it provides insights into the economic effects of various policies and programs related to agriculture. Agriculture is highly influenced by government policies such as subsidies, minimum support prices, credit schemes, crop insurance, and rural infrastructure development.

1.3 SCOPE OF ECONOMICS OF AGRICULTURE

The scope of the economics of agriculture refers to the boundaries and extent of the subject matter that it deals with. It includes the aspects related to the production, distribution, and consumption of agricultural goods and services. The above definitions also indicate the scope of agricultural economics, which basically indicates a common argument of scarcity of resources and choice of uses. That way, agricultural economics includes the issues related to production, consumption, distribution, marketing, financing and planning, and policy making. The subject matter is examined at the micro and macro levels. Static and dynamic analyses are also relevant for the agricultural sector of the economy.

To be more specific, agricultural economics examines how a farmer chooses various processes, e.g., production of crops or the raising of cattle and how he chooses various activities in the same enterprise. E.g., which crop to grow and which crop to drop; how the costs of production are to be

minimized; what combination of inputs for an activity are to be selected; what amount of each crop is to be produced; what type of commercial relation does the farmer have to build with the suppliers, customers and distributors.

Precisely, the scope of the economics of agriculture is as follows:

1. **Production function in agriculture**: Its scope includes examining the input and output relationship in farming. It studies the nature of land, labour, capital and management as factors of production and involves the optimal use of inputs like fertilisers, irrigation, etc. It also examines the budget and farm planning, along with issues related to decision-making under risk and uncertainty.
2. **Farm management**: The scope of economics of agriculture includes the concerns about the efficient allocation of resources of the farm with a focus on profit maximization, cost minimization, risk management, enterprise combinations and resource substitution.
3. **Agriculture marketing:** The scope of the subject deals with the movement of agricultural products from farm to consumer. It studies market structure, product pricing, storage facility, transportation system, grading, standardization, role of middlemen and market institutions etc.
4. **Agriculture finance**: The scope of economics of agriculture includes studies related to credit and investment in agriculture. Its scope includes the sources & types of agricultural credit, the role of cooperatives, banks and other financial institutions. It also studies the nature, problems and implications of rural indebtedness.
5. **Agriculture prices and policy**: The broad scope of the subject matter also examines the price behaviour and policy impacts. Therefore, its scope includes the price trends and volatility of different products, the issues related to minimum support prices (MSP), subsidies, procurement, and buffer stock. Studying the impact of government intervention and the impact of different internal and international policy implications.
6. **Rural development and welfare**: The focus of the subject is on the economic upliftment of rural communities. The scope of the subject involves the concerns related to employment generation within the agriculture and allied activities, poverty alleviation for the people related to agriculture, infrastructure development, and linkages of agricultural and non-farm sectors.

7. **Natural resources and environmental economics:** The scope of the subject matter also includes the studies related to the sustainable use of resources like land, water, forests, and labour forces. It also examines the concerns related to climate change and environmental degradation and conservation policies.
8. **International trade of agricultural commodities:** The scope of economics of agriculture also includes the exports, imports, and global value chains in production of agricultural products and the machinery used in the agriculture sector. It studies the impact and implications of trade policies, World Trade Organisation rules, comparative advantages in the production of different products, and the impact of globalisation.
9. **Agriculture labour and employment:** The subject matter of the economics of agriculture also includes the analysis, role, and condition of labour in the farm sector. It studies migration, wage trends related to the agriculture sector. It also examines the gender and caste issues related to rural agriculture and allied activities.
10. **Technological advancements:** The use and implications of advancements in agriculture production, productivity and mechanized products are also included in the scope of the economics of agriculture. The investment in research and development for the advancement of seeds, fertilisers and different varieties of plants and trees also enhances the scope of the subject. The use of advanced technologies like drones, robots, etc. in the farms etc. also enlarges the scope of the subject.

To conclude, agricultural economics does not study only the behavior of a farmer at the farm level; it also examines the agricultural problems at a macro level.

1.4 SPECIFICITIES OF FARM ORGANIZATION

Farm organizations refer to the structure, management and operational system of agricultural production units. In other words, it refers to the systematic arrangement and management of land, labour, capital, and other farm resources to achieve the maximum possible production and income sustainably. It includes planning, coordination and execution of farming operations and resource use to ensure efficient utilisation of tangible and intangible inputs for optimum output and profits. In simple words, a well-organised farm leads to higher productivity, better cost control, high income & sustainability, and efficient input use along with reduced wastage.

A farm organization, which encompasses planning, organizing, and controlling farm activities, is crucial for efficient and sustainable agricultural production. It involves managing resources like land, labor, capital, and inputs to maximize yields and profitability. Organized farming practices also facilitate better financial planning, resource allocation, and integration of various farming components for optimal output.

1. **Resource Optimization:** Farm organization aims to efficiently utilise the available resources such as land, labour, capital, and technology. It involves making informed decisions on resource allocation to ensure the best possible outcomes in terms of crop yields, livestock productivity, and overall farm performance.
2. **Productivity Maximisation:** The core objective of farm organization is to maximise productivity across all farm activities. This includes enhancing crop yields, improving livestock performance, and optimising the output of horticultural and other agricultural products. Increased productivity directly impacts farm income and contributes to food security.
3. **Profitability:** Farm organization focuses on achieving economic viability by maximising profits while minimising costs. Farmers strive to make well-informed financial decisions, including cost analysis, budgeting, and marketing strategies, to ensure the farm's financial success.
4. **Sustainability:** Sustainable farm organization is an essential objective that considers the long-term impacts of agricultural practices on the environment and society. It involves adopting eco-friendly practices, conserving natural resources, promoting biodiversity, and ensuring the well-being of future generations.
5. **Risk Management:** Farm organization seeks to mitigate various risks that farming operations are exposed to, including climate uncertainties, market fluctuations, and pest and disease outbreaks. Effective risk management strategies help farmers cope with unforeseen events and reduce potential losses.
6. **Enhanced Quality of Life:** Farm organization aims to improve the quality of life of farming families and rural communities. By optimizing farm productivity and profitability, farmers can generate sufficient income to meet their basic needs and invest in education, health, and overall well-being.

Specificities/ unique characteristics of farm organisations:

Farm organisations have several unique characteristics that distinguish them from other types of businesses or industrial organisations. This uniqueness is due to the nature of agriculture, the structure of farming, and the peculiarities of land and biological processes.

1. **Natural Resource dependence:** Farm output is dependent upon weather conditions, climate, soil fertility, rainfall, etc, and it is not entirely under human control. Therefore, there is a constant risk and uncertainty. Moreover, since land is an immobile factor of production, therefore, farm organisations concentrate on making optimal utilization of land with the use of machinery, labour, fertilisers, seeds, technology, etc.
2. **Biological nature of production:** Farming revolves around living organisms like plants, animals, etc. and the utilization of natural resources that necessitate the careful and in-depth knowledge about the biological growth cycles and related concerns.
3. **Varied size and family ownership:** The Varied size of farms necessitates different organisation systems. The requirement of inputs, the mechanisation system and the ownership form determine the organizational form. For example, a small family-managed land holding requires different organisational skills as compared to a big farmland. Furthermore, the irregular shape of land, fragmentation of land holdings and topology find difficulty in adopting modern machinery as compared to bigger land holdings.
4. **Risk and uncertainty:** High vulnerability to pests, diseases, droughts, and market fluctuations creates production and productivity risks that need strategies like crop diversification, crop insurance and storage facilities.
5. **Social and institutional constraints:** Land tenancy laws, credit availability, and local customs affect the organisational process of the land holding. Family system, labour laws, and gender roles also impact the farm organisational system.

1.5 AGRICULTURE PRODUCTION

Agricultural production refers to the process of cultivating crops and raising livestock to produce food and other agricultural products using land, labour, capital and management. It includes activities like crop farming, livestock rearing, fisheries, and forestry. Agriculture production relates to all biological and economic activities that convert natural resources into usable outputs

like food, fibre, fuel and raw materials for industry. It's a fundamental sector that impacts food security, livelihoods, and the entire economy. Key aspects include crop production (soil preparation, sowing, irrigation, etc.) and livestock management. Global agricultural production has increased significantly due to land expansion and rising crop yields, alongside a diversification of diets and increased international trade.

Agriculture production can be broadly categorized into several types, including subsistence, commercial, intensive, extensive, plantation, mixed, and organic farming, as well as specialized practices like aquaculture, horticulture, and floriculture, as discussed below. These types vary based on factors like scale of operation, land use, resource allocation, and production goals.

1) **Subsistence Farming:** This type of farming focuses on producing just enough food to meet the needs of the farmer and their family, with little to no surplus for sale or trade. It's often characterized by small landholdings and traditional farming methods.
2) **Commercial Farming:** In contrast to subsistence farming, commercial farming aims to produce crops and livestock for profit, selling the surplus in the market. It often involves larger farms, modern technology, and a focus on efficiency and high yields. Basically, commercial farming is done primarily for sale in the market.
3) **Intensive Farming:** Intensive farming utilizes significant inputs like labor, fertilizers, and pesticides to maximize yields on a given piece of land. It can be seen in both subsistence and commercial contexts, but it is often associated with commercial operations seeking high productivity.
4) **Extensive Farming:** Extensive farming relies on larger land areas with lower inputs of labor, fertilizers, and other resources per unit of land. It is often associated with lower yields per acre but can be more sustainable in certain environments.
5) **Plantation Agriculture:** This involves cultivating a single crop (monoculture) on a large scale, often for export or industrial processing. Examples, include rubber plantations or coffee farms.
6) **Mixed Farming:** Mixed farming combines crop production and livestock raising on the same farm. This can lead to more efficient resource use and a more diversified income stream.

7) **Organic Farming:** Organic farming relies on natural inputs like compost and crop rotation, avoiding synthetic fertilizers, pesticides, and other chemicals. It prioritises environmental sustainability and often commands premium prices.

8) **Acqaculture:** This involves farming aquatic organisms like fish, shellfish, and aquatic plants in controlled environments.

9) **Horticulture:** This focuses on the cultivation of fruits, vegetables, and ornamental plants.

10) **Floriculture:** This specializes in growing flowering plants for decorative purposes.

1.6 STAGES OF AGRICULTURE PRODUCTION:

Agriculture production is a systematic process that involves multiple stages, from preparing the land to marketing the final produce. The systematic stages help ensure efficient resource use, timely operations, and maximum yield. The following are the stages of agricultural production:

1) **Pre-production stage:** At this stage, land is prepared for cultivation. Therefore, the land preparation is done through ploughing, levelling, and removing weeds. Soil testing is done to check the nutrient levels for crop suitability. Seed selection is done to ensure high-yielding and disease-resistant varieties are used. At this stage, input planning is done to estimate the need for fertilizers, pesticides, irrigation and labour. Ultimately, financial planning is also done at this stage, which includes the estimation of required funds for cultivation, like arranging credit, finding the avenues of subsidies, and government support.

2) **Production Stage (Crop Cultivation):** This is the major stage when the crop growth and management take place. At this stage, sowing or planting is done using the proper seed rate and spacing. Irrigation is arranged for supplying water as per the needs of the crop, rainfall, and soil type. Nutrition management is also done at the crop cultivation stage, where the organic and chemical fertilizers are utilised to support the growth of the plants. Apart from these, weed controls (manual and/ or mechanical and/ or chemical) and pest and disease management (spraying, pesticides, fungicides, etc.) are also done at this stage. At this stage, sowing is done, irrigation facility is arranged, fertilization and pest management are done.

3) **Harvesting:** At this stage, the collection of mature crops or animal products is done. Therefore, key activities like monitoring the maturity level of plants are done before resorting to manual or mechanical harvesting of the crops. Thereafter, threshing of the crop is done, which means

separating the grains from the plants. The last stage of harvesting includes cleaning and drying to remove foreign material and reducing moisture for storage.

4) **Post-Harvest:** After harvesting, the produce must be processed, stored, and marketed properly. Storage is usually done in silos, godowns, and cold storage to prevent spoilage. Grading and packaging are done for transporting the products to the market. At times, processing is done for cleaning, and at times, advanced processing like canning, juicing, etc., is also done. Finally, transportation, marketing and selling are done either directly to the customers or through middlemen or cooperatives.

1.7 AGRICULTURE MARKETS

Agriculture markets refer to the mechanisms through which agricultural goods are exchanged between farmers and consumers, including input markets like seeds, fertilizers, etc. and output markets like crops, dairy, etc. Agriculture simply involves growing and raising crops and livestock, whereas market involves a series of activities related to moving the goods from the point of production to the point of consumption. Agricultural markets essentially involve the buying and selling of agricultural products on a wider scale across the country. Agriculture markets are basically platforms or systems where farmers sell their produce and buy necessary inputs like seeds, fertilizers, and equipment. It includes each and every activity related to supplying farm inputs to farmers and the movement of agricultural products from farms to consumers. There are basically three important functions served by agricultural markets: assembling or concentration of goods, preparation (processing) for consumption and distribution of agricultural products.

The classification of the agriculture market is done in various ways that are based on their stage of marketing, regulatory system, mode of sale, nature of commodities, and recent advancements in the form of agricultural markets. The details of these are discussed as follows:

1.8 TYPES OF AGRICULTURE MARKETS

1. Based on Stage of Marketing: As per the stage of marketing, the agriculture market is of the following types:

a) **Primary or Local Market or Village Markets:** Primary markets are the local markets within or near the village. In these markets, farmers sell their produce directly after harvest. These markets are usually unregulated and are dominated by middlemen. Many agriculturists sell

their farm products in this type of market. The village panchayats organize a primary market and charge rent from shopkeepers for the space occupied. Bargaining is the common feature of these markets.

b) Secondary Markets or Wholesale Markets or Mandis: These are located in towns and district headquarters. Farmers and village traders bring build produce in these markets to sell it to the customers. Secondary markets are permanent in nature, where business dealings get transacted regularly throughout the year. The production gets handled in big quantities and specialized operators are necessary for the performance of distinct services. Such markets offer facilities of storage, handling, banking services and are well-connected by roads and railways. These markets can be both regulated (like APMCs) and unregulated in nature.

c) Terminal Markets: These are found in big cities or port towns. These markets usually deal with very large quantities, usually for processing or exports. These are usually considered as the final markets in the domestic trade chain.

d) Exports Markets: These are the markets where the agricultural products are sold to international buyers. Therefore, quality certification, packaging, and phytosanitary standards are required in these markets. These are regulated by bodies like the Agricultural and Processed Food Products Export Development Authority (APEDA).

2. Markets classified on the nature of Regulation:

a) **Regulated Markets (APMC markets):** These markets are governed by the Agricultural Produce Market Committee Acts (APMC) of the states to ensure fair prices, to avoid exploitation by middlemen, and to provide transparency. In these markets, facilities like weighing, grading, auctioning and payments are done in a regulated manner.

b) **Unregulated markets:** These are the markets that operate without formal supervision or rules. There is a high degree of fear of exploitation of farmers in these markets. These types of markets are more common in remote and backward areas.

3. Markets based on the Manner of Sales:

a) **On-the-spot sales:** In this form of market, the farmers bring produce, and the exchange happens on the spot. Under the method, the payment is either done immediately or within a few days. These are the most common forms of market for small purchases.

b) **Forward and Future Markets:** Under this method, future contracts are traded in commodity exchanges. These are the transactions where delivery and payment occur at a future date. These are usually used for price discovery and risk management. This form of market is useful for farmers, traders, and processors to hedge price risks.

4. Nature of Commodity: Different commodities are handled in different forms of markets.

a) Foodgrain markets: In this market, foodgrains like rice, wheat, pulses, cereals, etc. are traded.

b) Cash Crop Market: In these, crops like cotton, jute, sugarcane, oilseeds, tobacco, etc, are traded.

c) Horticulture market: Fruits, vegetables, flowers and other perishable goods are traded in this market. Typically, cold storage facilities are used to store and transport these commodities.

d) Livestock and Dairy Markets: These are the markets wherein animals, poultry, milk, meat, eggs, etc., are traded.

5. New forms of Agricultural Markets: The following are the new forms of agricultural markets:

a) e-NAM (Electronics National Agriculture Market): These are Pan-India electronic trading platforms integrating APMCs. These markets helped in price discovery, digital payments, and interstate trade.

b) Contract Farming Markets: These are the markets wherein farmers and agribusiness firms agree to produce a crop at a pre-decided price. The contract farming system reduces market uncertainty, but it needs regulation to protect farmers.

c) Farmer Producer Organisation (FPO) Markets: Under this system, farmer collectives that aggregate produce and sell directly to buyers or processors. This system improves bargaining power and reduces dependency on middlemen.

d) Private markets or Agri-tech platforms: Different digital platforms facilitate market linkages, logistics, and price transparency. These are supported by mobile apps and GPS-based traceability.

1.9 SUMMARY

Agricultural economics applies economic principles to farming and rural development, focusing on the efficient use of resources, production, pricing, marketing, and policies. The nature of farm

organization is distinct because it heavily depends on land, weather conditions, biological processes, and family labor. Agricultural production is seasonal and uncertain, shaped by both natural and economic factors. Similarly, agricultural markets are characterized by problems such as price fluctuations, perishability of products, and imperfect competition. Thus, the economics of agriculture highlights the unique challenges and opportunities in managing farm resources and markets effectively.

1.10 QUESTIONS OR PRACTICE

A, Short Answer Type Questions

Q1 Mention any two characteristics of economics of agriculture?

Q2 What is agricultural production?

Q3 Mention the different stages of agricultural production?

Q4 What do you mean by agricultural markets?

Q5 Based on Stage of Marketing

Q6 unique characteristics of farm organisations

Q7 New forms of Agricultural Markets

B. Long Answer Type Questions

Q1. Write a detailed note on the nature and scope of the economics of agriculture.

Q2. Discuss the scope of the Economics of Agriculture.

Q3. Explain the specificities of farm organisations in detail.

Q4. Write a detailed note on the agricultural production.

Q5. Explain in detail the different types of agricultural production.

Q6. What are the different stages of agricultural production?

Q7. Explain the meaning of agricultural markets. What are the different types of agricultural markets?

1.11 SUGGESTED READINGS

- Heardy Earl O, The Economics of Agriculture Production and Resource Use, Prentice-Hall.
- Johl SS and Kapoor TR, Fundamentals of Farm Business Management, Kalyani Publishers.
- Mellor John W, The Economics of Agricultural Development, Cornell University Press.
- Ruddar Datt and KPM Sundharam, The Indian Economy, S Chand Publishers.
- Bilrgami SAR, An introduction to Agricultural Economics
- Tyagi, BP, Agricultural Economics and Rural Development.

MASTER OF ARTS (ECONOMICS)

SEMESTER-III

ECONOMICS OF AGRICULTURE

UNIT-2: AGRICULTURE AND INDUSTRIAL RELATIONSHIP: INTER-SECTOR LINKAGES OF AGRICULTURE [BACKWARD AND FORWARD LINKAGES]

Structure

2.0 OBJECTIVE

The role of agriculture sector is not only crucial in the initial stages of economic development but also for creating inter-sector backwards and forward linkages in an economy. The concept of linkages plays an important role in guiding strategies for future economic development. Not only is the output of the agriculture sector used as input in some industries, but agriculture also uses the output of some of the industries as inputs. With this background, the main objective of the present unit is to learn about the inter-sector linkages of the agriculture sector.

2.1 INTRODUCTION

As per unbalanced theory of growth given by Prof. Hirschman, "each sector has linkages with the other sectors in an economy, in the sense that it either purchases inputs from them for production of its output or provides to them as inputs, its own output. Thus, the expansion of any sector's output will, through technological interdependence, lead to the expansion of output of the other sectors." The sectors with the highest linkages are also more likely to experience rapid growth of income, employment and production with alternative allocation of resources (Hirschman, 1958 and Polenske and Sivitanides, 1990). The contribution of agriculture to the economy in general and to the industry in particular is well highlighted in developing economies. The interdependence of agriculture and industry sectors may vary and change over time in different economies. The study of the relationship and interdependence between the agricultural and industrial sectors helps identify the backward and forward linkages of the agricultural sector. The backward linkages identify how a sector depends on other sectors for its input requirements and forward linkages identify how a sector distributes its output to other sectors of the economy. The interdependence of the sectors to fulfil the need of productive inputs creates the production linkages, whereas demand linkages are created due to the interdependence of the sectors to meet the needs of the final consumption.

2.2 FACTORS DETERMINING LINKAGES IN AGRICULTURE AND NON-AGRICULTURE SECTORS

1. Diversification of Agriculture Sector- Over time there has been diversification in agriculture in terms of area and value of production. Also, with the development there has been diversification in diets away from food grains to high-value commodities like vegetables, fruits, meat, and milk products. This diversification of agriculture to high-value crops and allied activities helps to increase in growth of the agriculture sector by creating a link with food processing industry.

2. Rural Non-Farm Sector- Because of the limited capacity of urban sector in generating employment and saturation of employment in agriculture sector, rural non-farm sector plays a crucial role in generating employment and reducing poverty. The strong evidence is given by rural industries of China and other East Asian countries to generate employment in rural non-farm sectors. The agricultural growth and commercialisation of agriculture are important determinants of rural non-farm employment, which creates a linkage between farm and non-farm sectors.

3. Globalisation and Urbanisation-Globalisation leads to specialisation and foreign investments in agro processing and retailing, results in an increase in income and employment, which also becomes the reason of increase in urbanisation. The consumption pattern in urban areas shifts to high-value farm output and it leads to an increase in demand for agricultural products.

4. Technology and Mechanisation- with the change in technology and mechanisation of agriculture, the linkages between farm and non-farm sectors can be enhanced and strengthened. The use of HYV seeds, sprinkler irrigation, improved transportation, communication, and trading services also creates linkages among farm and non-farm sectors

5. Agro Processing and Retail Trading- the food and agro processing has huge potential to create linkages between farm and non-farm sectors. The promotion of retail trade and foreign direct investment in the food and agro-processing sector also strengthens the linkages between farm and non-farm sectors. The emergence of supermarkets can be beneficial for small farmers if they participate in supermarket procurement, as it is going to have a positive impact on their income.

6. Agricultural Trade- the exports of processed agricultural products also help in creating and strengthening linkages between farm and non-farm sectors. The processing of agricultural products for exports as per global demand not only enhances agricultural trade but also increases employment in food and agro-processing sectors.

2.3 THE INTERDEPENDENCE BETWEEN AGRICULTURE AND INDUSTRY

The interdependence between agriculture and industry sectors helps to fulfil the input requirements of both sectors. The product of one sector acts as input for the other sector so if one sector grows well, the other sector gets enough supplies. With some time-lag the flow of products to one sector ensures the return flow from the other sector.

2.3.1 CONTRIBUTION OF AGRICULTURE TO INDUSTRY OR HOW INDUSTRY DEPENDS ON AGRICULTURE

a) Supply of Raw Material to Industry- Many industries depend directly on agriculture for their raw material, for example, beverages, food processing and textiles. The agriculture sector acts as a raw material provider for these industries. Some industries are related to eatables and get fruits, vegetables and cereals from agriculture, whereas some industries get nonfood products from agriculture as their raw material, like cotton and jute.

b) Supply of Food Grains to Market- The market arrivals of food grains represent the availability of wage goods for the non-agriculture sector (if market arrivals are not distress sales by farmers). The agriculture sector is providing food to non-agriculture sectors by increasing the level of output, which also increases the marketed surplus. Agriculture provides food grains to the industry to facilitate the absorption of labour in industry.

c) Providing Capital Goods- The developing country can pay for capital goods imports by exporting agricultural products. After independence, India was importing food grains but over time it has also been exporting processed and unprocessed agricultural products. The agricultural exports not only pay for food imports but also help to pay for capital goods used by the industrial sector.

d) Providing Market to Industrial Sector- The increase in income of farmers not only creates the demand for consumer goods (like refrigerators, two and four wheelers, etc.) but also the agricultural equipment and machinery (like tractors, harvesting machines etc.). The 61st round of National Sample Survey Organization (NSSO) recorded the increase in use of motor cars, two wheelers and television sets in rural India between 1993-94 and 2004-05.

e) Providing Capital and Labour to Non-Farm Sectors- In the initial stages of economic development agriculture sector are the custodian of capital and labour. Initially agriculture provides labour to industrial sector and with the increase in income, it also helps to create capital for industry indirectly by consuming industrial products.

2.3.2 CONTRIBUTION OF INDUSTRY TO AGRICULTURE OR HOW AGRICULTURE DEPENDS ON INDUSTRY

a) Absorbing the Agricultural Labour- Industry helps to absorb the excess labour or labour with zero marginal productivity in agricultural sector**.** The country with growing population and slow progress in industry sector do not experience decline in agricultural population, which led to pressure of population on agriculture sector.

b) Providing Inputs to Agricultural Sector- The Industrial sector provides modern inputs like fertilizers, machinery, pesticides etc. to agricultural sector. These modern inputs can help the agricultural sector to increase production and improve productivity over time.

c) Provision of Infrastructure- The facilities of transport, electricity, roads, water supply, health and education services, research institutions, etc., are directly or indirectly provided by the industrial sector.

2.3.3 LIMITS OF INTERDEPENDENCE OF AGRICULTURAL AND INDUSTRIAL SECTORS

The contribution or dependence of agriculture sector on industrial sector and vice versa should not be considered as complete interdependence. There are needs of manpower, water and animals in agriculture sector which cannot be fulfilled by the industry sector. Similarly, some industries are based on raw materials that cannot be supplied by agriculture sector, like minerals and machinery. The problems of land tenure system, farm organisations, climate and sustainability of the agriculture sector do not have solutions within the industry sector. The issues of continuous change in technology and skills are not going to have any solutions from agriculture sector. The development of one of the sectors (industry or agriculture) is not going to end the problems of the other sector.

CHECK YOUR PROGRESS- I

Q1. Explain the factors determining the linkages between agricultural and non-agricultural sectors.

Ans:_____

_____

Q2. Discuss the contribution of agriculture sector to industry sector?

Ans:_____

_____

2.4 INTER-SECTORAL LINKAGES OF AGRICULTURE

"The Rosestein-Rodan (1943), Lewis (1954), Scitovosky (1954), Hirchman (1958), Jorgenson (1961), Fei and Ranis (1961) and others emphasised the role of agriculture only as a primary supplier of wage goods and raw materials and abundant labour supply to industry. The role of agriculture in the transformation of a developing economy was seen as ancillary to the central strategy of accelerating the pace of industrialisation (Vogel, 1994)."

2.4.1 BACKWARD LINKAGES OF AGRICULTURE SECTOR

The backward linkages of the agriculture sector include the linkages with other sectors that provide inputs to agriculture sector to complete its production process. The backward linkages include the following:

a) **Provision of Seeds**- The farmers need different varieties of seeds as per the requirements of the nation. Thus, access to seeds is an important backward linkage of agriculture sector. The seeds can be provided by the open market or by the government of country, also, if some seed scheme or seed bank is working in the country.
b) **Fertilizers, Pesticides, and Agrochemicals**- The crops need protection from various unwanted plants, insects and pests, for which farmers use fertilisers, insecticides, and pesticides. These requirements also create backward linkages in agriculture.
c) **Agricultural Machinery and Equipment**- agriculture has backward linkages with the industries providing farm machinery like tractors, harvesters and other equipment to supplement the agricultural production process. Farmers purchase machinery from their own income or they get subsidies on this machinery to purchase and use in agriculture.
d) **Irrigation and Water Management**- The facilities of irrigation and managing water for farming also form backward linkages of the agricultural sector.
e) **Credit and Financial Services**- The banks and financial institutions that provide financial support to purchase agricultural inputs are also forming backward linkages of the agricultural sector.
f) **Research and Development**- Agricultural research institutions, universities and extension services providing innovation and technology transfer related facilities to agriculture also form strong backward linkages of agriculture sector.

2.4.2 FORWARD LINKAGES OF THE AGRICULTURE SECTOR

Forward linkages in agriculture include activities that help in moving agricultural products from farmers to consumers. Forward linkages are as follows:

a) **Agro Processing Industries**- These are mainly food processing, textiles, beverages, and other commodities, which add value to the agricultural products. The vegetables, fruits, jute, cotton, tea and coffee are some of the examples of agricultural products which used in industries to prepare products by value addition.
b) **Processing and Value Addition**- The raw agricultural products are processed into value-added products with the help of activities such as milling, grinding, canning and

packaging for sale to consumers. For Example, raw wheat is processed into flour for selling to the consumer.

c) **Wholesale and Retail activities**- Agricultural products are sold to wholesalers, who further distribute products to retailers and local markets.
d) **Exports of Agricultural Products**- Agricultural products are also exported to other countries or international market, which is also a forward linkage of agricultural sector.

2.4.3 BENEFITS OF AGRICULTURE-INDUSTRY INTERDEPENDENCE

The interdependence between agriculture and industry contributes in a nation's growth and development in the following ways:

1. **Employment Opportunities**- the development of agro-processing related industries is helpful in job creation and agriculture provides raw material to these industries. The jobs related to processing procedures, transportation, marketing, etc, get created through the agro processing industry.
2. **Alternate Source of Income and Improved Standard of living**- farmers can have contract farming with agro processing units and supply them agricultural material to diversify their incomes. The diversified sources of income result in increased incomes, which also improve standard of living of farmers.
3. **Skill Development Activities**- with the development of rural industries based on the processing of agricultural products, the skill development activities, schemes and centres also get their way to enter in the rural areas.

2.5 INTERSECTORAL LINKAGES IN INDIA

Over time, India has not only recorded an increase in food grain production but also in non-food grain production, along with the emergence of food processing, textiles, and other industries that are receiving their raw material from the agricultural sector. These industries created the forward linkages of Indian agricultural sector. The availability of various agricultural inputs also increased, which strengthens the backward linkages of Indian agricultural sector.

2.5.1 FORWARD LINKAGES OF THE INDIAN AGRICULTURE SECTOR

The foodgrains production (includes rice, wheat, jawar, bajra, maize, pulses etc.) of India increased from 50.8 million tonnes in 1950-51 to 332.3 million tonnes during 2023-24. The production of oilseeds increased to 39.7 million tonnes in 2023-24 from 6.2 million tonnes in 1950-51. The production of cotton increased to 32.5 million bales from 3 million bales during

1950-51 to 2023-24. As per Economic Survey 2022-23, “The food processing sector is of enormous significance for India's development because of the strong connections and interactions it promotes between industry and agriculture. During the last five years ending FY21, the food processing industries sector has been growing at an average annual growth rate of around 8.3 per cent. As per the latest Annual Survey of Industries (ASI) 2019-20, 12.2 per cent of persons in the registered manufacturing sector were employed in the food processing sector. The value of agri-food exports, including processed food exports, was about 10.9 per cent of India's total exports during 2021-22.”

As per Agricultural and Processed Food Products Exports Development Authority (APEDA), India’s export value of all agricultural products increased to Rs. 450,839.80 crores in 2024-25 from Rs. 439,820.70 crores in 2022-23. The value of exports of APEDA agricultural and processed food products of India was Rs. 107,482.90 crores in 2015-16, which increased to Rs. 243,042.10 crores in 2024-25.

2.5.2 BACKWARD LINKAGES OF INDIAN AGRICULTURE SECTOR

As per Economic Survey 2024-25, “Despite the increase in crop production, further enhancements in productivity across various crops and regions are vital for boosting performance and positively influencing farmers' incomes. Productivity is closely linked to on-farm and post-harvest inputs such as improved access to quality seeds, better irrigation facilities, efficient water management practices, effective extension services, soil health improvements, modern post-harvest infrastructure, and accessible markets.” The availability of credit to small and marginal farmers is also crucial for improving agricultural income and productivity. Over time Indian Government also provided facilities for farm mechanisation and research and development for agriculture sector.

Table 1- Period Averages of Annual Growth Rates of Value of Intermediate Inputs (2004-05 prices)

Inputs	Pre-Green Revolution (1951-52 to 1967-68)	Green Revolution (1968-69 to 1980-81)	Wider Coverage (1981-82 to 1990-91)	Early Liberalisation (1991-92 to 1996-97)	Ninth Plan (1997-98 to 2001-02)	Tenth Plan (2002-03 to 2006-07)	Eleventh Plan (2007-08 to 2011-12)
Seed	1.5	1.1	2.3	1.6	-0.6	1.4	4.1

Feed of livestock	1.9	4.0	0.1	0.9	3.9	0.7	3.3
Organic manure	0.0	1.3	0.7	0.5	1.6	2.9	3.3
Fertilisers and pesticides	18.2	9.3	8.7	2.0	3.9	4.8	6.7
Diesel Oil	26.0	13.1	8.7	4.3	5.1	5.1	5.8
Electricity	18.5	15.2	12.9	14.4	-4.1	2.6	8.0
All inputs crops and livestock	2.4	4.5	2.2	1.9	3.0	2.5	4.4
Inputs for Fishing	4.6	3.3	5.4	6.5	2.7	1.5	3.5
Inputs for Forestry	1.7	-0.2	0.1	0.3	2.6	1.3	2.3
All Inputs Agriculture and Allied	2.3	3.9	2.1	1.9	3.0	2.4	4.3

Source: data.gov.in

Table 1 clearly shows the backward linkages of the Indian agricultural sector in terms of averages of annual growth rates of various time periods. The average annual growth rate of all inputs in agriculture and allied sectors was 2.3 during the Pre-Green Revolution (1951-52 to 1967-68) and it increased to 4.3 during 11th Five-Year Plan. In every period, diesel oil or electricity recorded maximum figures, followed by fertilisers and pesticides.

CHECK YOUR PROGRESS- II

Q1. Discuss the backward and forward linkages of the agriculture sector.

Ans:_____

_____

Q2. Explain the case of backward and forward linkages of Indian agricultural sector?

Ans:_____

_____

2.6 DIFFERENCE BETWEEN FORWARD AND BACKWARD LINKAGES OF AGRICULTURE SECTOR

	Forward Linkages	**Backward Linkages**
1.	Agricultural products are supplied as raw material to other sectors	Products of other sectors are used as inputs in agriculture sector
2.	Help in the growth of the industries which process, market, and trade in agricultural products.	Help in the growth of the industries that produce agricultural inputs.
3.	Forward linkages come into existence after farming activity.	Backward linkages come into existence before the beginning of farming activity.
4.	Food processing, textiles, beverages, dairy, etc are examples of forward linkages of agriculture sector.	Fertilisers, seeds, machinery, irrigation, credit, etc, are examples of backward linkages of the agriculture sector.

2.7 SUMMARY

The linkages of the agricultural sector play an important role in developing related industries in an economy. The backward linkages of agricultural sector provide the necessary raw material required to produce agricultural products and forward linkages help to transfer agricultural produce to its consumers. The strong agriculture sector creates significant linkages, which also strengthen the base of industrial sector of the economy. In India, there is a lot of scope in the food and agro-processing industry to create a linkage with agriculture sector as the emergence of supermarkets within the country and an increase in global demand can be beneficial for small farmers, if, through farm organisation, they supply their agricultural output for processing industries and also for exports.

2.8 GLOSSARY

- **Linkages-** the dependence of a sector of an economy on other sectors for inputs or for markets of their products creates linkages.
- **Production Linkages-** The interdependence of the sectors to fulfil the need of productive inputs creates the production linkages, whereas demand linkages are created due to interdependence of the sectors to meet the needs of the final consumption.
- **Demand Linkages**- The demand linkages are created due to interdependence of the sectors to meet the needs of the final consumption.
- **Backward linkages of agriculture sector-** include the linkages with other sectors that provide inputs to agriculture sector to complete its production process.
- **Forward linkages in agriculture sector-** include activities that help in moving agricultural products from farmers to consumers.
- **Farmer Producer Organisations (FPO)-** These are producer organisations formed by small and marginal farmers collectively to address the common challenges faced by the farmers.
- **National Sample Survey Organization (NSSO)-** It is an organisation in the Ministry of Statistics and Programme Implementation, Government of India, which conducts periodic surveys and censuses on socio-economic topics.

2.9 QUESTIONS FOR PRACTICE

A. Long Answers Questions

Q1. What are linkages? Explain the types of linkages of agricultural sector?

Q2. Explain the interdependence of agricultural and industrial sectors. Differentiate between the forward and backward linkages of agricultural sector?

Q3. Explain the contribution of agricultural sector to Industrial sector?

Q4. Explain the contribution of Industrial sector to Agricultural Sector?

Q5. Explain the forward and backward linkages of Indian agriculture?

Q6. “The study of relationship and interdependence of agriculture and industrial sectors helps to identify the backward and forward linkages of agriculture sector.” Explain.

Q7. Explain (i) contribution of agriculture sector to industrial sector, (ii)Forward linkages of agricultural sector?

Q8. Discuss (i) contribution of industrial sector in agriculture sector, (ii) Backward linkages of agricultural sector?

Q9. Differentiate between forward and backward linkages of agricultural sector? Explain the case of Indian agricultural sector linkages?

Q10. How agriculture sector depends on industrial sector? Explain the case of India?

B. Short Answer Questions

Q1. Define the term Linkages.

Q2. What is production linkage?

Q3. What is Demand linkage?

Q4. What is forward linkage of the agriculture sector?

Q5. What are backward linkages of agricultural sector?

Q6. How agriculture sector contributes to agricultural sector?

Q7. How industry sector contributes to agriculture sector?

Q8. How unbalanced theory of growth given by Prof. Hirschman explains linkages of sectors?

Q9. Differentiate between demand and production linkages?

Q10. Differentiate between forward and backward linkages?

2.10 SUGGESTED READINGS

- Soni, R. N. and Malhotra, S. (2017). *Leading Issues in Agricultural Economics.* Vishal Publisher co., Jalandhar.
- Subramaniam, Vijay and Reed, Michael (2009) Agricultural Inter-Sectoral Linkages and Its Contribution to Economic Growth in the Transition Countries, presented at the International Association of Agricultural Economists Conference, Beijing, China.
- Dev, S. Mahendra (2018) Farm and Non-Farm Sector Linkages and Future of Agriculture, *Indian Journal of Agricultural Economics,* Vol. 73, No. 1, pp.54-76.

MASTER OF ARTS (ECONOMICS)

SEMESTER-III

ECONOMICS OF AGRICULTURE

UNIT 3: ROLE OF AGRICULTURE IN ECONOMIC DEVELOPMENT: CONTRIBUTION OF AGRICULTURE TO ECONOMIC DEVELOPMENT

STRUCTURE

3.0 OBJECTIVE

After reading this unit, learners will be able to know about:

- Role of agriculture in economics growth/development
- Contribution of agriculture in India
- Contribution of agriculture in China

3.1 INTRODUCTION

Economic Development begins with the development of agriculture. This is because in the early stages of development, agriculture accounted for one-third to one-half of the GDP and employed two-thirds or more of the labour force (Synthesis Report, FAO, 2006). Presently, as per the Global Hunger Index Report, 2024, out of 130 countries, still 42 countries are

experiencing serious (36 countries including India) or alarming (06 countries) hunger, which gives an idea that achieving zero hunger by 2030 is going to be a difficult task. This also means that over time, if agricultural production is increasing, the food requirements are also increasing, and food security has become one of the major concerns. With this given background, it is pertinent to go through the role and contribution of agriculture in the economic development of a country.

The agriculture sector is an integral part of the rural economy, which not only plays a supportive role in economic development but must be an indispensable part in any overall strategy of economic progress, especially for low-income developing countries (Todaro & Smith, 2020).

As per the World Development Report (2008), "In the 21st century, agriculture continues to be a fundamental instrument for sustainable development and poverty reduction." The report also discussed that agriculture is used for the development agenda to achieve sustainable growth and reduce poverty in different ways in agriculture-based, transforming and urbanised countries. The productivity revolution in small holder farming is the main solution for agriculture-based countries, whereas in urbanised countries, agriculture can reduce rural poverty by helping small land holders to become direct suppliers in modern food markets, which further create jobs in agriculture and agriculture-based industry, and markets for environmental services are introduced. In transforming countries, moving towards high-value agriculture, decentralising non-farm activity and moving people out from agriculture helps to reduce rural-urban income inequalities.

Gerdien Meijerink & Pim Roza (2007) studied the role of agriculture in the economic growth of South Asia, East Asia & Pacific, Sub-Saharan Africa, Europe & Central Asia, the Middle East & North Africa and Latin America & Caribbean. They explained a paradox in the role of agriculture in economic development and confirmed that the share of agriculture contributing to GDP is declining over the years, but the productivity of cereal yields has been increasing. It seems that as agriculture becomes more successful, its importance declines in the overall economy. The agricultural sector contributes to economic growth, but that economic growth reduces the role of agriculture in terms of GDP. The share of agriculture in total employment in developing countries constituted 53% of the total workforce in 2004. In Sub-Saharan Africa, 60% of the economically active population works in the agricultural sector. It is concluded that recent years have seen tremendous changes in economic development in developing countries in general, but for the agricultural sector in particular. This coincides with a renewed debate on the role of agriculture, whereby the realization of the important role of agriculture is not only

reaffirmed, but also the importance of the linkages between agricultural and non-agricultural sectors, farm and nonfarm activities and rural and non-rural regions is emphasised.

3.2 ROLE OF THE AGRICULTURE SECTOR IN ECONOMIC DEVELOPMENT

The share of agriculture in a country's GDP reflects the importance of agriculture in its economic development. The literature on development during the 1950s was rather pessimistic about the potential positive role of agriculture in a country's overall growth. After the work of Schultz (1979) and his "efficient farmer" hypothesis, literature recorded not only productivity growth capability of agriculture and its response to technological change (on which the "green revolution" was based), but also that the agricultural sector can have significant multiplier effects and therefore growth in the agricultural sector could be spread to other non-agricultural sectors in the economy.

Historically, discussion on the role of agriculture in economic growth is more like a debate, but the realization that agriculture has a significant role in the growth process of UDCs is relatively recent. Johnston and Mellor (1961) identify five types (discussed in the next section) of inter-sectoral linkages that highlight agriculture's role in economic growth.

Agriculture has historically been viewed as a key driver of economic growth, particularly in developing regions. However, despite productivity increases, its contribution to GDP is declining, raising questions about its effectiveness in poverty alleviation. With an increase in urbanisation, the rural population is declining, but a still large portion of the poor reside in rural areas. In developing countries, agriculture employs 53% of the workforce, with 60% in Sub-Saharan Africa, where Productivity growth has been inconsistent, and this region lags other regions. In recent years, Sub-Saharan Africa outperformed East Asia in agricultural growth (Meijerink & Roza, 2007)

3.3 CONTRIBUTION OF AGRICULTURE TO ECONOMIC DEVELOPMENT

3.3.1 Bruce F. Johnston and John W. Mellor (1961) summarised five prepositions to show the agriculture sector's contribution to economic growth. These are inter-sectoral backwards and forward linkages operating through both production and consumption.

1. **Expanded Food Supplies**: Demand for agricultural products substantially increases with economic development and not keeping pace of food supplies with the growth in its demand negatively impacts economic growth. An increase in the demand for food is having more economic significance in underdeveloped countries due to three major reasons:

a) High rates of population growth, as a result, increase international borrowings in the public health field to reduce the death rates sharply, combined with a slow decline in the birth rate. This resulted in a substantially higher rate of natural increase in undeveloped countries as compared to developed countries.
b) Income elasticity of demand for food in UDCs is considerably higher than in high-income countries. For the given rate of increase in per capita income, there is a higher increase in demand for agricultural products as compared to developed countries. Further, with the increase in population in the cities or industrial centres, the demand for marketed supplies (purchased food) increases at a higher rate than the overall rate of increase of agricultural products.
c) rise in food prices due to the slow pace of increase in food supply results in pressure on wage rates, which in turn leads to declining industrial profits, investments, and economic growth.

The consequences are more severe in developing countries because 50 to 60 per cent of total consumption expenditure is on food only. Failure in expanding food supply increases food prices and this further arises political discontent. To avoid this situation, as a solution, food shortages are covered by imports in countries where sufficient foreign reserves are available after fulfilling the need of developmental imports (i.e., machinery etc).

2. **Increase in income and foreign exchange earnings:** In the early stages of development, agricultural products exports propitious means to increase earnings from foreign exchange and the income of a country. An addition of a crop having export prospects in the ongoing cropping system helps to increase agricultural exports, as it often requires moderate capital and is almost dependent on non-monetary but direct investment by farmers. Even in the case of unfavourable world supply-demand of a commodity, to increase foreign exchange earnings when there are no other options available, expansion in agricultural exports is a logical step to take. There are, certainly, problems of dependence on agricultural exports, when simultaneous efforts to increase agricultural exports are taking place in a number of underdeveloped countries, as it has the risk of decline in prices, especially in the case of low price and income elasticities. But during the long run, diversification reduces the vulnerability of a country depending heavily on export earnings from a few crops because "one of the rewards of the structural transformation associated with economic growth is the greater flexibility of a diversified economy."

3. **Agriculture provides manpower for non-agriculture sectors**: According to Lewis ' sector model, labour force requirements for manufacturing and other expanding sectors can be fulfilled easily from the agriculture sector. In the early stages of development, transfer of labour from agriculture to non-agriculture sectors is pertinent as there is no other source available. Also, manpower supply is not a problem in manufacturing and other sectors if sincere and intelligent efforts are taken to increase farm productivity over time.
4. **Capital formation by the agriculture sector:** As discussed earlier, there is scope for increasing agricultural productivity with a moderate amount. It is possible for the agriculture sector to contribute to the country's capital requirements for industry and infrastructure development, that is too without reducing the consumption level of the farm population. An increase in agricultural productivity is achieved by a combination of reduced inputs, reduced agricultural prices or increased farm receipts. Labour is an abundant input in the UDCs, which can be reduced in agriculture to make it a manpower source for non-agricultural sectors. In underdeveloped countries, where agriculture accounts for 40 to 60 per cent of the GDP, agriculture makes a net contribution to capital formation in the expanding non-agricultural sectors only with the level of saving and investment, which can achieve a rapid rate of economic growth (and not a stagnant level of saving and investment).
5. **Stimulus to industrial expansion:** As per Lewis, increased rural purchasing power is a valuable stimulus to industrial development. But the problem is of insufficient markets for manufactured goods in the countries where the farm population is two-thirds to four-fifths of the total population. This farm population is too poor to buy manufactured goods and there is a lack of real purchasing power because of the low level of agricultural productivity. Thus, again, stimulus to industrial expansion from agriculture depends upon the efforts to increase agricultural productivity.

3.3.2 ACCORDING TO KUZNETS, AGRICULTURE CONTRIBUTES MAINLY IN FOUR WAYS TO THE ECONOMIC GROWTH OF A COUNTRY:

(i) Factor contribution of agriculture: With the development over time, agriculture provides some productive resources to the non-agriculture sector, which is nothing but factor contribution. The factor contribution of agriculture to non-agriculture sectors can be in two forms:

(a) **Capital contribution:** In the initial stages of economic development of both closed and open economies, the maximum portion of income and factors is held by the agriculture sector. The shift or transfer of capital from agriculture to non-agriculture sectors can be possible in two ways: Voluntary and Compulsory. When an agriculturist at his or her own will invests their savings in industry-related projects, it is a voluntary transfer of capital to the non-agriculture sector. If, through taxation on agriculture, the government spend net proceeds on non-agriculture sectors, then it is a compulsory transfer of capital from agriculture to non-agriculture sectors. Imposing levies or arbitrarily keeping prices low can be another form of compulsory transfers, which are not always necessary. The voluntary investment is helpful as it reduces prices of agricultural produce, reduces the cost of production of manufactured products and increases profits, which indirectly generate capital in non-agriculture sectors. As per Nurkse, the zero value labour (also known as disguisedly unemployed whose contribution to agriculture is almost zero) in densely populated agriculture-based economies, can be utilised for some overhead capital like roads, canals etc, which indirectly help in the development of non-agriculture sectors.

(b) **Labour contribution:** Out of three potential sources of labour force- natural population growth, immigration and agricultural population/labour, the supply of labour from the first two sources is generally inadequate. Also, population growth is normally not encouraged beyond a certain level and immigration has technical and other problems of religion, language, lack of skill, etc. Thus, it is only the farm population that can be treated as the most reliable source of labour supply. In overpopulated countries, transfer of labour from agriculture to non-agriculture sectors can smoothly take place, but in thinly populated countries, where there is no disguised unemployed labour is available in farms, shifting of labour to non-agriculture sectors will also bring down the agricultural production. The country in the process of economic development will face problems due to a fall in agricultural production, which leads to a decline in the supply of raw material and an increase in demand for food grains because of an increase in income. Thus, in a thinly populated country, increasing agricultural labour productivity can help in transferring labour from agriculture to non-agriculture sectors. As per Kuznets, transferring labour to non-agriculture sectors in later stages of economic development, when the agriculture sector also uses capital-intensive techniques, means transferring more trained and skilled labour.

(ii) **Product contribution of agriculture:** Over time, as the economy moves further on the path of economic development, agriculture plays a pertinent role by product contribution in the following two ways:

(a) Contribution of foodgrains: Due to the shift to non-agricultural sectors, the agricultural population experiences an increase in income, which leads to an increase in demand for foodgrains. With this, due to an increase in the prices of farming production (because of an increase in demand), the income of the agricultural population also witnesses an increase, which further increases their consumption. With the development of non-agriculture sectors, their dependence on agriculture for labour, capital, raw material etc. may reduce, but for foodgrains, they always depend upon agriculture only.

(b) Contribution of raw material: Historically, the industrial development of advanced countries started with agriculture-based industries because of easier access to raw material and flexible techniques to be used in agriculture-based industries. In the initial stages, labour-intensive techniques can be used and later, as per availability, capital-intensive techniques can be used. The psychological cost of transfer of labour from farm to industry is also not high, as it is an agro-based industry and not a mineral-based based. The raw materials must be produced in the initial stage of industrial development by:

- bringing more area under cultivation or
- diverting land from food grains to raw material, or
- increasing the productivity of crops.

It is also important to produce more food grains over time due to an increase in demand because of an increased population and an increase in income over time. Thus, out of two options of increasing productivity or more area under cultivation any one can be followed to increase production of raw materials.

(iii) **Market contribution of agriculture**: During the development process, agriculture also contributes to creating markets at national and international levels in the following ways:

(a) Market for products of non-agriculture sectors: During the initial stages of industrial development, a growing agriculture sector also provides a market for the products of other non-agriculture sectors as the income of its own people increases over time. The increased income of the farming sector leads to an additional demand for products of other sectors for both consumption as well as production purposes. The

consumption purpose includes both durable and non-durable goods and the production purpose covers the machinery and equipment requirements to increase both agricultural production and productivity.

(b) Agricultural products for other sectors of the economy: With the development of agriculture, the demand for its products also increases, and due to this, the institutions related to marketing, processing, packaging, distribution, and other services also develop, in turn creating employment.

Thus, it is a two-way process; the developed agriculture sector provides a market for industrial products and the developed industrial sector provides agricultural inputs and consumer goods to the farming population.

(iv) Foreign Exchange contribution: The Agriculture sector also helps in earning foreign exchange by promoting exports of its surplus products. It can result in having necessary imports of capital and consumer goods from other countries. Here, it is a combination of factor and market contributions helping the non-agriculture sectors by providing capital indirectly.

3.4 CONTRIBUTION OF AGRICULTURE IN INDIA AND CHINA

In China, since 1984, agricultural GDP has recorded the annual growth of approximately 3 to 4 per cent, but over a much larger base because of technological change based on labour, along with the use of modern varieties and inputs such as chemical fertilisers and irrigation. The growth has been sustained by public investment in rural infrastructure and in research and technology development.

In China, agriculture accounted for more than 35 per cent of the GDP in 1970, which declined to 15 per cent in 2004. The level and pattern of food consumption changes due to increasing incomes and urbanization and the farming sector has diversified production to meet changing food demands. As a result of market and trade liberalization, a gradual shift was recorded to high-value labour-intensive commodities from land-intensive commodities such as horticultural crops, livestock, and fisheries. Trade policy and exchange rate reforms have given a further boost to agricultural production for export and the ratio of total exports to the GDP increased from 6 per cent in 1980 to 36 per cent in 2004.

India was dependent on imports and food aid to meet domestic requirements of food till the mid-sixties. Due to severe drought years of 1965 and 1966, India adopted significant policy reforms based on the green revolution, which focused on the production of cereal grains, and

simultaneously achieved the food grain self-sufficiency that has shaped Indian agricultural policy ever since (Gulati *et al.* 2005).

During India's Green Revolution phase, high-yielding varieties of wheat were imported. Initially increase in production was recorded in irrigated areas of the Punjab, Haryana, and western Uttar Pradesh. Due to an increase in total foodgrain production, India became self-sufficient during the initial years of the 1970s. Gulati *et al.* (2005) attribute this success to the price incentives provided to farmers, the dynamism of the national research system and the availability of credit and inputs such as improved seeds, canal irrigation and fertiliser. The success of this coordinated approach demonstrated that even in a country as diverse as India, the government can play an important role in setting the agriculture sector on a high-growth path.

In India, as in China, the agricultural economy is undergoing structural changes. Between 1970 and 2003, the GDP in agriculture declined to 22 from 43 per cent. During the early 1970s, the growth in agricultural GDP was approximately 3.6 per cent *per* annum and in this period also witnessed a decline in poverty. However, the greatest increase in productivity occurred in the 1970s and 1980s and the greatest decrease in poverty occurred in the 1980s and 1990s. The growth rate in agricultural GDP rose gradually from 3 to 4 per cent in the 1960s and 1970s, to 5 to 6 per cent in the 1980s, to 6 to 7 per cent following the financial reforms in 1991, but declined sharply in the late 1990s, to less than 2 per cent. (FAO, 2006)

Comparison of agricultural development in India and China

Indicator	**India**	**China**
1. Major reform time	Post 1965, but Gradual with irregular and unequal impact	Early and strong -post 1978
2. Agricultural Labour Transfer	Slow shift of labour to non-agricultural sectors	Rapid transfer of labour to industry
3. Technological changes	During the green revolution, with a positive impact on selected states	Extensive productivity reforms and deep structural changes

4. Role in economic development	Important for food security and poverty alleviation	Important for Broader economic transformation
5. Current challenges	Low agricultural productivity, low farm income and rural distress	Ageing farm population and increasing rural-urban inequalities.

3.5 SUMMARY

The agriculture sector plays a vital role in the economic development of a country, particularly for underdeveloped countries, not only by providing foodgrains but also manpower and foreign exchange for non-agricultural sectors. As per the Food and Agriculture Organisation (2006), the least developed countries having a large agricultural population must support agricultural growth and rural development to solve poverty and hunger-related problems, as it helps in rapid economic growth with a strong, sustainable basis. The studies in Asia show that agricultural growth in the early stages of development has a more direct and greater impact on poverty reduction. The strategy to address the problem of agriculture and rural development consists of (i) increasing agricultural productivity growth, diversification, and competitiveness, (ii) measures to address production and nutrition issues in remote regions with a high incidence of poverty. This requires research and development of suitable crops, infrastructure development and strengthening linkages with non-agricultural sectors.

3.6 GLOSSARY

- **Agriculture-based countries-** heavily dependent on agriculture, contributing 32% of GDP growth and having 70% of the rural poor.
- **Transforming Countries-** have reduced agriculture contribution to GDP growth (7%) but still have 82% of the poor in rural areas.
- **Urbanised Countries-**agriculture contributing only 5% to GDP growth, with 45% of the poor still living in rural areas.
- **High value agriculture-** production of agricultural commodities that generate higher returns, like fruits, vegetables, etc.
- **Structural Transformation-** means a change in the composition of an economy, generally from agriculture to manufacturing and then to services.

- **Agriculture diversification-** shifting from traditional agriculture to modern and dynamic agriculture by introducing new crops and sustainable agricultural practices to increase income and reduce risk.
- **Backwards and forward linkages-** backwards linkages of agriculture mean industries from where input is supplied for agricultural production and forward linkages of agriculture mean the industries which use agricultural output.
- **land-intensive commodities-** agricultural products which require a large amount of land for their production due to the involvement of large-scale of farming operations.
- **Real Purchasing Power**-After adjustment for inflation, it is the amount of goods and services that can be purchased with a unit of money.
- **Efficient Farmers Hypothesis-** Given by Schultz (1979), stated that farmers in traditional or subsistence agriculture are not inefficient as they are already making the best possible decisions given the constraints and resources available to them.

3.7 QUESTIONS FOR PRACTICE

A. Long Answers Questions

Q1. "The agriculture sector is an integral part of the rural economy." Explain.

Q2. Explain how the factor and market contributions of the agriculture sector help in the process of economic development?

Q3. "Agriculture sector plays a vital role in the economic development of a country, particularly for underdeveloped countries." Explain.

Q4. Explain how the factor and product contributions of the agriculture sector help in the process of economic development?

Q5. Explain the contribution of agriculture to economic development as given by S. Kuznets?

Q6. How agriculture sector provides manpower for non-agriculture sectors? Explain the case of developed and developing countries.

Q7. Discuss the contribution of agriculture to economic development given by Johnston and Mellor (1961).

Q8. How agriculture sector plays a significant role in the economic development of underdeveloped economies by supporting non-agricultural sectors?

Q9. Explain and compare the cases of India and China for the contribution of their agricultural sectors in economic development.

Q10. Explain the views of different economists on the role and contribution of the agriculture sector in economic development.

B. Short Answer Questions

Q1**.** Explain the term structural transformation.

Q2. What are the major reforms for agricultural development in India and China?

Q3. Give the situation of India as per the Global Hunger Index Report, 2024?

Q4. How is agriculture used for the development agenda in transforming and urbanised economies?

Q5. How does agricultural development help in earning foreign exchange and increasing income?

Q6. What are the forward and backwards linkages of agriculture?

Q7. What do you mean by the efficient farmer's hypothesis?

Q8. What is the induced innovation theory in agricultural development?

Q9. How agriculture sector helps in capital formation?

Q10. What are the current challenges faced by the agricultural sectors of India and China?

3.9 SUGGESTED READINGS

- Food and Agriculture Organisation of the United Nations (2006). Rapid Growth of Selected Asian Economies. Regional office of Asia and the Pacific (RAP) https://www.fao.org/4/ag087e/AG087E00.htm#Contents
- Johnston, B. F. and Mellor, J.W. (1961). The Role of Agriculture in Economic Development. The American Economic Review, 51(4). Retrieved from https://www.jstor.org/stable/1812786

- Meijerink, G. & Roza, P. (April 2007). The Role of Agriculture in Economic Development, Market, Chains and Sustainable Development Strategy & Policy Paper 4. Wageningen University and Research Centre. https://edepot.wur.nl/690
- Soni, R. N. and Malhotra, S. (2017). Leading Issues in Agricultural Economics. Vishal Publisher Co., Jalandhar.
- Todaro, M. P. and Smith, S.C. (2020). Economic Development (Thirteenth ed.). Pearson.
- World Development Report, (2008). Agriculture for Development. World Bank

MA (ECONOMICS)

SEMESTER III

ECONOMICS OF AGRICULTURE

UNIT-4: LAND REFORMS IN INDIA

STRUCTURE

4.0 OBJECTIVE

After reading this unit, learners will be able to know about:

- Land Tenure Systems in Pre Independence Period
- Land Reforms in India during Post Independence period
- Abolition of Intermediaries
- Tenancy Reforms
- Ceilings on agricultural holdings

- Consolidation of Land Holdings
- Cooperative Farming
- Reforms in the Current Phase

4.1 INTRODUCTION

As per Encyclopaedia Britannica "land reform, a purposive change in the way in which agricultural land is held or owned, the methods of cultivation that are employed, or the relation of agriculture to the rest of the economy. Reforms such as these may be proclaimed by a government, by interested groups, or by revolution. Land reform and agrarian reforms have become synonyms, indicating that reform programs have become more comprehensive and encompass much more than the reform of land tenure or land distribution."

Broadly speaking, land reforms include:1) Regulations related to ownership of land, 2) ceiling of land holdings and redistribution of land, 3) Regulation of conditions under which the land is cultivated by farmers, and 4) Tenancy reforms.

4.2 LAND TENURE SYSTEMS IN PRE-INDEPENDENCE PERIOD

Historical background of efforts for systematic land management in India mainly started with Akbar's regime implemented by Todar Mal which mainly introduced measurement, classification, and fixation of rent as its main components. 'Todar Mal's implemented ryotwari system of collecting from individual cultivators, and payment in cash. However, the old system of dividing the crop was retained by Akbar in Kashmir and Sind. The two main features of Akbar's system were not present in its successors' system- a) payment of official salaries in cash and b) collection of land revenue as far as possible from individual cultivators. Thus, land suffered as the agricultural population was left at the mercy of various types of assignees and middlemen. Under the various pre-British regimes, land revenues collected by the state confirmed its right to land produce, and that it was the sole owner of the land. Britishers also follow the same system and allowed the existence of non-cultivating intermediaries. These rent-seeking intermediaries worked as an economic instrument to extract high rents and maintain political hold on the country. Thus, at the time of independence Indian land tenure system rotten by no cultivating intermediaries, existence of different land revenue and ownership systems across regions, a large share of the land held by small numbers of land holders, higher numbers of tenant cultivators and having insecure tenancy, and exploitative production relations (Appu, 1996).

During pre-independence period, there were mainly the following three type of land tenure systems existing in the India:

Zamindari System: In 1793, Lord Cornwallis had done permanent settlement with the landlords to increase revenue of East India Company. Under the permanent settlement system landlords are known as zamindars who were declared as the full proprietors of large areas of land. Zamindars had to collect rent from farmers for state and the share of rent was going as remuneration to the zamindars. Thus, the zamindars were to act as intermediaries between cultivators and the state. As per P.S.Appu (1996), "the essence of the Zamindari system was the existence of one or more layers of proprietary rights between the State and the actual holder of the land". At the time of independence, zamindari system was followed by the states of Bihar, Odisha, Uttar Pradesh, West Bengal, Andhra Pradesh, and Madhya Pradesh. The zamindari system had having number of problems:

1) The zamindars had the right to share the produce of agricultural land with personal participation in the process of cultivation.

2) Zamindars had unlimited rights to extract as much rent as possible, which was nothing but exploitation.

3)The portion of produce taken away by intermediaries in the form of rent was very high and the actual cultivator was left with no surplus to invest in seeds, fertilizer etc, which also means no incentive to increase production and productivity.

4) The records of rights in land were not maintained in most of the areas under zamindari, due to which selling or mortgaging land was difficult. This is the reason for the slow development of credit institutions and low public investment in these areas.

Mahalwari System: This system was introduced by William Bentinck in 1833 in Agra and Oudh, which was later extended to Madhya Pradesh and Punjab**.** The whole village was treated as one revenue unit known as "mahal", and the responsibility of collecting and depositing the land revenue was of village headman. The ownership of land was collective and it was something like collective proprietary rights i.e., the land remains under the ownership of community or village and the rent was revised periodically.

Ryotwari System: This system was introduced by Thomas Munro in 1820s in Tamil Nadu, later extended Maharashtra, East Punjab, Assam etc. There was no intermediary and land revenue were collected directly from cultivator (or individual ryot). The ryot could not be evicted from land if rent is paid and ryot had full rights of sale, transfer, and leasing of land.

The zamindari system did not have such rights. Under the ryotwari system, settlement of land revenue was temporarily ranging between 20 to 40 years for different states.

Of all three land tenure systems discussed above, the Ryotwari system holds merits, but due to loans from moneylenders, a substantial portion of land gets transferred from cultivators to moneylenders, who then start giving for cultivation on lease. This created another type of zamindars, who exploited cultivators by giving them loans on their lands.

4.3 LAND REFORMS IN INDIA DURING POST-INDEPENDENCE PERIOD

At the time of Independence, the major challenge for India was to improve agrarian structure. Thorner and Thorner (1961), in an analysis of the agrarian structure of India, vividly describe the pre-Independence structure as a complex of legal, economic, and social relations - a multilayered structure that pulled down the production efficiency in the agricultural sector. As per Deshpande (2003), "the Constitution of India provided under Article 39 that: (1) the ownership and control of the material resources of the country should be so distributed as best to serve the common good; and (2) the operation of the economic system should not result in a concentration of wealth or a means to production to the common detriment. The Constitution of India also made land a state (provincial) subject. So, only state (provincial) legislatures have the power to enact and implement land-reform laws. However, the central government played a significant advisory and financial role in land policy based on its constitutional role in social and economic planning (a role held concurrently with the states). The Government of India established a National Planning Commission immediately after Independence to fulfil this role of social and economic planning." After independence, a committee chaired by J.C.Kumarappa (known as the Kumarappa committee) was formed for rural economy and agriculture, which also investigated the problem of land. This committee recommended comprehensive agrarian reforms related to elimination of intermediaries and equitable distribution of land. The land reforms in India were initiated to deal with the issues of land ownership and social injustice. The main objectives of land reforms in India are:

1. To remove exploitative zamindari system inherited from past to increase agricultural production.
2. To ensure social justice to tiller of land by providing security and assuring equality and opportunity to all sections of the rural population.

The other objectives include increasing agricultural productivity, alleviating poverty, social justice and creating more equitable society.

To achieve the above objectives, the measures in the form of land reforms undertaken are:

1) Abolition of intermediaries,

2) Tenancy Reforms, which include regulation of rent, security of tenure and ownership rights of tenants and

3) Reorganisation of agriculture, consisting of redistribution of land through ceiling and consolidation of holdings and cooperative farming.

4.3.1 ABOLITION OF INTERMEDIARIES

The zamindari system was the main reason for stagnation of Indian agriculture during the pre-independence period. During the early years of independence, the focus of land reforms was to remove intermediaries who did not cultivate the land themselves and just collect rent from the cultivators to exploit them, which also created the class of absentee landlords. At the time of independence, the maximum area of land (i.e., 57%) was under the zamindari system. As per Appu (1996) "The incidence of the Zamindari system, however, varied greatly between states. While its incidence was very high in the North and the East, it was only 27 per cent in the Madras Presidency and 7 per cent in the Bombay Presidency. Intermediary interests existed to a greater or lesser extent in the Princely States as well."

During the First Five-Year plan, enactment of laws and acquisition of areas related to work was carried out. In temporary settlement areas, like Uttar Pradesh and Madhya Pradesh, due to the availability of the land records and administrative machinery, the work was not that difficult as in the permanent settlement areas, such as Bihar, Orissa and West Bengal and areas under jagirdari settlement, where land records and administrative machinery had to maintained from scratch. In all, 173 million acres of land was acquired from intermediaries and about two crore tenants were coming directly in relationship with state.

As discussed earlier that most of the states enacted the zamindari abolition act by the end of First Five Year Plan, but the stage of implementation faced difficulties as zamindars were not ready to lay down their rights and moved to court. This legal battle took a long time but ultimately when zamindars lost the battle, they tried to delay it further by refusing to give land records and other documents. Zamindars identified the loop holes of the legislation and resumed to the permission to obtain land for personal cultivation (according to which zamindars could assume land for personal cultivation up to ceiling limit and tenants could get rights in land above the ceiling limit). Thus, previous zamindars have acquired large areas for personal cultivation, on which for cultivation they hired agricultural labour. In the case of

Rajasthan, Thorner concluded that "Jagirdari had to be abolished because the Jagirdars were "intermediaries". But the Jagirdars had to live, so they were enabled to acquire Khud-Kasht lands and thereby to become cultivators. Now, as owner of Khud-Kasht lands, they are to be permitted to have their lands cultivated by tenants, i.e, to become once again intermediaries. Thus, the full circle has been completed; Rajasthan is back where it started."

Thus, the official documents claim that zamindari has been abolished, but zamindars are now big landholders and have formed a new class of dominant rural capitalists.

4.3.2 TENANCY REFORMS

Tenants can be classified into three types:

(i) Occupancy tenants- having permanent rights like an owner and cannot be evicted if they are paying rent on time.
(ii) Tenants at will and
(iii) Subtenants, both depend on the mercy of the landlord and get exploited.

As per the eighth round of National Sample Survey in 1953-54, about 20 percent of agricultural land was under the tenancy system. According to K.N. Raj, approximately 50 per cent of agricultural land in India was under one or the other form of tenancy in pre green revolution period. As per Deshpande (2003), "Tenancy is completely prohibited in some states but completely free in others. Punjab and Haryana have not prohibited tenancy, whereas Karnataka has a near-complete ban on tenancy. Some states have conferred ownership rights on tenant cultivators except for sharecroppers, whereas West Bengal chose to provide owner-like rights only to the sharecroppers. Some states, such as Maharashtra and Odisha, chose to provide different tenancy reform regimes for different areas within the state. Many states allowed tenancy only for certain limited groups of people, often broadly termed "disabled" (referring to physical disability). Orissa law considers a landowner owning less than 3 acres of land as a disabled person. In Rajasthan, a student pursuing studies in an educational institution and less than 25 years old is also a disabled person. In Uttar Pradesh, such a student is included if his father is dead. In Uttar Pradesh, all minors, women and unmarried daughters are not treated as disabled, unless their husband or father is dead. In Bihar, a public servant whose salary is below the given norm is treated as disabled."

The tenancy reforms cover following three measures:

(i) Regulation of Rent- In pre independence period exorbitant rent charged by zamindars and they had powers to suppress tenants to squeeze maximum rent. Thus after independence,

to reduce the burden on tenants and to regulate limits of rent legislations were enacted. The national policy recommended that fair rent payable by tenant through mutual agreement, should be limited to 20 - 25 percent of the produce. Individual states recalculated for their legislations, by using land revenue or gross value of produce as a basis. Most states using the gross value of produce to set the maximum rent levels in the range of 25 - 33 percent. Therefore, the variations in the tenancy contracts across states and related contracts over the decades are expected changes. As per First Five-Year Plan, the maximum rent is fixed at one-fourth and one-fifth of total produce, which is observed by all states except Punjab, Haryana, Jammu and Kashmir, Tamil Nadu and some areas of Andhra Pradesh. In Punjab and Haryana, fair rent is fixed at one-third of total produce. In Tamil Nadu, it is 40 % of gross produce of irrigated areas, 35% for land where lift irrigation existed and 33.33% in other cases. In J&K, for land owners having land less than 12.5 acres, one-half of the total produce was fixed as fair rent and for land owners having more than 12.5 acres, rent was fixed at one-fourth of total produce for wet lands and one-third for dry lands. In Andhra Pradesh, fair rent was 30 per cent of the total produce for irrigated land and 25 per cent for dry land. However, due to a strong socio-economic and political background, landowners have still been able to extract more rent than fixed by legislation. This is partly because sharecroppers are not aware of their legal rights and partly because of their weak economic and social position.

(ii) Security of Tenure- This includes (a) the protection of tenants from unnecessary expulsion except in accordance with law provisions, (b) Resumption of land by landowner for personal cultivation only and (c) in case of resumption, assurance to the tenant for the prescribed minimum area. The following are some of the important points regarding the security of tenure in different states of India:

a) In some states like UP and West Bengal, the sharecroppers are not regarded as tenants so no tenancy law protecting them.
b) The limited right of land resumption by the landowner for personal cultivation was not granted in UP and West Bengal.
c) In some states, land resumption was permitted up to ceiling limit while other states permission was below ceiling limit.
d) Laws were passed in several states related to leaving certain minimum area for tenant if landlord assumes land for personal cultivation.

The major problem was that any landlord could reject any tenant on the plea of personal cultivation, so in Fourth Five Year Plan, it was recommended that all tenancies should be

declared non resumable and permanent (except landholders serving in defence or disabled) and penalty should be imposed on wrong evictions. Another problem was related to voluntary give up by tenant under the threats and pressure created by landlord. The fourth Five Year Plan also took note on this and made policy in a way where all surrenders should be in favour of government only and landowners are prohibited from taking possession of surrendered lands. This provision was enacted in few states only (i.e., West Bengal, Karnataka, HP, Gujarat, Kerala and Odissa). The availability of correct and up to date land records are required to implement laws related to security of tenure. In some states, there is no provision of annual revision of land records and up dated only after long time. In states where annual revision of records is done, tenants do not try to get their names recorded because of fear of eviction.

(iii) Ownership Rights for Tenants- In plan documents, ownership rights are explained as giving ownership of land to its tenant cultivator. Some states passed this law as it is, some states did not adopt this as legislation and in other states, laws fall short of expectations. The states of West Bengal, Karnataka and Kerala have achieved success as compared to other states. As a result, approximately 12.42 million tenants have acquired ownership rights over 6.32 million hectares of land. Over a long time, many tenants did not want to purchase land they were cultivating because (a) tenants could not afford to pay the purchase price and (b) tenants were unwilling to purchase land, which also reflecting the dominant controlling power of landlords.

4.3.3 CEILINGS ON AGRICULTURAL HOLDINGS

As per Deshpande (2003) "Land distribution at the time of Independence was extremely skewed. Fifty-three per cent of the land was held by 7 per cent of the landowners, whereas 28 per cent of landowners with submarginal and marginal holdings owned about 6 percent". The three reasons for ceiling on agricultural land are-

a. Strong evidence of inverse relationship between size and productivity of land, indicating that aggregate production efficiency of land is hindered, when land is held in large holdings.
b. Evidence that large holders of land left large area uncultivated promoting uneconomic land use.
c. Large proportion of the population wanted land as an economic resource for their livelihood.

The argument in favour of land ceilings was based largely on spreading social justice and equity and not on increasing production and developing agriculture.

Legislation related to the ceiling on land was enacted in two phases:

Phase I- 1955 to 1972

The second Five-Year Plan proposed:

(a) Ceilings should apply to all future acquisitions of land and existing agricultural land under personal cultivation.
(b) The ceiling should be fixed at about three family holdings.
(c) Exemptions should be given to tea, coffee, rubber plantations, orchards, specialised farms engaged in cattle breeding, dairying, wool raising etc, sugarcane farms operated by sugar factories and efficiently managed farms with heavy investment in permanent structural improvements.
(d) States asked to lay down their own policy regarding compensation to owners and price recovery from persons to whom allotments are made.
(e) In case of distribution of land, priority should be given to tenants displaced due to resumption of land for personal cultivation, landless workers, and farmers with uneconomic land holdings.
(f) Transfer of land which have already taken place should be reviewed, and for ceiling the transferred land should be added to the land retained by the landlord.

The guidelines given by the second five-year plan followed by the subsequent plans. The guidelines are not applied uniformly in the law formulation but laws related to ceiling on land holdings passed in almost all states except Nagaland, Meghalaya, Arunachal Pradesh and Mizoram, where land is held by community.

Phase II-1972 onwards

"Among the major loopholes in the ceiling acts during phase I, of various states included an ambiguity in various definitions, retrospective transfers, large numbers of exemptions, and the basis of fixing ceiling limits. High ceiling limits exempted many landlords" (Deshpande, 2003). In July 1972, to bring uniformity in policies of ceilings on land holdings of different states, a new policy on land ceiling was announced, which was enacted by all states except Goa and north eastern states. This new policy includes a) lowering of ceilings, b) change in unit of application in fixation of ceiling levels, c) reduced exemptions, d) retrospectively declaring benami transactions null and void etc.

According to 12th Five Year Plan, only around 3 million hectares of land has been declared surplus so far (just around 2% of net sown area in India). Also 30 5 of this land is not yet been distributed due to litigations on it. Many landless households allotted unproductive, inferior, barren and wasteland and in the absence of resources to make it productive, they have to sell it off. In many cases, land allotted to rural poor was not in their possession. The major argument against ceiling of land holdings is affecting the economic efficiency of the farms adversely and decline in production due to the breaking up of large land holdings into small holdings. In India around 86 per cent of the operational holdings are small and marginal, i.e., holdings of less than 2 hectares. The fragmentation of large land into small and marginal land holdings is the reason of wastage of land, low productivity, disguised unemployment, land disputes, land mismanagement and lack of technological development.

4.3.4 CONSOLIDATION OF LAND HOLDINGS

The laws of inheritance, population pressure, declining joint family system, psychological attachment to land, indebtedness of farmers and the practice of crop sharing are the causes of fragmentation of holdings. To solve the problem of fragmentation of holdings, the method of consolidation of holdings was introduced, under which one consolidated holding is granted to a farmer having small holdings at different places. Initially consolidation programme was voluntary, but it was compulsory; still, progress under this is not satisfactory. Most of the states stopped the consolidation process, but the bulk of land was consolidated in Punjab, Haryana, UP, Bihar and Odisha. The laws related to the prevention of subdivision and fragmentation of land beyond a certain minimum limit have been passed in most states.

The progress of the programme is not satisfactory because of the following reasons:

a) It is very difficult to allot land of the same productivity to a farmer as held by him previously, so it is important to devise some valuation method (market value or rental value) to allot different types of land to different farmers on a comparable basis.
b) Sometimes emotional attachment of the farmer makes the task difficult for the consolidation officer.
c) As many state governments are busy with land reforms of abolition of intermediaries, tenancy reforms, etc., so postponed the consolidation task.
d) Unavailability of up-to-date land records is another problem, which is reason of disputes for ownership of land.
e) Implementation also delayed because of unavailability of trained staff.

The major problem of consolidation of holdings includes that influential people manage to get fertile land and poor people get inferior land. Also, effective steps were not taken up to ensure security of tenants, which results in large ejectment of tenants.

4.3.5 COOPERATIVE FARMING

To solve the problem of subdivision and fragmentation, cooperative farming was suggested. The farmers, having very small holdings, join hands and pool their lands for cultivation. The holdings of less than 2 hectares can be sufficient for subsistence farming only and are also not profitable. To earn the profits of large-scale farming, pooling of resources and land to cultivate jointly can help small and marginal farmers.

The main advantages of cooperative farming are:

a) The agricultural inputs like fertilizers, seeds, and equipment are purchased in bulk jointly, which also reduces cost.
b) Big agricultural machinery like tractors can be purchased collectively and used easily on large lands.
c) The benefits of new agricultural practices and technological innovations can be extracted fully.
d) The labour and other resources of the farmers remain underutilised on small-sized holdings, but on pooled large land holdings, all such resources can be utilised in the best possible way.
e) The marketable food grain surplus and industrial raw material can be obtained easily and in large quantities from large land holdings.
f) The large cooperative farms provide agricultural data more accurately with a higher level of reliability and authenticity.
g) Cooperative farming increases confidence, collective efforts, and joint thinking among members of society.

The first three five-year plans encouraged cooperative farming and offered many financial and technical incentives along with a preference of the supply of agricultural inputs. The progress was very slow and unsatisfactory and the fourth five-year plan admitted the failure of cooperative farming. It mentioned that there were problems of motivation and organisation, and lack of a large group of opinion within the country. The survey of 22 cooperative societies by the planning commission and the examination of 34 working cooperative societies by the Nijalingappa committee, also indicated that most of the societies were not formed by small

farmers but by large farmers to receive certain benefits from the government. The management of cooperative societies lacked the professional skill and willingness to do the work effectively.

The 12th five-year plan working group on disadvantaged farmers, including women recommended loan-cum-grant scheme with 50 percent as low interest loan and 50% percent as grant to help landless farmers to purchase land collectively.

4.3.6 REFORMS IN CURRENT PHASE

"Independent departments at federal and state government levels handle land and agricultural administration. In one way, this helps to monitor land outside agricultural use separately from agricultural land, but the lack of integration creates uneasy administrative regimes. Moreover, there are several different departments responsible for various aspects of land administration, land data, and land legislation. Unfortunately, these do not work with perfect coordination, which gives rise to various problems. The spread of administrative regimes makes land-policy decision-making and implementation difficult. In recent years, the government's land policy has specifically focused on the correction and computerisation of land records, improving the process of land survey, and improving land quality through the reclamation of degraded wasteland and forests. Now, Land reform implementation is not a major concern, but discussions on whether certain land reform interventions should be reversed, particularly whether the land ceilings should be increased and whether tenancy restrictions should be liberalised, are taking place as an urgent need. Another important concern is marginalisation of land holdings and land administration." (Deshpande, 2003)

In 2016, the Government launched the Digital India Land Records Modernisation Programme (DILRMP) as a central sector scheme, which was extended to 2023-24 to complete the target of computerisation of land records. It helps states to develop an Integrated Land Information Management System (ILIMS) across the country. This provides real-time land ownership records, free accessibility to records, single window service, certificates based on land data, etc. to the citizens of India.

4.4 LAND REFORMS IN INDIA-AN EVALUATION

1. Complications in Legislation-
   a) the definition of 'personal cultivation' was highly unsatisfactory.
   b) Limits for retention of land for personal cultivation allowed zamindars to resume large areas, and it encouraged absentee landlords.

c) Zamindars were involved in large-scale transfer of land to family members to escape land ceiling laws.

d) laws of tenancy reform were not protecting sharecroppers' rights.

e) Tenants were forced by landlords for voluntary surrender of land.

f) Inadequate ceiling limits as different states were having different limits.

2. Lack of political will- The Report of the Task Force on Agrarian Relations highlighted the gaps between policy and legislation and between law and its implementation. The governments were not interested in the implementation of land reforms and were merely trying to give land reforms a progressive and socialistic look. At the same time, continuing to function under the pressures of large farmers.
3. Indifferent behaviour of bureaucracy- The administrators who wanted to implement land reforms seriously were immediately transferred, which also demoralised the willing administrators.

Thus, the strong network between the politicians, administrators and large land owners dominates the state governments and worked as a strong impediment in the implementation of land reforms.

4.5 SUMMARY

Before independence, zamindari, mahalwari and ryotwari agricultural land systems were existed. Land reforms were introduced in India after independence to achieve social justice and equal distribution of land. The first laws related to the abolition of intermediaries were enacted to establish direct contact between the state and the land tiller. Secondly, tenancy reforms were introduced for the security of tenure, regulation of rent and ownership rights of land. Thirdly, a ceiling on land holdings reform was introduced to give surplus land to landless persons and following this, consolidation of land holdings-related reforms was initiated to solve the problem of small and marginal holdings. The cooperative farming was introduced to pool the small holdings and resources of small farmers to get the benefits of large holdings. Recently, the government has been working on the computerisation of land records along with web-enabled anytime-anywhere access services for Indian citizens. The complications in legislation, problems in land records and lack of political will are the major issues faced by the working and implementation of land reforms in India. In the present India, land reforms should be given priority to solve the issues of low agricultural productivity and income and make it profitable for future generations.

4.6 GLOSSARY

- **Land Reforms-** As per Encyclopaedia Britannica "land reform, a purposive change in the way in which agricultural land is held or owned, the methods of cultivation that are employed, or the relation of agriculture to the rest of the economy.
- **Mahal-** The whole village is treated as one revenue unit known as "mahal" under mahal wari system.
- **Ryot-** farmer or Cultivator of soil.
- **Permanent Settlement System**-Introduced by Britishers to collect land revenue where zamindars are given land ownership in exchange of fixed tax payment to britishers.
- **Occupancy tenants**- having permanent rights like owner and cannot be evicted if they are paying rent on time.
- **Ceiling on land holding**- means the statutory absolute limit on the amount of land which an individual may hold.
- **Consolidation of land holding**- granting one land area to a farmer equal to the total of land under his possession in different scattered areas/plots.
- **Cooperative farming**- pooling of land and resources by small farmers for cultivation and getting benefits of large agricultural land.

4.7 QUESTIONS FOR PRACTICE

A. Short Answer Questions

Q1. Define the zamindari system.

Q2. Differentiate between the Mahalwari and Ryotwari systems.

Q3. What is personal cultivation?

Q4. Define Cooperative farming.

Q5. Give the reasons in favour of ceilings on agricultural land holdings.

Q6. What is the consolidation of land holdings?

Q7. Discuss the concern of the current land policy of India.

Q8. Explain the three types of Tenants.

Q9. Give the features of the new policy on land ceiling introduced in 1972?

Q10. Give the objective of land reform based on the abolition of zamindaris.

B. Long Answer Questions

Q1. Explain the need of land reforms in India? Evaluate the land reforms in India.

Q2. Explain the zamindari system that existed during pre-reform period and explain the related land reform taken place in India?

Q3. Discuss the land reforms of ceiling and consolidation of land holdings in India?

Q4. Explain in detail the tenancy reforms of India? What are the major flaws of these reforms?

Q5. Explain the different land tenure systems existed in pre reform India? Also explain with reasons, which one was considered as best?

Q6. Explain the land reforms implemented in India during the post-independence period?

Q7. Explain the main objectives of land reforms and give the details of the consolidation of land holdings and cooperative farming land reforms.

Q8. Discuss the major flaws of the regulation of rent and security of tenure related to tenancy reforms. Suggest some ways to strengthen the tenancy reforms?

Q9. In your opinion, what are the major drawbacks of different land reforms introduced in India during the post-independence period?

Q10. What do you mean by fragmented holdings? Why are small and marginal holdings are considered as uneconomic holdings? Explain the land reform that helped to solve the problem of fragmentation and uneconomic holdings.

4.9 SUGGESTED READINGS

- Deshpande, R.S. (2003). Current Land Policy Issues in India. *Land Reform, 2003/3, Special Edition*. Food and Agriculture Organisation. https://www.fao.org/4/y5026e/y5026e0b.htm#bm11
- Thorner, D. & Thorner, A. 1961. *Land and labour in India*. New Delhi, Asia Publishing House.
- Puri, V.K., Misra, S.K., and Garg, B. (2024). *Indian Economy* (42 ed.). Himalaya Publishing House.

MASTER OF ARTS (ECONOMICS)

SEMESTER-III

ECONOMICS OF AGRICULTURE

UNIT 5: AGRICULTURAL PRODUCTION

STRUCTURE

5.0 OBJECTIVES

After studying this unit, the learner will be known about:

- To understand the condition that gives the optimum use of capital, labour, land and management of resources in the production of crops and allied activities.
- To assist the firm to improving farm management and understanding how we can make maximum profit.

- To analysis the effects of technical and institutional changes on agricultural production and agriculture resource.
- To evaluate the forces which decide the existing production pattern and production resource uses.
- To analyse Factor relationship
- To analyse Product -Factor relationship
- To analyse product-product relationship
- To explain the uniqueness of agricultural production.
- To provide insights and recommendations to farmers and policymakers
- To identify new opportunities for optimising agricultural production.

With the help of these objectives, the study contributes to the understanding of agricultural production relationships.

5.1 INTRODUCTION

Agricultural production refers to the process of cultivating and managing crops, livestock and other agricultural products. The motive of agricultural production is to meet the food and fibre needs of humans and animals. It is one of the most important sectors of the economy that contributes significantly to the GDP of the economy, food security and sustainable development of the nation**.** Growth in agricultural production is necessary for the overall development of the agricultural sector. Agriculture production in economics examines the production relationship and principles of rational decision making to optimise the use of farm resources for individual farmer as well as from the point of view of the entire economy. In production theory, we consider the main choice upon what to produce (i.e. which product or combination of products); how much to produce (the level of output) and how to produce (the combination of inputs to use). Agriculture production in economics involves the study of factor-product, factor-factor and product-product relationship, the size of the farm, return to scale, credit and risk and uncertainty etc.

5.2 THE PRODUCTION FUNCTION

Production is a process in which goods and services, called inputs, are transformed into other goods and services called outputs. For example, producing a tone of rice requires some inputs as land, climate conditions, seed, fertilizer, the service of equipment and human labour. Simply,

we can say that an input or a set of inputs can produce only one unique amount of output. This unique relationship between input and output is called the production function. Production function is purely a physical relationship that looks into the maximum output in physical terms of every combination of specified inputs in physical terms.

Production function may be written in three forms.

A. A table of physical quantities of output and input-

In this production function, we draw a form of an arithmetic table where the first column shows one unit of input and the second column shows total output of the product.

Table No. 1: A Production Function

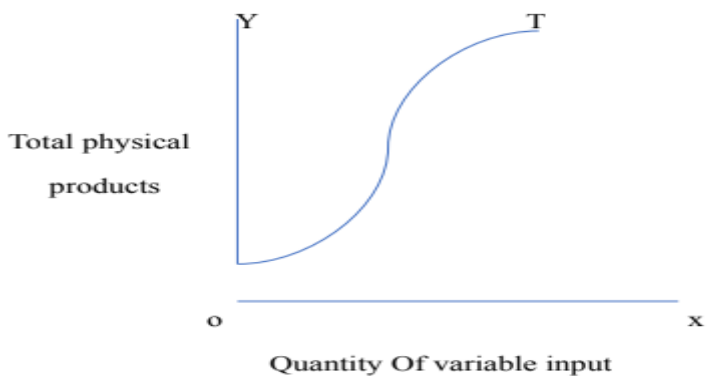
Unit of fertilizer used	Total corn yield (bushels)
0	20
1	32
2	41
3	48
4	52

Table 1: Example of a tabular production function showing the unit of fertilizer used and the resulting total corn yield. Total corn yield is increasing (column 2) or more units of fertilizer are applied.

B. An input-output curve:

In this production function, we draw a simple graph in fig.1. Inputs are measured along the horizontal axis, and total output on the vertical axis.

The point on the curve OT indicates different quantities of output associated with particular levels of the input used.




```
```

C. An algebraic equation

In this production function, production can be shown as an algebraic equation in which output is a dependent variable and input is an independent variable. It can be written as:

$$Y = f(x)$$

Where (Y) represent the output, (x) the input and (f) means "is a function of" or 'depends on'. Here, it is assumed that output depends on a single factor, but it must be understood that in actual life, agricultural output is never a function of a single factor. It depends upon a variety of functions like seed, amount of fertilizer used, irrigation, nature of soil and so on. This can be written as…

$$Y = f(X_1, X_2, X_3 \text{----------} X_n) + u$$

This function shows that output depends upon all factors required by X_1, X_2, etc. and on the level of unknown or uncontrollable factors represented by u.

The technical aspects of production are discussed in terms of:

1. Factor-product relationship
2. Factor-factor relationship
3. Product-product relationship

5.3 THE FACTOR-PRODUCT RELATIONSHIP – (HOW MUCH TO PRODUCE)

Now we will explain how we can use this production functions and its three regions of production to decide how much a farmer should produce if they want to maximize his profit. In others words we will try to understand the situation which operating factor-product relationship. The factor-product relation can be written as.

$$Y = f(X_1, X_2 \text{--------} X_n)$$

Where Y output (e.g. rice), X_2------X_n is a fixed factor and X_1 is the only variable factor. This relationship can be shown by the graph as using the total physical product in fig. 2.

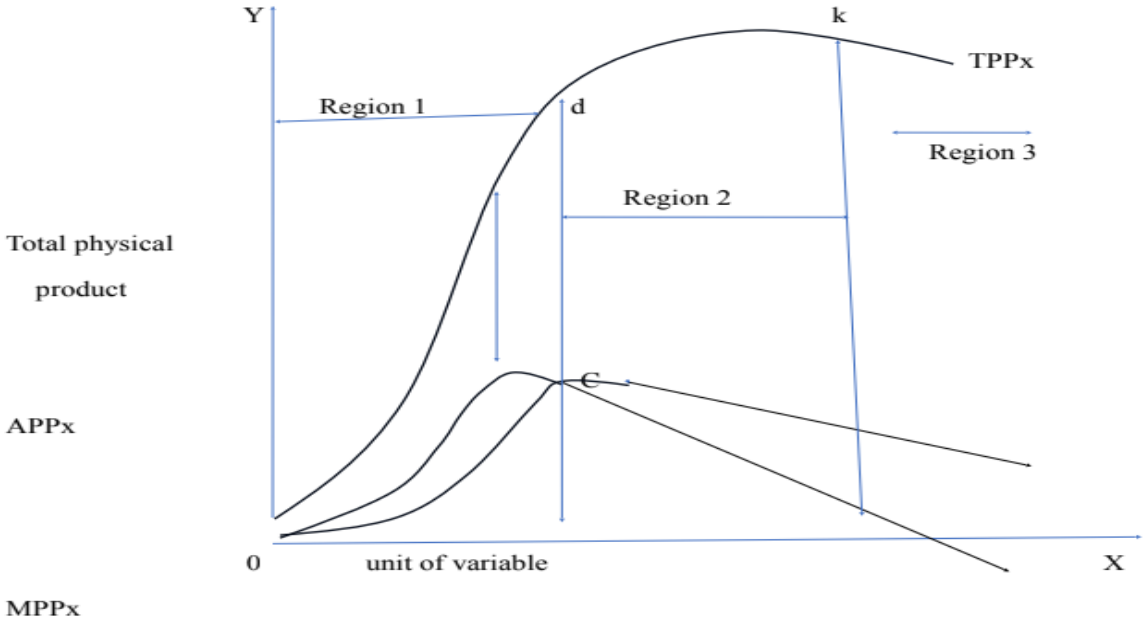
Total physical product (TPP) is the quantity of the output (e.g. rice) X_1 is the quantity of input (e.g. fertilizer) used in the production of Y.

Marginal physical product (MPP) is described as a change in output following a small change in the quantity of the variable input indicated per unit of input. The symbol Δ is used to denote change.

$MPPx_1 = \Delta y \, \Delta x =$ Incremental change in output / Incremental change in input

As $\Delta X_1 > 0$, $\Delta y > 0$ slope (dy / dx)

Average physical product (APP) is defined total product divided by the amounts of variable inputs. $APPx_1 = Y/X_1$ = slope of line from the origin to any point on the TPP curve.



Three regions of products in the production functions:

Figure.2 if more fertilizer (X_1) is applied then (rice) output also increases and reaches at maximum point denoted by K. After that if apply more quantity of fertilizer then total productivity is reduced. In the diagram when the slope of TPP is greatest then MP is maximum. This is a point of inflection. When the slope of the TPP curve is horizontal, at point K, then MPP is zero at that point. After that TPP are negative and MPP are also negative.

Three regions of production function:

The TPP, MPP and APP curve are commonly divided three regions of production functions. Behavior of these curve in each region are summarized below

	Region 1	Region 2	Region 3
TPP	TPP increases at an increasing rate and then at a decreasing rate	TPP continues to increase at a decreasing rate until it reaches a maximum	TPP begins to decrease and continues decreasing

MPP	MPP also increases to a maximum, then begins to decrease	MPP continues to decrease until it reaches zero at the end of region 2	MPP is negative
APP	APP is increasing and reaches a maximum at the end of region1	APP is decreasing and continues to diminish	APP continues to decrease

The optimal region of production function:

Now we explain nature of each region of production outlining the most efficient resources allocation region.

- Region 1- APP is increasing and MPP>APP, if value of APP at given price is greater than the price of a unit of input. It will advise the producer to continue use more or more unit of input as long as APP, per unit of output increasing.
- Region 3- in the third region of production function, the total production is decreasing and MPP also negative. So this region is also a region of irrational production and farmer suffer double loss.
- Region 2- from the above discussion, we can say that region 2 is only the region of rational resource used. Here total outputs are increasing and MPP are decreasing but remains positives and loss the APP. This is region producer will operate maximum profit. Boundaries of this region are economic relevance.

5.4 THE FACTOR-FACTOR RELATIONSHIPS: (HOW TO PRODUCE)

Now we shall be discussing the condition regarding factor-factor relationship. Which guide a farmer in deciding about the combination of various inputs that are essential for producing a particular amount of a crop at the given prices of various input. We know about the minimum cost combination of two inputs necessary for producing a given amount of output. In this case, we are examining the relationship between output and the set of variable inputs and how can be one variable factor one substituted for another.

Assuming two variable inputs, the production function is written as;

$$Y = f(Z_1 Z_2 / Z_3 \text{------} Z_n)$$

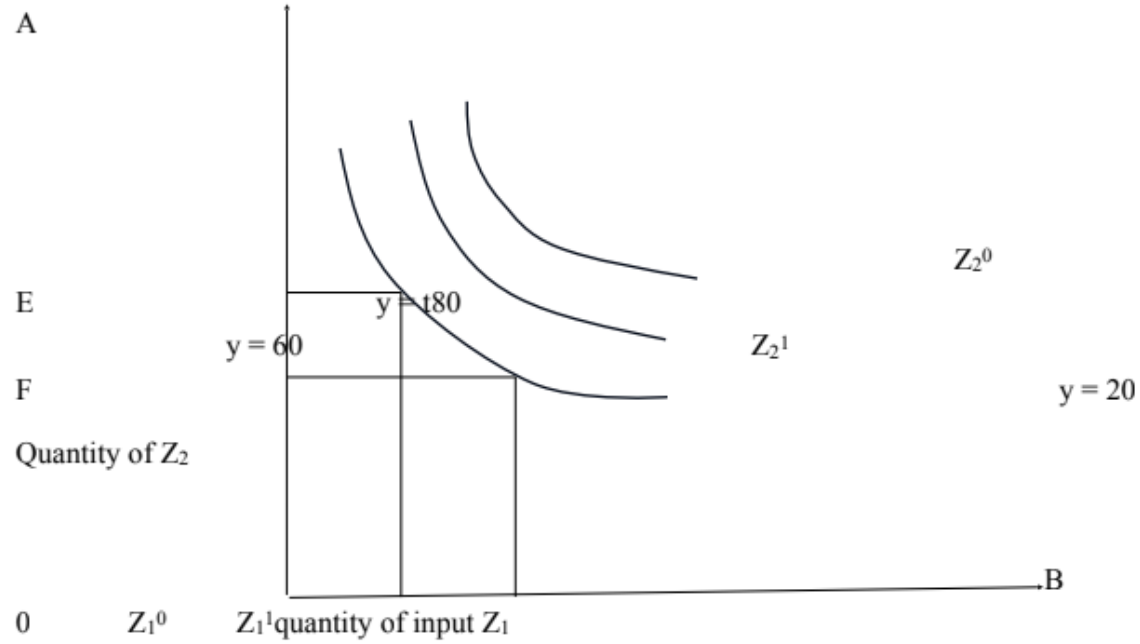
Where Z, Z_2 two variables input and after vertical line all factor are fixed.

This relationship can be easily illustrated by an Iso-quant map that shows in the fig. 3. An Isoquant curve is a line of different combinations of the tow inputs which gives the same level

of output. For example;

Diagram show 20qtls, 60qtls, 80qtls rice, using Iso-quant.

Difference of two inputs namely E and F



In moving from E to F the amount of Z_1 is increase from Z_1^0 to Z_1^1 and that of Z_2 is reduced from Z_2^0 to Z_2^1.Z_1 substitutes for Z_2 along the Iso-quant. (The rate of which one input substitutes for another at any point on the Iso-quant is called the marginal rate substitution (MRS) and it is given by the slope of the Iso-quant). It can be an Isoquant which is convex to the origin show the various combination of two input resulting in the production of the constant (same) output following a declining rate of technical substitution. It may be written as;

MRS of Z_1 for $Z_2 = \Delta Z_2 / \Delta Z_1$

Therefore, MRS of Z_1 for $Z_2 = dZ_2 / dZ_1$ (i.e. slope of Isoquant) it is clear from the above analysis that for any Iso-quant. The value of the marginal rate of technical substitutions

At any point I.e. ΔZ1ΔZ2(or dZ1dZ2) is equal to the value of its slope which is equal to

ΔZ1ΔZ2 (or dZ1dZ2)

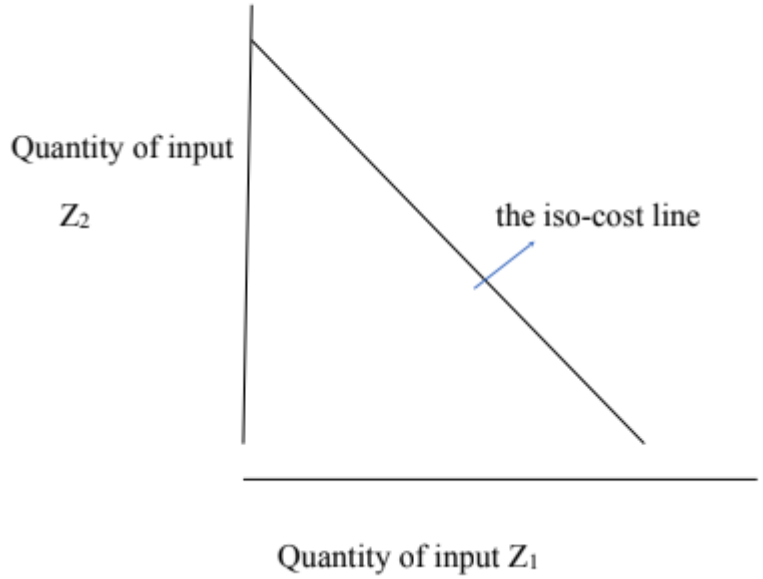
- **Optimal condition of factor-factor relationship:**

To understand the suitable level of input use where there are two variable factors of productivity a produce must know the rates at which inputs are exchanged on the market (their relative price) as well as the rate at which they can be exchanged in production their marginal rate of

substitution). To understand the relative price of input we introduce the concept of Iso-cost price in fig.4.

Iso-cost indicate the various combination of two variable input which can be purchased with the same amount of money. In other word, Iso-cost line shows the combination of two inputs used to produce a given amount of output will result in the minimum cost of production (given that the price per unit of each input remains the same when total cost (TC) increases or decreases then Iso-cost line value more to higher level or lower level but it slopes always be parallel to the original Iso-cost line.

Figure – the iso-cost line



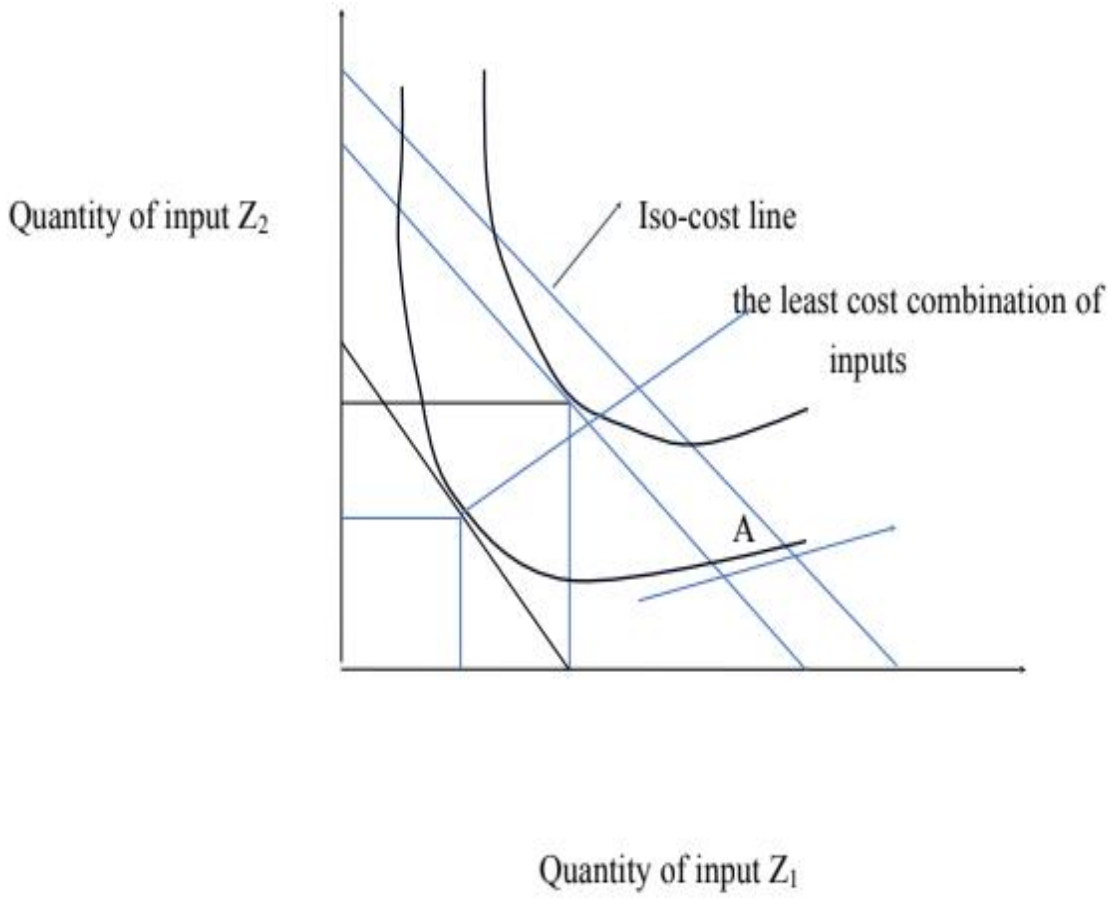
We are now fully equipped to find out the least cost combination, required to produce a given amount of a product. The optimal level of nature found to be at the point when Iso-cost line and Isoquant are from each other. At the point the slope of the Isoquant is equal to the slop of Iso-cast and since the slope of the Isoquant is the marginal rate of substitution (MRS). The optimal condition obtained when

MRS of Z_1 for $Z_2 = PZ_2 / PZ_1$

Slop of the Isoquant (at any point) = $\Delta Z1 \Delta Z2$

Slop of the Iso-cost line =PZ2PZ1

So the situation for minimizing the cost of producing a given amount of output by only two inputs – Which show the total cost will be minimized when the inputs needed for producing the given quantity of output.



The least cost combination of inputs.

Optimal condition regarding factor-factor relationship in terms of marginal value production of inputs --

the marginal rate of technical substitution depend upon the relation between the marginal value productivities of the two inputs.

we know the ΔZ1ΔZ2 is the slope of the Isoquant and slope of an Isoquant at any point shows the marginal rate of technical substitution at that point.

5.5 THE PRODUCT-PRODUCT RELATIONSHIP – (WHAT TO PRODUCE)

So far, we can have discussion about two production decisions namely, (factor-product relationship) and (factor-factor relationship). In this situation, we are discussion about the product-product relationship. It is concerned with the situation such a combination of two

Alternative crops both of where can be produced with the same available land. The production options which are technically suitable can be illustrated by a production possibility curve (or transformation curve). This (e.g. maize and rice) curve show the combination of two alternative crop which can be produced with a set of inputs and assuming a particular state of technology. If all available resources were used in the production of maize (Mo) units of maize would be

grown. If all resources were used in the production rice (Ro) units of rice would be produced. Alternative combinations of the maize and rice crops are represented by points along the curve Mo Ro.

The slop of the production possibility curve represents the marginal rate of transformation (MRT) of maize to rice i.e.

$$MRT = \Delta YM \Delta YR$$

This measures the opportunity cost of producing maize in terms of rice.

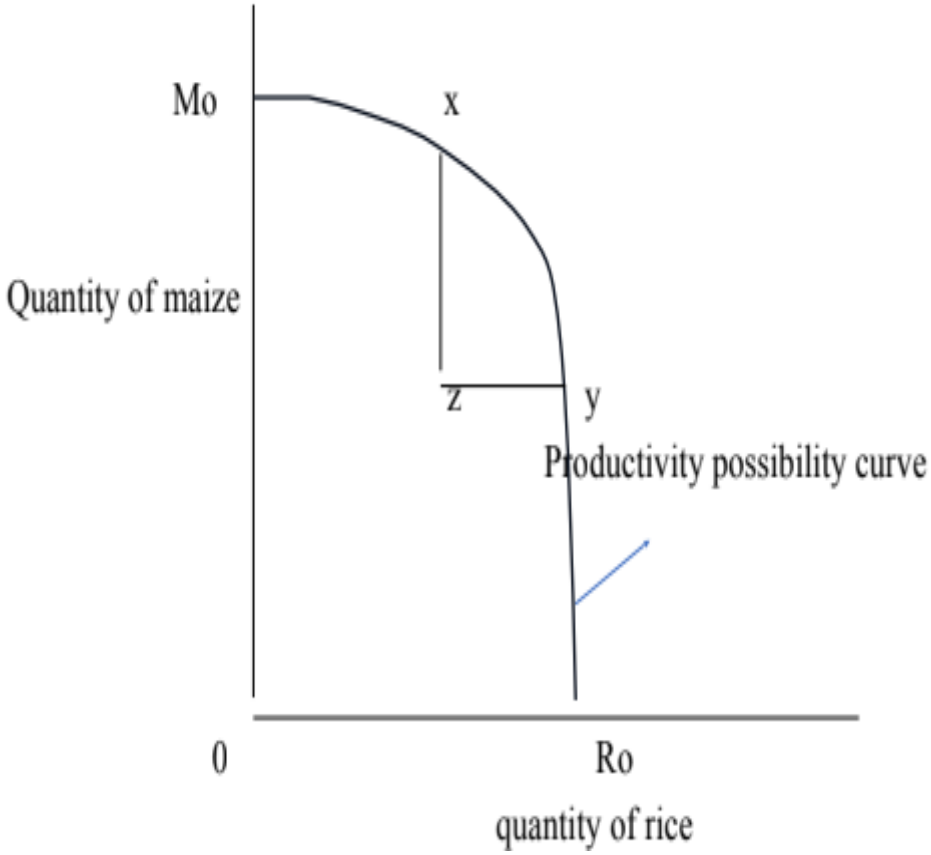


Figure. The production possibility frontier

It should be noted that an efficient farmer would choose to operate at some point on the production frontier. Point Z in the figure would be considered an inefficient use of resources since with same level of inputs; more at least one of the products could be forthcoming.

If a farmer or firm wants to maximize his profit, then they are always required a information on (1) the marginal rate of transformation (MRT)and (2) products prices. To understand the given prices of the products we can illustrate an ISO-REVENUE line. Iso-revenue line shows the point of various combinations of the products which will yield the same revenue to the firm

or farmer, when the prices of the two products are given. Profit maximization is achieved by maximizing total revenue, assuming that the quantity of inputs and their prices are given.

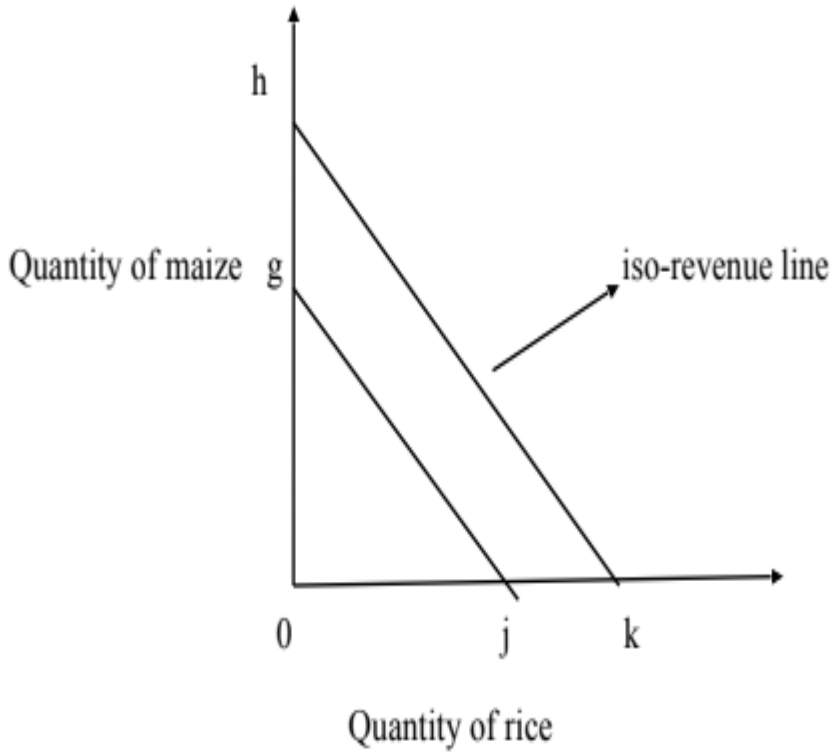
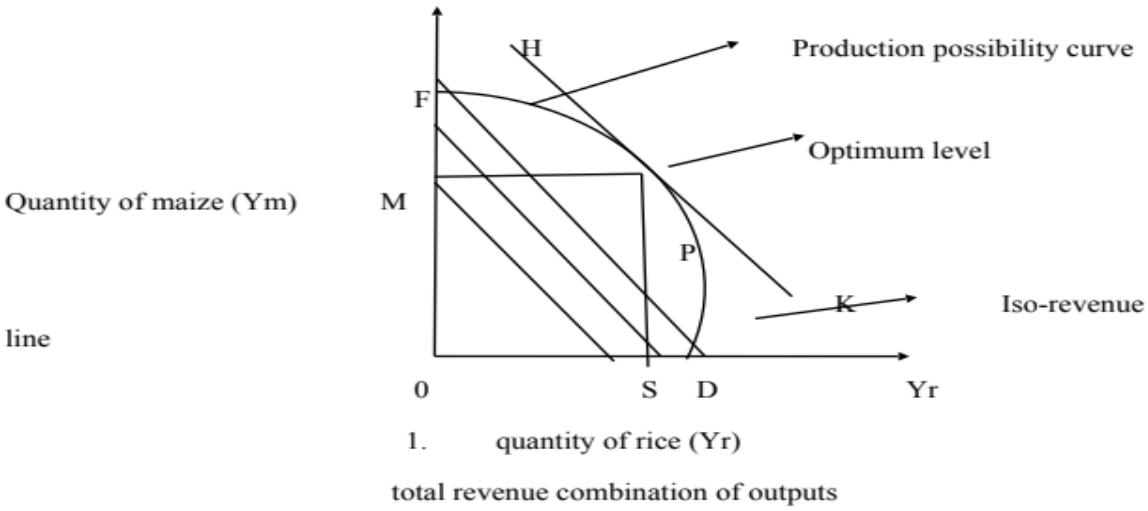


Figure. iso-revenue line

The slope of the line is given by the ratio of the product prices, e.g. Pm/Pr. The figure shows two such Iso-revenue lines, namely GJ and HK, representing two different levels of total revenue received by the production of two products. We may hear that a higher Iso-revenue line will imply a higher total revenue if the prices of two products remain constant. for example, HK represent a higher total revenue as compared with GJ. All the Iso-revenue lines are parallel to each other.

The optimal condition in the product-product relationship;

Now we will consider the optimal level of production in the product-product relationship. The diagram shows how the point of maximum total revenue is achieved when the production possibility curve and a set of Iso-revenue lines are given. At point P, one of the Iso-revenue lines is tangent to the given production possibility curve. In other word, at that point (P) slope of the production possibility curve are same as the slope of the Iso-revenue line. the production possibility curve is concave to the origin; this condition will obviously be satisfied when one of Iso-revenue lines is tangent to the production possibility curve.



We have already pointed out that the slope of production possibility at any point is the MRT of ΔYm /ΔYr and the slope of the Iso-revenue line is determined by PYr / Pym (ratio between prices of products).
so the condition for optimum product-product relationship in the case of a production possibility curve which is concave to the origin is;

MRT or ΔYm / ΔYr = -PYr/Pym

The negative sign reflects the fact that the MRT of the product is generally negative. Since increasing the output of one require production of the other to be reduced. About diagram indicates the rule of the production frontier in two-product case that enable the farmer or firm to determine the profit-maximising level. So point P represents the optimum combination of two products. The farmer will produce OM units of maize and OS unit of rice and will get the maximum total revenue.

5.6 UNIQUENESS OF AGRICULTURE PRODUCTION

The uniqueness of agriculture production refers to the distinct features and characteristics that set it apart from other industries and sectors. here we will discuss about the unique aspect of agriculture production. The uniqueness of agriculture production stems from several key factors, its dependence on natural process, its vulnerability on environment condition, it provides several resources for human survival etc.

- **Depend on natural process-** Mostly agriculture production depends on natural process and their interaction with the environment. Natural factor e.g. weather patterns, soil quality, pests impact agriculture production.

- **Biological Nature**- Agriculture production includes living organisms such as plants, animals and micro-organisms. This unique nature of agriculture makes it different from other areas of the economy that deal with inanimate objects.
- **Agriculture production by nature-** Agriculture is seasonal and cyclical. Crops are produced according to season and cycle,
- **Renewable resource base-** Mostly agriculture production relies on renewable sources like water, sunlight, and fertile land, but some agriculture inputs like fertilizer can be non-renewable.
- **Food security-** Agriculture is the foundation of food security. It provides the primary source of nourishment for human survival.
- **Uncertainty and Risk-** Agriculture production faces a lot of uncertainties and risks. Risks are due to weather conditions, pests and diseases. These risks and uncertainties can affect the quantity of crop production, the quality of production and the profitability of farmers.
- **Rural livelihoods-** In developing countries, a large portion of the world population depends on agriculture for their livelihood.
- **Regional difference-** Environment and weather conditions are different in different regions, and this regional difference leads to a diverse range of agriculture practices and products. Agricultural activities are different across different regions due to differences in topography, climate and soil types.
- **Economic development-** Agriculture plays an important role in economic development, particularly in developing countries, contributing to trade, income and livelihoods.
- **Environmental effects**- Agricultural production affects our environment, including soil degradation. loss of biodiversity. level of water degradation. Essential sustainable agriculture measures should be adopted to mitigate these environmental effects.

Uniqueness of agriculture production lies in its dependence on natural resources. its biological nature. seasonality and cyclical nature. uncertainty and risk, importance of food security, rural livelihoods, regional differences economic development and environmental effects.it is very important to understand these characteristics for developing new and effective agriculture policies. These policies will promote sustainable and productive agriculture.

5.7 SUMMARY

In agricultural production, the farmer can solve any problem that falls under the scope of resource allocation and marginal productivity analysis. Agriculture production thus provides a framework for decision-making at the level of the firm for increasing efficiency and profit. If a farmer or a firm wants to increase their production for profit maximizing so they should know the production function, like what is efficient production? What enterprise combination will maximise profits? How will technical change affect output? All these questions are given in the study of agricultural productive economic analysis. Agriculture deals with resource use efficiency, resource combinations, resource allocation, resource management and resource administration. agriculture production, wherein principles of economic choice are applied to the use of resources of land, management, labour and capital in the farming industry. Agriculture production analysis helps the policy maker to determine the consequences of alternative public policies on output, resource use and profit. In case of firm, there are three main principle of resource allocation: (1) Factor-Product relationship (2) Factor-Factor relationship (3) Product-Product relationship. All these three principle have to be understood simultaneously, if the farmer has to maximise his total profit. From these methods of economics to study problems of agriculture to get maximum profit and output from the use of resources that are limited for the well-being of society in general and the farming industry in particular.

5.8 GLOSSARY

- Production- The process through which some goods and services, called inputs, are from transformed into other goods called outputs.
- Optimality- it is a situation in which costs are minimum and profit is maximum.
- Slope of a line- it is the rate of change in the variable that occurs when another variable change slope at different points on a curve but remains the same on all points on a given line.
- Total physical product- total amount of output produced by using different units of inputs measured in physical units for value kg, tones etc.
- Average physical product- when total product divides by the amount of variable input, or ratio of output to input.
- Marginal physical product- addition to total output obtained by rising the marginal unit of input and is measured as $\Delta y / \Delta x$.

- Productivity- output per unit of inputs is called productivity.
- Production function- express the systematic relationship among various quantities of: inputs and the corresponding quantities of output is called a production function.
- Resources- the resources are physically used in production process. Anything that aids in production is called a resource.
- Fixed resources- the resources that remain unchanged irrespective of the level of production are called fixed resources. For example, land, building, and machinery.
- Variable resources- three resources exist both in the short run and long run. The resources that vary with the level of production are called variable resources.
- Cost of production- the expenditure increased on all inputs in raising a crop on a unit area is called the cost of production, i.e. kg.

5.9 QUESTIONS FOR PRACTICE

A. Short Answer Type Questions

Q1. What is agricultural production?
Q2. What is efficient production?
Q3. How is the most profitable amount of inputs determined?
Q4. How will technical change affect output?
Q5. What is a factor-product relationship?
Q6. Write down the uniqueness of agricultural production.
Q7. What enterprise combination will maximise profits?
Q8. Explain the three stages of the factor-product relationship?
Q9. Explain the optimal condition of factor-factor relationship?

B. Long Answers Type Questions

Q1. What are the three regions in factor-product relationship? Discuss.

(a) factor-factor relationship
(b) product-product relationship?

Q2. What is the agriculture production? Write down on the various forms of production function?

MASTER OF ARTS (ECONOMICS)

SEMESTER - III

ECONOMICS OF AGRICULTURE

UNIT VI: FARM SIZE, STRUCTURE, AND ECONOMIC OUTCOMES IN AGRICULTURE

STRUCTURE

6.0 OBJECTIVES

After a thorough study of this unit, the learner will be able to know about:

- measure farm size and understand the nuances of various farm structures.
- Inverse Relationship (IR) hypothesis, its theoretical underpinnings (especially Sen's labour-based argument), and the empirical evidence supporting it.
- To analyse the modern challenges to the IR hypothesis, including measurement issues, omitted variables, and the emergence of a U-shaped productivity curve.
- To apply the economic concept of returns to scale specifically to agriculture, identifying the sources of both economies and diseconomies of scale.
- To assess how the distribution of farm sizes and structures impacts the functioning of land, labour, and credit markets.
- To understand how agrarian structure influences, aggregate agricultural supply, market equilibrium, and price stability.
- To discuss the policy trade-offs between efficiency and equity and evaluate various government interventions, from land reform to supporting Farmer-Producer Organizations.
- To analyse the future trajectory of farm structure in the context of precision agriculture, climate change, and globalisation.

6.1 INTRODUCTION

The structure of agricultural production is a cornerstone of economic development, food security, and rural welfare. It represents the very foundation upon which rural societies are built and national economies evolve. At the heart of this structure lie two fundamental and interconnected concepts: farm size and farm structure. For centuries, economists, policymakers, and social scientists have debated the optimal configuration of land holdings. Is a system of small, family-owned farms—often seen as the backbone of rural society—more efficient and equitable? Or does agricultural progress and the ability to feed a growing global population depend on the consolidation of land into large, mechanised, corporate entities that can leverage economies of scale?

This unit delves into this seminal debate, exploring the intricate relationships between farm size, the organizational structure of farms, and their economic performance. We will dissect the theoretical underpinnings and empirical evidence surrounding three key economic outcomes: productivity, returns to scale, and market equilibrium.

6.2 DEFINING CORE CONCEPTS: SIZE, STRUCTURE, AND MEASUREMENT

Before analysing the relationships, we must establish clear, operational definitions for our key terms. The way we define and measure these concepts profoundly influences the conclusions we draw.

6.2.1 FARM SIZE: A MULTIDIMENSIONAL CONCEPT

While intuitively understood, "farm size" is a multifaceted concept that can be measured in several ways, each with its own advantages and limitations. The choice of metric can itself bias the outcome of any analysis.

1. Physical Area: This is the most common and straightforward measure, typically expressed in hectares or acres. It is easy to collect and compare, making it a favourite for census data and large-scale surveys.

- **Limitation:** This metric is famously crude. It overlooks significant variations in land quality, soil fertility, access to irrigation, climate, cropping intensity (the number of crops grown per year), and the type of crops grown. A 1-hectare irrigated plot in Punjab growing high-value vegetables is economically much larger and more productive than a 10-hectare rain-fed plot in an arid region of Rajasthan used for grazing. To mitigate this, researchers

sometimes try to standardise land into "irrigated equivalent hectares," but this is a data-intensive and imperfect process.

2. Economic Size (Value of Output): This measures the total market value of all agricultural produce from the farm over a specific period (e.g., a year).

a) **Advantage:** This is a superior measure as it inherently captures differences in land productivity, crop choice, and cropping intensity, providing a better reflection of the farm's economic contribution.
b) **Limitation:** It can be highly volatile due to price fluctuations and weather-related shocks, making year-on-year comparisons difficult. It also poses significant challenges in subsistence economies where a large portion of output (e.g., food for home consumption, fodder for animals) is not marketed. Valuing this non-marketed output requires imputation, which can be subjective. European Union statistics often use a standardized measure called the **Standard Output (SO)** to classify farms based on their potential monetary output under normal conditions.

3. Scale of Inputs Used: Farm size can also be measured by the quantity or value of inputs used.

a) **Labour:** The number of full-time equivalent workers (family or hired).
b) **Capital:** The total value of machinery, equipment, buildings, and livestock.
c) **Advantage:** This metric is useful for understanding the production technology, factor intensity, and level of modernization of the farm.
d) **Limitation:** Valuing capital stock is notoriously difficult due to depreciation. Standardising labour units is also complex, as a full day of family labour during peak season might involve more effort than a day of hired labour during the off-season.

In academic literature, particularly the farm size-productivity debate, **physical area** remains the most widely used metric for its simplicity. Still, it is almost always used in econometric models that include careful statistical controls for land quality, irrigation, crop choice, and regional factors to isolate the pure effect of size.

6.2.2 FARM STRUCTURE: THE ORGANISATIONAL DIMENSION

Farm structure refers to the ownership, tenure, and organisational characteristics of the farming enterprise. It goes beyond mere size to ask, "Who owns the land, who works it, and under what arrangements?"

1. **Family Farms:** The dominant form globally, from smallholdings in Asia to large family-owned farms in North America. The defining feature is the fusion of the family and the enterprise: the household provides the majority of the labour, management, and capital. The family owns the land or has secure tenure. Production can range from pure subsistence to fully commercial. The economic logic of the family farm, as argued by Russian economist A.V. Chayanov, often revolves around a "labour-consumer balance"—ensuring the family's survival and needs—rather than pure profit maximisation.
2. **Tenanted Farms:** The land is cultivated by a tenant who does not own it. The arrangement with the landowner is critical:
   a) **Sharecropping:** The tenant pays a share of the output (e.g., 50%) to the landowner. This model involves risk-sharing (a bad harvest hurts both parties) but creates a severe **Principal-Agent problem**. As the tenant keeps only a fraction of any additional output, their incentive to apply costly inputs (like fertilizer) or exert maximum effort is blunted, leading to sub-optimal productivity. This inefficiency was famously analysed by Alfred Marshall.
   b) **Fixed-Rent Tenancy:** The tenant pays a fixed sum of money or a fixed quantity of produce to the landowner, regardless of the harvest. The tenant bears all the production risk but, crucially, also reaps 100% of the marginal benefit from their effort and investment. This is generally considered more efficient than sharecropping.
   c) **Fixed-Wage (Hired Labour):** The landowner directly manages the farm and hires labour at a fixed wage. This transforms the farm into a capitalist enterprise and is common on large commercial farms.
3. **Corporate Farms:** The farm is owned and operated as a legal corporate entity, with shareholders, a board of directors, and professional management. These are typically large-scale, highly capitalized, and often vertically integrated (controlling multiple stages of the supply chain, from seed production to food processing). They bring financial muscle and managerial expertise but are often criticized for their social and environmental impacts.
4. **Cooperative Farms:** Resources (land, machinery) are pooled by a group of farmers who work together and share the profits. This structure aims to help smallholders achieve economies of scale while maintaining collective ownership. There are various models, from full production cooperatives (where land is farmed collectively) to service cooperatives (where members farm individually but jointly market produce or purchase inputs). The

Amul dairy cooperative in India is a world-famous example of a successful service cooperative.

5. **Contract Farming:** An intermediate structure where a firm (the contractor) agrees with farmers to produce a specific quantity and quality of a commodity at a predetermined price. The firm often provides inputs and technical guidance. This links small farmers to markets but can lead to unequal bargaining power.

The interplay between the size of the farm and its structure is crucial. A small, owner-operated family farm behaves very differently from a large, corporate farm managed with hired labour, even if they grow the same crop.

6.3 The Farm Size-Productivity Relationship: A Seminal Debate

One of the most enduring and empirically contested topics in agricultural economics is the relationship between farm size and productivity. Productivity, in this context, is almost always measured as output per unit of land (i.e., yield or land productivity). The central question is: are small farms more or less productive than large farms? The answer has profound implications for land reform and agricultural development strategy.

6.3.1 THE INVERSE RELATIONSHIP (IR) HYPOTHESIS

The classical view, supported by a vast body of empirical work from the 1960s onwards, especially from developing countries like India, Brazil, and Thailand, is the **Inverse Relationship (IR) hypothesis**. It posits that as farm size (in acres/hectares) increases, productivity (output per acre/hectare) decreases.

This finding was initially counterintuitive. Standard economic theory would suggest that larger farms should be more efficient and thus more productive due to their ability to exploit economies of scale in machinery and marketing. The discovery of a persistent inverse relationship demanded an explanation, and several powerful theories emerged.

6.3.2 DECONSTRUCTING THE LABOUR-BASED EXPLANATION (SEN'S HYPOTHESIS)

The most influential explanation was provided by Nobel laureate **Amartya Sen** in 1962. He argued that the IR arises from fundamental imperfections in factor markets, specifically the dualism of the labour market in agrarian economies.

1. **Peasant vs. Capitalist Farms:** Sen distinguished between small "peasant" farms that primarily use uncosted family labour and large "capitalist" farms that rely on hired wage

labour. These two farm types operate under different objective functions. The large farm aims to maximise profit, while the small family farm aims to maximise output to ensure the family's subsistence and well-being.

2. **The Opportunity Cost of Labour:** This is the core of the argument.

a) On a large, profit-maximising farm, the owner will hire labour up to the point where the marginal product of labour (MP_L) equals the market wage rate (w). Hiring another worker beyond this point would cost more in wages than the worker adds in output, reducing profit. Thus, the equilibrium condition is $MP_L = W$

b) On a small family farm, there is often a surplus of family labour with limited outside employment opportunities, meaning the opportunity cost of their labour is very low, perhaps even close to zero. The family's objective is to maximize total farm output. They will continue to apply family labour to their small plot as long as it adds *any* positive amount to the total harvest, i.e., as long as the marginal product is positive ($MP_L > 0$) even if that marginal product is far below the prevailing market wage rate.

3. **Intensification of Labour:** Because the "imputed cost" of labour is much lower on family farms, they apply far more labour per hectare than large farms. This higher labour intensity translates into more careful cultivation—more weeding, more careful transplanting, better water management, more intensive inter-cropping, and more thorough harvesting. These painstaking activities, which would be unprofitable for a wage-based farm, collectively lead to significantly higher output per hectare.

6.3.3 Other Supporting Arguments for the IR

While the labour-based argument is central, other factors were proposed to support the IR:

a) **Supervision Costs:** Family labour is self-motivating. It is far easier and cheaper for a family to supervise its own members than it is for a large landowner to monitor and motivate dozens of hired workers. Hired workers may shirk their duties (a moral hazard problem), leading to lower effective labour input. The higher supervision cost on large farms means they apply less labour than would be optimal if supervision were costless, further contributing to lower yields compared to the self-supervising family farm.

b) **Land Quality:** Some early studies argued that smaller farms tend to have higher quality, more fertile land. This could be a historical artefact: as populations grew, plots were subdivided, with the most fertile plots being the most subdivided. Or, during land sales,

distressed families might sell their less fertile, peripheral plots first. If land quality is not properly controlled for in the analysis, this could create a spurious inverse relationship where higher productivity is attributed to small size when it's actually due to better soil.

6.3.4 CHALLENGES TO THE INVERSE RELATIONSHIP AND MODERN PERSPECTIVES

Beginning in the 1980s, the consensus around the IR began to fray. More sophisticated econometric techniques and, more importantly, changing agricultural realities led to a critical re-evaluation.

a) **Measurement Errors and Spurious Correlation:** Critics argued that the observed IR could be a statistical artifact. It was found that small farmers often report their output more accurately but are less precise about their land area, sometimes not accounting for bunds or uncultivated patches. If there is a systematic tendency for small farmers to overestimate their plot size less than large farmers, it could mechanically create an inverse relationship between (measured) size and (calculated) productivity.

b) **The Role of Omitted Variables:** The simple bivariate relationship between size and productivity might be misleading by failing to account for other important factors. As mentioned, soil quality is the most cited omitted variable. When studies meticulously control for soil quality, the IR often weakens or disappears entirely. Other omitted variables could include managerial ability (better managers might acquire larger farms but also be more productive) and access to irrigation.

6.3.5 THE DISAPPEARING IR AND THE RISE OF THE U-SHAPED CURVE

The most significant challenge to the IR comes from recent evidence suggesting that in many parts of the world, the relationship has weakened, flattened, or even reversed. This is largely attributed to technological and market transformations that have altered the traditional advantages.

a) **Mechanization and Capital Intensity:** The Green Revolution and subsequent technological advancements introduced machinery (tractors, combine harvesters) and capital-intensive inputs (high-yielding seeds, fertilizers, pesticides). These technologies often have significant indivisibilities and economies of scale. A tractor is not economically viable on a 0.5-hectare plot but is essential for timely operations on a 50-hectare farm. As agriculture becomes more capital-intensive and less labour-intensive, the traditional labour advantage of small farms erodes.

b) Market Access and Credit: In a globalized food system, access to markets and finance is critical. Larger farms have better access to formal credit markets, allowing them to invest in new technologies. They have better bargaining power in both input and output markets, enabling them to buy inputs in bulk at a discount and sell their produce at higher prices. Smallholders often face severe credit constraints and are at the mercy of local intermediaries. This has led some economists to propose a U-shaped or L-shaped relationship between farm size and productivity.

c) Small farms remain productive due to the classic labour-intensity advantage.

d) Medium-sized farms are often the least efficient. They are too large to get the full benefit of the family labour advantage but too small to effectively utilize large-scale machinery, access bulk discounts, or secure formal credit. They are "stuck in the middle."

e) Large farms regain and then surpass the productivity of small farms through superior access to technology, mechanization, credit, and markets.

In summary, the farm size-productivity debate has evolved from a simple belief in an inverse relationship to a more nuanced, context-dependent understanding. The classic labour-based IR may still hold in subsistence-oriented, low-technology, labour-surplus agrarian systems. However, in modernized, market-integrated agricultural economies, the advantages of scale in technology and market access often lead to a situation where large, commercial farms are the most productive per unit of land.

6.4 RETURNS TO SCALE IN AGRICULTURE

The concept of returns to scale is fundamental to understanding the optimal size of a firm in any industry. It describes how output responds when all inputs are increased by the same proportion in the long run. In agriculture, this analysis is particularly unique due to the central, and often fixed, role of land and the influence of biological processes.

6.4.1 THEORETICAL FOUNDATIONS OF RETURNS TO SCALE

Let the production function be $Q = f(X_1, X_2. X_3 .. X_n)$ where Q is output and X_i are inputs like land, labour, capital, and materials. If we increase all inputs by a factor λ (where λ_1), then:

a) If output increases by *more than* the factor λ (i.e., f(λX_1,..., λX_n) > λQ), we have **Increasing Returns to Scale (IRS)**. This implies that the firm's long-run average cost (LRAC) is falling.

b) If output increases by *exactly* the factor λ (i.e., f(λX_1,..., λX_n) = λQ we have **Constant Returns to Scale (CRS)**. This implies a flat LRAC.

c) If output increases by *less than* the factor λ (f(λX_1,..., λX_n) < λQ we have **Decreasing Returns to Scale (DRS)**. This implies a rising LRAC.

Mathematically, this is often modeled using a **Cobb-Douglas production function**:

$$Q = A.L^{\alpha}.K^{\beta}$$

Where Q is output, L is labour, K is capital, and A is a technology parameter. The sum of the output elasticities (α+β) determines the returns to scale.

- $\alpha + \beta > 1 \Longrightarrow$ IRS
- $\alpha + \beta = 1 \Longrightarrow$ CRS
- $\alpha + \beta < 1 \Longrightarrow$ DRS

6.4.2 SOURCES OF INCREASING RETURNS TO SCALE (ECONOMIES OF SCALE)

In the initial stages of farm expansion, agriculture can exhibit significant increasing returns. These are the advantages that drive farm consolidation.

a) Technical Economies (Indivisibilities): This is the most significant source of IRS. Certain capital inputs have a minimum effective size and high fixed costs. A small farm cannot use half a tractor or a quarter of a combine harvester. As a farm grows large enough to spread the high fixed cost of this "lumpy" machinery over more units of output, the average cost per unit falls dramatically. For example, a combine harvester might cost ₹20 lakhs and be able to harvest 500 hectares in a season. It is completely uneconomical for a 2-hectare farm, but highly efficient for a 500-hectare farm.

b) Managerial Economies (Specialization of Labour): On a large farm, workers can specialize in specific tasks. One person can be an expert mechanic for the machinery, another can specialize in irrigation systems, and another in pest management. This specialization leads to greater efficiency, skill development, and productivity ("learning by doing"). On a small family farm, each person must be a generalist, handling everything from plowing to accounting.

c) Pecuniary Economies: These are monetary advantages. Large farms can often secure bulk discounts on inputs (seeds, fertilizers, chemicals) because they buy in large quantities. They can also command better prices for their output due to their large volume and ability to

meet the quality and consistency demands of large buyers like supermarket chains or food processors. They may also get lower interest rates on loans.

6.4.3 SOURCES OF DECREASING RETURNS TO SCALE (DISECONOMIES OF SCALE)

Despite the potential for IRS, agriculture is overwhelmingly characterized by the eventual onset of decreasing returns to scale. This is the primary economic reason why agriculture has not become dominated by a few massive, continent-spanning farms in the same way manufacturing has.

1. The Fixed Factor: Land & Spatial Constraints: The most fundamental reason for DRS is the spatial nature of agriculture. While you can scale up a factory on a small plot of land by building a taller building, you can only expand a farm by acquiring more land, which is often geographically dispersed and non-contiguous. As the farm expands, the costs and time spent moving machinery, inputs, and harvested crops between scattered fields increase significantly. This "travel time" is a major source of inefficiency.

2. Management and Supervision Diseconomies: This is a critical factor. As a farm grows from a manageable 10 hectares to a sprawling 10,000 hectares, the owner's ability to personally supervise operations diminishes and eventually disappears. This leads to several problems:

a) **Principal-Agent Problem:** The farm owner (the principal) must hire managers and workers (the agents) whose interests (e.g., minimizing effort) may not align with the owner's (maximizing profit). Monitoring the effort of workers across vast distances is difficult and costly, leading to shirking and inefficiency.

b) **Coordination Challenges:** Coordinating timely operations across a huge area becomes exponentially more complex. Planting, irrigation, spraying, and harvesting are all time-sensitive and weather-dependent. A delay in one section can have cascading negative effects. Managing a pest outbreak on a 10,000-hectare farm is a logistical nightmare compared to a 1-hectare plot. The sensitivity of agricultural operations to unpredictable biological cycles and weather makes this coordination far more difficult than in a controlled factory environment.

c) **Soil Heterogeneity:** As a farm expands, it inevitably incorporates land with varying soil types, topography, drainage, and microclimates. Managing this heterogeneity with a standardized, one-size-fits-all approach (e.g., same fertilizer application rate everywhere) becomes highly inefficient. Tailoring practices to each specific plot (precision agriculture)

is possible but requires significant investment in technology and data analysis, adding to managerial complexity.

6.4.4 THE LRAC IN AGRICULTURE: A SYNTHESIS

The typical long-run average cost (LRAC) curve for a farm is therefore believed to be **L-shaped or U-shaped**.

Initially, as the farm expands, technical and pecuniary economies lead to a sharp fall in average costs (Increasing Returns to Scale). Then, there may be a flat portion where the farm is large enough to be efficient but not yet suffering from major managerial issues (Constant Returns to Scale). Eventually, as the farm becomes too large and sprawling, the forces of management and coordination diseconomies take over, and average costs begin to rise (Decreasing Returns to Scale). This sets a practical limit on the optimal size of a single farming enterprise.

6.5 THE ROLE OF FARM SIZE AND STRUCTURE IN MARKET EQUILIBRIUM

The distribution of farm sizes and the dominant farm structures within a region or country have profound implications for the functioning of agricultural markets. They affect both the markets for factors of production (land, labour, credit) and the markets for final products, ultimately shaping market equilibrium, prices, and welfare.

6.5.1 IMPACT ON FACTOR MARKETS (LAND, LABOUR, CREDIT)

The agrarian structure creates and perpetuates imperfections in factor markets.

1. Land Market:

a) In a system dominated by small, subsistence farms, land is often seen not just as a factor of production but as a source of social security, status, and ancestral heritage. This leads to a very **thin land rental and sales market**. Transactions are infrequent, and prices may not reflect true economic value, hindering the reallocation of land to more efficient users. The problem of **land fragmentation** (where a single farmer owns multiple tiny, scattered plots) is also common, which further increases production costs.

b) In contrast, a structure with large corporate farms leads to a more active, commercialized land market. However, this can also lead to aggressive land consolidation, the displacement of smallholders, and rising landlessness.

2. Labour Market:

a) As explained by Sen, a prevalence of small family farms can lead to a situation where the marginal product of labour in agriculture is very low, sometimes near zero, creating a pool of "surplus" or **"disguised" unemployment**. This concept is central to the **Lewis model of dual-sector development**, where this surplus labour can be drawn into the industrial sector at a low wage, fueling industrialization.

b) A structure of large farms creates a more formal agricultural wage labour market. However, if a few large farms dominate a region, they can exert **monopsony power** (being the primary buyer of labour). This allows them to suppress rural wages below the competitive equilibrium level, exploiting agricultural workers.

3. Credit Market:

a) This is one of the most significant market failures. Smallholders typically lack formal collateral (like clear land titles) and have no documented credit history. They are perceived as high-risk by formal lenders like banks, leading to **credit rationing**—they are simply denied loans, even if they are willing to pay a high interest rate. This forces them to rely on informal moneylenders who charge exorbitant rates. This credit constraint is a major barrier to adopting improved seeds, fertilizers, and machinery, thus trapping them in a low-productivity cycle. The rise of **Microfinance Institutions (MFIs)** is a direct response to this market failure.

b) Large farms, with their land assets as collateral and formal business structures, have easy access to cheap, formal credit. This allows them to invest in capital-intensive technologies and weather price shocks more effectively. This differential access to credit is a key driver of inequality and the "U-shaped" productivity curve.

6.5.2 Impact on Aggregate Supply and Product Market Equilibrium

The composition of farm sizes affects the aggregate supply curve of agricultural products, influencing overall output, prices, and price stability.

1. Supply Response: The elasticity of supply—how much quantity supplied responds to a change in price—is shaped by farm structure.

a) Subsistence Farms: Small, subsistence-oriented farms may have a very low or even **perverse supply response**. Their primary goal is often to achieve a fixed target income for essential non-farm purchases (clothing, medicine, school fees). If the price of their cash crop rises, they can achieve their income target by selling *less* produce, allowing them to

consume more at home. In this case, a higher price could lead to a lower marketed surplus, a phenomenon that perplexes policymakers.

b) **Commercial Farms:** Large, commercial farms operate on a profit-maximization principle and exhibit a strong, positive supply response. Higher prices directly incentivize them to increase production by using more inputs and planting more area.

2. Marketable Surplus: This is the portion of total output that is sold in the market (Total Output - Home Consumption). Its size is crucial for feeding the non-farm population and enabling industrialization. A country with millions of small farms that consume most of what they produce will have a small marketable surplus, even if total production is high. This can create a bottleneck for economic development.

3. Risk Aversion: Small farmers are generally more risk-averse than large farmers because a single bad harvest can threaten their very survival. This rational risk aversion, from a micro perspective, can lead to macro-level inefficiency:

a) They may prefer low-risk, low-yield traditional crop varieties over high-risk, high-yield modern varieties.

b) They engage in diversified cropping patterns rather than specializing in the most profitable crop to avoid "putting all their eggs in one basket."

c) They avoid taking loans for productive investments for fear of being unable to repay them.

Therefore, an agricultural economy dominated by small, risk-averse, credit-constrained farms is likely to have a lower, more **inelastic aggregate supply curve**. This means that shocks to supply (like a drought or flood) will lead to much higher **price volatility** in the food market. The equilibrium price of food will be higher and more unstable, with serious consequences for urban consumers and the poor.

6.6 Policy Implications and The Future of Farm Structure

The analysis of farm size, structure, and productivity leads to complex policy trade-offs. The "optimal" farm structure is not a one-size-fits-all solution but depends on a country's specific goals regarding efficiency, equity, and social stability.

6.6.1 THE EFFICIENCY VS. EQUITY DILEMMA

A. Efficiency Argument: If the primary goal is maximizing national agricultural output, ensuring a large marketable surplus to feed cities, and boosting agricultural exports, policy might favor land consolidation and the growth of large, mechanized commercial farms. These

farms are better positioned to exploit economies of scale, adopt modern technology, and respond efficiently to market signals.

B. **Equity Argument:** Small family farms are the largest source of employment and livelihood in most developing countries. They are the bedrock of rural communities and social stability. Policies that aggressively push for consolidation could lead to mass displacement of rural populations, exacerbate inequality, increase urban migration and the growth of slums, and potentially cause social unrest, even if it boosts aggregate output.

Finding a policy balance that promotes efficiency while protecting the livelihoods of the rural poor is one of the greatest challenges in development economics.

6.6.2 KEY POLICY LEVERS: A DETAILED EXAMINATION

Governments use various tools to influence farm size and structure:

1. Land Reform:

- **Land Ceilings:** Placing a legal limit on the amount of land an individual or entity can own. The goal is to redistribute surplus land to the landless. While noble in intent, these have often been ineffective in practice in countries like India due to legal loopholes and poor implementation.
- **Tenancy Reform:** Regulating sharecropping and rental arrangements to provide tenants with more security of tenure and a fairer share of the crop. Secure tenure encourages tenants to make long-term investments in the land.
- **Land Consolidation:** Programs to help farmers consolidate their fragmented and scattered plots into more contiguous and economically viable units. This reduces costs and improves efficiency, but can be a complex and contentious process.

2. Enabling Smallholders to Overcome Scale Disadvantages: This is a popular modern policy approach that seeks to achieve both efficiency and equity. The goal is not necessarily to increase the physical size of the farm, but to allow smallholders to access the *benefits* of scale through collective action.

- **Farmer Producer Organizations (FPOs) and Cooperatives:** By banding together, small farmers can achieve collective scale. A well-run FPO can buy inputs in bulk at a discount, jointly own and use machinery, access credit as a single legal entity, and aggregate their produce to bargain for better prices from large buyers. India, for example, is actively promoting the formation of 10,000 new FPOs.

- **Custom Hiring Centers:** Government or private sector initiatives that rent out expensive machinery (tractors, harvesters, laser levellers) on an hourly or per-acre basis. This makes mechanization accessible to smallholders who cannot afford to buy the equipment. The rise of app-based services ("Uber for tractors") is a modern, market-based solution.
- **Contract Farming:** Linking small farmers with agribusiness firms can provide them with access to technology, quality inputs, credit, and an assured market, overcoming many of the disadvantages of small scale. However, it requires strong regulation to protect farmers from exploitation by powerful corporations.

3. Investment in Technology and Infrastructure:

- **Public R&D:** Focusing agricultural research on developing **scale-neutral technologies** (e.g., high-yielding seeds, improved farming practices, biological pest control) that can benefit both small and large farms, rather than just large-scale machinery.
- **Infrastructure:** Investments in rural roads, electricity, irrigation, and storage facilities reduce transaction costs and improve market access for all farmers, but the marginal benefits are often greatest for smallholders who are most isolated.

6.6.3 THE FUTURE CONTEXT: TECHNOLOGY, CLIMATE CHANGE, AND GLOBALIZATION

The debate is continuously evolving in response to powerful global trends.

- **Precision Agriculture:** The new agricultural revolution is data-driven. Technologies like GPS-guided tractors that apply inputs with surgical precision, drones for monitoring crop health, and IoT sensors that optimize irrigation are highly capital-intensive and require significant technical skill. This could dramatically tilt the advantage further towards large, sophisticated farming operations, potentially widening the gap with smallholders.
- **Climate Change:** The increasing frequency of extreme weather events (droughts, floods, heatwaves) places a premium on resilience. Building resilience often requires significant investment in adaptive technologies (e.g., drip irrigation, climate-resilient crop varieties, protective structures), which could be a challenge for resource-poor smallholders. This poses a major threat to food security in vulnerable regions.
- **Globalization:** Integration into global food value chains often requires consistent quality, large volumes, and traceability (the ability to track a product from farm to fork). These

standards are often easier for large, well-organized commercial farms to meet, potentially excluding smallholders from the most lucrative markets.

6.7 CONCLUSION

The relationship between farm size, structure, productivity, returns to scale, and market equilibrium is dynamic, complex, and context-dependent. We have moved beyond simplistic, dogmatic conclusions to a more nuanced understanding that appreciates the interplay of economic theory, empirical evidence, and institutional context.

1. The classic **Inverse Relationship** between farm size and land productivity, driven by the labour and supervision advantages of small family farms, remains a relevant phenomenon in labour-surplus, low-technology settings. It provides a powerful argument for equitable land distribution.
2. However, in modernized and market-integrated agriculture, the advantages of scale in adopting capital-intensive **technology** and accessing **markets** often lead to a **U-shaped** productivity curve, where both very small and very large farms can be highly efficient, while medium-sized farms struggle.
3. Agriculture is characterized by an initial phase of **Increasing Returns to Scale** due to indivisibilities in machinery, but it ultimately succumbs to **Decreasing Returns to Scale** because of rising managerial and coordination diseconomies inherent in its spatial nature. This prevents the unlimited consolidation seen in other industries.
4. The prevailing farm structure profoundly shapes **factor market imperfections**, particularly in credit and labour, and determines the elasticity and stability of the **aggregate food supply**, thereby influencing overall market equilibrium and national food security.

Ultimately, there is no single "optimal" farm size or structure valid for all times and places. An ideal agrarian structure may be a **"bimodal" system** where efficient, large commercial farms coexist with productive, well-supported, and market-linked smallholder farms. The challenge for policymakers is not to choose between small and large but to create an institutional environment—through secure property rights, competitive markets, targeted public investment, and robust support for collective action—that allows farms of all sizes to operate efficiently, sustainably, and equitably. The future of global food security and rural prosperity rests on getting this complex balancing act right.

6.8 QUESTIONS FOR PRACTICE

A. Short Answer Type Questions

Q1. List and briefly explain the three main ways to measure farm size.

Q2. What is the core difference between a fixed-rent tenancy and sharecropping? Which is considered more efficient and why?

Q3. Define the Inverse Relationship (IR) hypothesis in the context of agriculture.

Q4. What is meant by the "indivisibility" of capital, and how does it lead to increasing returns to scale?

Q5. Explain the concept of "disguised unemployment" in the agricultural labour market.

Q6. What is a "perverse supply response" and why might subsistence farmers exhibit it?

Q7. Define Farmer Producer Organizations (FPOs). How do they help smallholders overcome scale disadvantages?

Q8. What are the two main reasons for the eventual onset of decreasing returns to scale in agriculture?

B. Long Answer Type Questions

Q1. "The Inverse Relationship between farm size and productivity is a statistical artifact that disappears once technology and market access are considered." Critically evaluate this statement, drawing on both the classical arguments for the IR and modern challenges to it.

Q2. Using the concept of returns to scale, explain why agriculture has not become dominated by a few giant multinational corporations in the same way as the automobile or software industries. Draw and explain the typical shape of the Long-Run Average Cost (LRAC) curve for a farm.

Q3. Analyze in detail how the predominance of small, subsistence farms in an economy can lead to imperfections in the markets for land, labour, and credit. What are the consequences for economic development?

Q4. Discuss the fundamental policy trade-off between "efficiency" and "equity" in designing an agricultural strategy. How can modern policies, such as promoting FPOs and contract farming, attempt to achieve both goals simultaneously?

Q5. How are the forces of precision agriculture, climate change, and globalization likely to reshape the debate on optimal farm size and structure in the 21st century?

6.9 SUGGESTED READINGS

- **Sen, Amartya K. (1962).** "An Aspect of Indian Agriculture." *The Economic Weekly*, Vol. 14. (The seminal paper outlining the labour-based explanation for the IR).
- **Berry, R. A., & Cline, W. R. (1979).** *Agrarian Structure and Productivity in Developing Countries*. Johns Hopkins University Press. (A classic, comprehensive empirical study on the IR across several countries).
- **Eastwood, R., Lipton, M., & Newell, A. (2010).** "Farm Size." In *Handbook of Agricultural Economics* (Vol. 4, pp. 3323-3397). Elsevier. (An excellent, more recent survey of the literature on the farm size-productivity debate).
- **Deininger, K. (2003).** *Land Policies for Growth and Poverty Reduction*. World Bank and Oxford University Press. (A key text on the policy implications of land tenure and farm structure).
- **Ellis, Frank (1993).** *Peasant Economics: Farm Households and Agrarian Development*. Cambridge University Press. (Provides a deep dive into the economic logic of family farms and smallholder agriculture).
- **Todaro, M. P., & Smith, S. C.** *Economic Development*. Pearson Education. (Relevant chapters on agricultural transformation and rural development provide excellent textbook coverage of these topics).

MASTER OF ARTS (ECONOMICS)

SEMESTER-III

ECONOMICS OF AGRICULTURE

UNIT 7: RISK AND UNCERTAINTY IN AGRICULTURE

Structure

7.0 OBJECTIVES

- To discuss the essential measures to reduce risk and uncertainty.
- To explain the behaviour of farmers in risky decision- making situation.
- To study the effects taken by the government to deal with risk and uncertainty.
- To examine the literature relating to risk and uncertainties.
- To explain the behavior aspects of decision making associated with risk and uncertainty.
- To discuss farm level measures to reduce risk and uncertainty.

7.1 INTRODUCTION

In business and economics, people are always making decisions. However, many decisions are taken under risk and uncertainty. For example, investment decisions, buying and selling insurance, investment in new industries and countries and choice of new technologies. Nature plays an important role in the agriculture sector, due to that the agriculture sector being distinguished from the other sectors of the economy. Like the agriculture sector, the industrial sector also faces some uncertainty. There is uncertainty about the future prices of their product, the inputs that they purchased or the emergence of new substitutes, etc. The input-output relations are unpredictable because floods, droughts, rain diseases all affect and reduce agricultural production. The biological nature of agriculture is responsible for this uncertainty. Most of the farmers adopt risk-reducing strategies involving such elements as flexibility, liquidity, diversification and caution in adopting new techniques and levels of input that yield less than maximum expected returns. The agriculture sector also deals with uncertainty and risk. Every year, one part of food crops is affected by a natural calamity. It not only affects the income and welfare of farmer households but also affects the Indian economy. To achieve satisfactory management in agriculture and minimise the losses, it is necessary to manage all these risks and uncertainties properly. This chapter discusses the concept of risk and uncertainty in agriculture, types of risk and uncertainties, farm-level measures to reduce risk and uncertainties and various initiatives taken by the government to reduce risk and uncertainty in agriculture. Understanding these concepts is important for farmers, policymakers, and stakeholders to develop effective policies and strategies for mitigation and management.

7.2 RISK AND UNCERTAINTY IN AGRICULTURE-

The terms ‘risk’ and ‘uncertainty’ can be defined in various ways. Sometimes, the terms ‘risk’ and ‘uncertainty’ are used synonymously. However, in economic analysis, risk and uncertainty are considered different from each other. While risk can be measured and estimated but uncertainty cannot. The idea that risk and uncertainty can be relevant for the economic analysis was suggested in 1921 treatise Risk, Uncertainty and profit by Frank H. Knight. Risk is a situation in which the outcome of a decision is uncertain, but the probability of each possible outcome is known and can be estimated. For example, a poultry farmer knows through past experience that a certain percentage of eggs, after production, is destroyed through breakage during their transportation to the market, this type of outcome which can be forecast with Some probability is said to involve risk and not uncertainty. On the other hand, uncertainty refers to those events, to the occurrence of which, probability value is not known. For example, floods, droughts or

earthquakes etc. risk is imperfect knowledge where the probabilities of the possible outcome are known, and uncertainty exists when these probabilities are not known.

7.3 TYPES AND SOURCES OF UNCERTAINTY IN AGRICULTURE

The state of uncertainty, characterized by doubt because of a lack of knowledge of what will happen or not in the future. There are some major types of uncertainty in agriculture (a) yield uncertainty (b) price uncertainty, (c) tenurial uncertainty (d) and uncertainty with regard to input price/quality, etc. We may now briefly explain the nature of these types of uncertainty in agriculture.

(1) Yield uncertainty- the biological nature of agricultural farming is responsible for this uncertainty. Agriculture production mainly depends on natural factors in comparison with the products of non-farming industries. Flood, drought, epidemics, etc all affect the yield of agriculture directly or indirectly without any warning at any time. Yield fluctuation is different some regions as compared to others. For example, tropical regions are more prone to yield uncertainty than temperate areas. Moreover, the yield of some crops, such as cotton, is more variable than that of others like wheat. The quality of raw material or variation in raw material used by the farmers can also affect the final crop production yield.

(2) Price uncertainty - uncertainty also exists about the prices of agricultural products. The degree of price uncertainty is greater in agriculture as compared to other non-form industries. The main reason for that non-farm industries measure weather-generated price fluctuations and monopolistic market structure. Generally, farmers operate in a respect to a competitive market structure, therefore they are price takers and not price makers. Some outside features that affect the prices are (a) weather-induced random fluctuations in output. (b) the behaviour of other farmers taken together. (c) Fluctuation in national income. In the case of industry, it is easier to adjust the supply of its product to change in demand when compared with agriculture. Price is an exogenous or uncontrolled variable so prices fluctuate in the economy from time to time and that fluctuations affect individual farmers in the economy.

(3) Input price/quality uncertainty – generally price of capital inputs is costly, therefore farmers react to capital inputs prices uncertainty by postponing the purchase of such capital inputs. This type of uncertainty also exists in the farmers with regard to the prices and quality of inputs. The cost of resources used in production is unpredictable or varies from

time to time. Changes also impact the decision, and fluctuating input prices affect production costs.

(4) Tenurial uncertainty– we know that land is generally leased out to tenants. The taught (farmer) does not know how long we will be able to retain the land in his possession. Therefore, he will hesitate to make long-term investments in land.

(5) Institutional uncertainties – this type of uncertainty often results in non-availability of resources in appropriate quantities, time and place. Institutions like government, banks, etc. may also cause uncertainties for an individual farmer.

(6) Economic uncertainty – economic uncertainty of this nature is usually caused by national and international policies that are beyond the approach of an individual farmer. Some economists have suggested six, indicating uncertainty. There is price uncertainty, production uncertainty, technology uncertainty, political uncertainty, personal uncertainty and people's uncertainty

(7) Political uncertainty – refers to the uncertain political condition in the country. Sometimes the government's vague policy about land reforms and other institutions may create (political uncertainty.

(8) Personal uncertainty exists due to some mishaps in the farmer's household or in his permanent labour force.

(9) People's uncertainty refers to the relationships of the farmer with other persons. Those reasons include labourers (both family, hired, bankers, landowners, and neighboring farmers.

7.4 Types and sources of risks in agriculture

There are various types of risks that already exist in the agriculture sector. The following types of risk can often depend on the farming system.

1) Production risk - agriculture production is based on biological factors so agriculture depend on nature. That risk comes from the unpredictable nature of the weather and uncertainty about the performance of crops. Weather risk and technical risk are also included in production risk. Change in weather conditions leads to a change in production is a weather risk. For example, vagaries of monsoon, input-pest attacks.

2) **Price risk**- changing prices in the market (for both input suppliers and output sales) may become a source of risk for the farmer. for example, price fluctuations and availability of

inputs like labour, seeds, fertiliser, and plant protection chemicals. Price uncertainty is more relevant because of the inherent volatility of the agriculture market due to demand fluctuations. An unpredictable change in price can affect a farmer's income, costs and overall financial performance. If demand for commodities decreases or there is an over-supply, then farmers face the risk of lower crop prices in the future. The nature of price risk varies significantly from commodity to commodity.

3) **Institutional risk**- institutional risk is another source of risk for farmers ; change in government rules and policies become the source of risk. For example, subsidy and taxation changes, ban on export of agricultural commodities, etc., complex land ownership regulations and inefficient land tenure system can impact farmers' ability to farm effectively. tariffs and international trade agreements, and changes in food quality regulation, can affect export-oriented agriculture businesses.

4) **Financial risk**- various reasons lead to financial risk. Financial risk may arise due to a change in the rate of interest, a change in repayment plans drawn by banks, change in the institution's policy. Financial risk results when the farmer borrows money and creates an obligation to repay debt. Financial risk increases with increased amounts of borrowed money. Restricted credit availability to the farmer leads to financial risk. Source of financial risk- inflation, change in exchange rate, and difficulty in marketing products.

5) **Business risk**- the aggregate effect of production, market, institutional and personal risk is called as business risk. business risks are the risks facing the firm independently of the way in which it is financed.

6) **Personal risk**- personal risk refers to factors such as problem with human health or personal relationships that can affect the farm business. It includes accident, illness, death and divorce.

7.5 MEASURES TO REDUCE RISK AND UNCERTAINTY – MEASURE AT THE FARM LEVEL

The various measures generally used to counter risk and uncertainty in agriculture are as follows.

(a) Flexibility – the farmer may use the technique of flexibility for minimizing the impact of uncertainty. Flexibility means that farming system is so arranged in which farmer can move from one enterprise to another if economic condition make this shift desirable and helps in obtaining advantage. Heady says "flexibility is the avoidance of rigid production method". In

case of flexibility if farmer wants reduce to uncertainty then they should be adopted multi-product enterprise. There are different forms of flexibility in agriculture. Some of these are as follows:

- **Time flexibility** – farmers should adopt short-lived farm structures as productive assets rather than longer ones. For example, an orchard plantation is a relatively more rigid enterprise than annual crops like wheat, maize, paddy, etc. Farmers use bamboo instead of steel to construct the poultry shed.
- **Product flexibility** – production of short-duration crops instead of long-duration crops will ensure greater flexibility in production. In this flexibility, we consider the form of physical resources, e.g. machines, farm structure, etc. Production of annual crops will ensure greater flexibility than that ensured by fruit production.
- **Cost flexibility** – cost flexibility refers to variation in output within the structure of a plant with a longer life. Farmers can purchase only the services of the permanent assets rather than purchasing them themselves.
  It may be noted that flexibility only method to reduce the impact of such an uncertain event.

(b) Diversification – diversification is a very important, useful and popular method to safeguard against uncertainty in agriculture. Diversification means that farmers can choose several farm of enterprises simultaneously to avoid the danger of uncertainty. Here we refer to diversification as a means of stabilising the income of the farmers and reducing the variation in his aggregate income (because the price of all products may not vary in the same direction simultaneously). For example, if the return from one product is low, return from another product might be high enough to compensate for loss. It may note that diversification can effective only if the yield of the product bear proper correlation

(c) Capital rationing – capital rationing means to maintain the flow of capital to an enterprise. Even when the return, it is quite high. Farmers might have various viable project e.g. irrigation system, improved seeds, new equipment) but cannot attend to implement a farm. Capital rationing is quite common in agriculture. For example; it has often been noted that the marginal return to labor is below in comparison to the industry sector, where people move out of agriculture to the capital sector. Until the marginal product of each labor became the same in each sector and in this situation, efficient allocation of resources would be obtained.

(d) Contract farming – Contract farming is another measure to reduce uncertainty among farmers. Contracts may either be in money or in kind. On the other hand, share cropping is a good example forward contract in kind. It involves contractual agreements in terms between the farmers, manufacturing firms and input supplier's Through this agreement, farmers also establish a useful link with manufacturing firms. Through this method, the farmer is fully able to protect against price uncertainty. For example, an agreement on crop and cost sharing can reduce the impact of yield and price uncertainty for a tenant farmer.

(e) Maintaining reserve- this is another form of flexibility to reduce uncertainty. Maintenance of food reserves may also be helpful at times; maintenance of extra multipurpose equipment is also a measure to reduce uncertainty.

(f) Selective of enterprises with low variability- there are certain enterprises where the yield and price variability are much lower than others. This inclusion of enterprise with low variability in the farm plan provides a good way to safeguard against risk and uncertainty.

(g) Choice of reliable enterprise- farmers know that the yield from certain enterprises is more stable than from others. For example, cereal yield is generally less variable than the yield from root crops.

- **Intercropping** – it also provides an opportunity to grow short-duration crops along with long-duration crops. This minimises competition for soil nutrients and maximizes the use of soil moisture, sunlight, etc. Intercropping can lower yield risk because of lower incidence of insects as well as disease.
- **Sharecropping** – sharecropping helps to minimise risk in production. Share-cropping is more beneficial, particularly when the tenant is a small farmer. The Advantage of share-cropping is that they raised their social status, received 1/3 to ½ of crop when harvested, Raised their self-esteem.

We have explained above the various measures to reduce risk and uncertainty at the farm level. Diversification, flexibility, capital rationing: we must note that all these measures are based on the pattern of resource use. Through these measures farmers can adopt more efficient Resources use patterns. Diversification method means inclusion of unremunerative crops in the crop pattern.

1.7 PUBLIC POLICY OR MEASURES TAKEN BY GOVERNMENT TO REDUCED RISK AND UNCERTAINTY –

Now we will discuss the various steps taken by the government to reduce risk and uncertainty.

A. Crop insurance – it is a financial assistance, which minimises the loss by distributing the loss burden. Crop insurance protects against the uncertainties of crop production due to natural factors. Through crop insurance, farmers can transfer their larger risk to crop insurance agencies. Crop insurance can be of various types. It can be:

(a) insurance for specific crops,

(b) insurance for all crops taken together,

(c) voluntary crop insurance

(d) compulsory crop insurance.

Insurance can be based on two approaches:

(1) an individual approach

(2) an area approach.

In India till recently, the various crop insurance schemes have been started by the government of India. The Government of India had appointed an expert committee under the chairmanship of Dr. Dharam Narain to examine the desirability of introducing crops in India.

B. Comprehensive crop insurance scheme – in 1985 comprehensive crop insurance scheme was introduced with the active participation of the state government. The main objective of the scheme was to protect the farmer against the losses suffered by them due to crop failure on account of natural calamities such as cyclone, flood, hailstorm, fire, disease etc. under the scheme farmer take loan from cooperative societies, regional rural bank and commercial bank for growing wheat, rice, millet, oil seeds etc. in 1999, the government replaced the comprehensive crops insurance scheme by other scheme called "national agricultural insurance scheme". This scheme covers all farmers large or small, loanees or non-loanees, and also food crops as well as horticultural and annual commercial crops and oil seeds. At present this scheme is implemented by the agricultural insurance company of India Ltd.

C. Pradhan mantri fasal bima yojana – this new agriculture scheme is in line with the one nation one scheme theme. The objective of this scheme is to provide insurance

coverage and economic support to the farmer in the case of failure of any of the notified crops as a result of natural calamities and stabilize the income of the farmer.

D. **Pilot scheme or seed crop insurance** – it was introduced in the 2000 kharif season in eleven states. The objective of this scheme to provide stability to infrastructure state-owned seed corporations. This scheme provides financial security and income stability to the seed grower in the event of failure of the seed crop.

(2) Buffer stock scheme – the buffer stock scheme also aims to remove price uncertainty. In this method, the buffer stock authority (government agency) purchases stocks of agricultural commodities in a year of bumper crops and uploads these agricultural commodities into the market to deal with price fluctuations in the future. It is essential for the buffer stock authority to maintain the balance between commodity purchases and sales over a period of time. The buffer stock operating agency must fix the judicious price and lie between the ceiling and floor prices. If the ceiling price is relatively low and the floor price is high, then the degree of stabilization would be achieved. It is also necessary that the larger the number of commodities, larger will be the need for funds, for storage capacity, for administration setup, etc to run the scheme efficiently. The buffer stock scheme will be more successful if price changes both upward and downward movements rather than unidirectional.

(3) Guaranteed agricultural prices – under the system of guaranteed prices, the Indian government introduced minimum support price (MSP) for major food-grains in advance of the sowing season for mitigating price uncertainty. The objective of a guaranteed minimum price to ensure that farmers remove their price uncertainty. A variant of the guaranteed minimum price is the guaranteed price range. It should fluctuate between a clearly specified floor and ceiling level. In the U.S.A., for example, legislation provides a system of guarantees for a wide range of farm products such as cotton, wheat, maize, rice, honey, milk, and groundnuts. Generally, these price lies within a certain percentage of the 'parity prices'.

(4) Rainfall insurance scheme – the Agriculture Insurance Company of India Ltd introduced an insurance scheme known as 'varsha bima' in 2004 during south west monsoon period. The objective of this scheme to protect the farmer in the rain-fed region against failure of rainfall.

(5) Farm credit package – to improve the flow of credit and manage the financial risk and uncertainty of farmer, the government started farm credit package programme in June 2004 to double the flow of agricultural credit. Kisan credit card scheme was introduced in 1998-99 to meet the basic credit requirements such as cultivation, post-harvest expanses, provide working

capital for maintain etc.

we have explained above the various measure taken by the government to reduce risk and uncertainty. Except that, some other measure like better irrigation facilities can reduce the uncertainty caused by uncertain rainfall and the development of drought and disease-resistant crop can be another step to reduce uncertainty. Fixation of fair rent is another measure to ensure stability with regard to tenurial arrangements. it may be noted that these measures will never be able to eliminate the uncertainty in agriculture completely, but their impact will be considered to reduce uncertainty among farmers.

(6) Risk management strategies in agriculture-in discussing how to design appropriate risk management policies, it is useful to understand strategies and mechanisms used by producers to deal with risk. Risk management strategies are divided into two mechanisms: one is informal and the other is formal. Informal strategies involved diversification of income sources and choice of agricultural production strategy. Traditional cropping systems in many places rely on crop diversification and mixed farming. Crop diversification and intercropping systems are meant to reduce the risk of crop failure due to adverse weather conditions, crop pests or insect attacks. Crop sharing arrangements in land renting and labour hiring can provide an effective way of sharing risks between individuals. In community-level risk pooling strategies, members of the group transfer resources among themselves in order to rebalance marginal utilities. Second, formal risk management strategies can be classified as publicly provided or market-based. Government actions play an important role in risk management and uncertainty. The government also reduces the impact of risk by developing relevant infrastructure and by adopting social schemes. Crop insurance is a mechanism to protect farmers against the uncertainties of crop production due to natural factors beyond farmer control. Crop insurance gives farmer's greater confidence in making greater investments in agriculture. Contract marketing is an important price risk in a mitigation tool. Recent experience in the use of climate information in the country to anticipate and manage risks in agriculture, provide useful insights. So good management is the only way to avoid uncertainty and risk and can also maximize opportunities. These strategies should not only be about managing risk damages resulting from hazards but also the process and procedures that empower the individual or a group to take risks.

7.6 SUMMARY

Agriculture is a dominant sector of our economy. Agriculture sector also deals with risk and uncertainty. In India, the agriculture sector is exposed to a variety of risks and uncertainty which occurs with high frequency. These include climate variability, frequent natural disasters,

uncertainties in yield and prices, weak rural infrastructure, imperfect markets and lack of financial services. The enterprise of agriculture is subject to a great many uncertainties. The biological nature of the agriculture sector is responsible for these uncertainties like floods, droughts, epidemics etc. Uncertainty also exists with regard to the prices of agricultural products. The major risks in an agrarian economy are due of wide fluctuations in yield and prices. Specific adverse agro-climatic conditions contribute to the production risk of individual crops, both in irrigated and unirrigated areas. Production risks are exacerbated by price risk, credit risk, technological risk and institutional risk. Another risk related to changes in the price of agricultural input products, fertilizer prices, changes in policies and regulations, not within the control of the farmers. Weaknesses of agriculture marketing system and infrastructure too contribute to the farmer's risk in prices/ income realizations.

To achieve satisfactory management in agriculture and minimize losses, it is necessary to manage all these risks and uncertainties properly. We have explained above that the various measures at the farm level or step taken by the government to reduce risk and uncertainty in agriculture. In India till recently, there are various scheme started y government like MSP, crop insurance, Pradhan Mantri Fasal ima yojna, buffer stock scheme etc to reduce the uncertainties among farmers. Flexibility, diversification, and contract farming is various measure at farm level to reduce risk and uncertainty.

7.7 QUESTIONS FOR PRACTICE

A. Short-answer type questions

Q1. What is risk? write down two types of risk.

Q2. What is uncertainty?

Q3. Distinction between risk and uncertainty?

Q4. Explain the various types of risk?

Q5. Explain the concept of crop insurance.

Q6. Briefly explain the various measures at the farm level to reduce risk and uncertainty.

Q7. Explain the steps taken by the government to reduce risk and uncertainty.

Q8. Briefly explain risk management strategies in agriculture?

Q9. What is contract farming?

Q10. Briefly explain the concept of risk and uncertainty in agriculture?

B. Long-answer type questions

Q1. What is risk and uncertainty in agriculture? Discuss the various measures to reduce risk and uncertainty in agriculture.

Q2. Distinction between risk and uncertainty? Explain the different types of risk and uncertainty in agriculture.

MASTER OF ARTS (ECONOMICS)

SEMESTER III

ECONOMICS OF AGRICULTURE

UNIT 8: INSTABILITY IN AGRICULTURE: TYPES AND MEASURES FOR REDUCING INSTABILITY FOR AGRICULTURE

STRUCTURE

8.0 OBJECTIVES

After studying this unit, learners will be able to:

- Define agricultural instability
- Differentiate clearly between production, price, and income instability
- Causes of Agricultural Instability
- Types of Agricultural Instability
- Measures to Reduce Instability

8.1 INTRODUCTION

The agricultural sector serves as the economic backbone for a significant portion of the global population, particularly in developing economies like India. Despite its strategic importance, the sector is perpetually characterized by high volatility, often summarized by the phrase: "Agriculture is a gamble with nature." This inherent instability refers to the frequent, large, and unpredictable variations in agricultural outcomes—be it the quantum of output, the prices realized in the market, or the final income earned by the farmer—from one season or year to the next.

Agricultural instability refers to the fluctuations in agricultural production and income over time, which can affect the livelihood of farmers and the overall economy. These fluctuations may occur due to various factors such as unpredictable weather conditions, pests and diseases, price volatility, and changes in government policies. Unlike industrial production, agricultural output is highly dependent on natural conditions, making it inherently uncertain. This instability can lead to periods of surplus and shortage, affecting food security, farm incomes, and rural employment. Managing agricultural instability requires effective planning, use of modern technology, crop diversification, irrigation facilities, and supportive government interventions like minimum support prices and crop insurance schemes.

This instability presents a difficult challenge to policymakers. For the farmer, it means determined risk, debt, and poverty; for the consumer, it leads to volatile food prices and food insecurity; and for the national economy, it translates into inflationary pressures and unpredictable growth cycles.

While technology (like irrigation and high-yielding seeds) has significantly reduced the severity of chronic instability observed in the pre-Green Revolution era, the problem persists in a different

form. Contemporary instability is less about widespread famine and more about acute income instability driven by market mechanisms and localized weather extremes.

8.2 CAUSES OF AGRICULTURAL INSTABILITY

Understanding the problem requires isolating the structural factors that make agricultural outcomes inherently volatile compared to, say, car manufacturing or software development. These factors can be grouped into biological, economic, and institutional causes.

1. Natural Factors

a) Monsoon Dependency: 60–65% of cropland in monsoon-dependent nations like India is rain-fed. Rainfall that is too much, too little, or delayed causes droughts or floods, which interfere with agricultural output.
b) Climate Uncertainty: Unexpected rainfall, heat waves, cyclones, hailstorms, and seasonal changes all harm standing crops and weaken their stability.
c) Diseases and Pests: Abrupt yield losses are caused by agricultural diseases and insect infestations (such as locusts and bollworms).
d) Issues with the Soil: Decreased fertility, salinity, alkalinity, and erosion lower land productivity and cause yield volatility.

2. Production Constraints

Agricultural production is governed by biological time lags and spatial heterogeneity, making centralized control and quick adjustment virtually impossible.

a) Dependence on Fixed Natural Factors: Land, the main agricultural input, is limited and fixed geographically. Moreover, sunlight and water (rainfall), the two most important secondary inputs, are totally reliant on uncontrollable weather conditions. This stands in stark contrast to industry, where inputs can be sourced internationally or controlled (for example, factory temperature). The main structural cause of instability in India is the country's reliance on the extremely unpredictable South-West Monsoon.
b) Time-bound and irreversible Production: In the near term, the biological process that produces a crop is irreversible once it is sown. A farmer cannot convert to making, say, computers if wheat market prices abruptly decline in the middle of the growing season.

The supply curve in agriculture is therefore extremely inelastic in the short run. Furthermore, the entire output for a year is often harvested in a very short period (the harvest season), leading to a massive, momentary influx of supply into the market, which strains storage and pricing mechanisms.

c) Pests, Diseases, and Biological Multiplicity: Because agricultural production involves so many living things, pests, plant diseases, and animal epidemics have the potential to quickly and extensively destroy the entire process. Non-biological production systems hardly ever encounter this kind of danger. A pest outbreak can wipe out large tracts of crop regardless of human intervention.

3. Economic and Market Causes

a) Price Fluctuations: Prices of agricultural products fluctuate due to inelastic demand and perishable nature of goods. Farmers often sell at throwaway prices during bumper harvests.

b) Rising Input Costs: Seeds, fertilizers, pesticides, electricity, and diesel prices rise frequently, disturbing farmers' cost–benefit balance.

c) Small and Fragmented Land Holdings: Limits mechanization and makes farming less profitable and riskier.

d) Market Imperfections: Poor storage, lack of transport, and dependence on middlemen increase farmers' vulnerability.

4. Institutional and Global Factors

Factors beyond the farm gate, such as policy and global trade, also generate instability.

a) Trade Policy: Sudden changes in export/import duties, bans, or global commodity price fluctuations (driven by speculative funds or geo-politics) can transmit global price volatility directly to domestic markets.

b) Credit Structure: A lack of timely, affordable institutional credit forces farmers to rely on informal, high-interest loans. When crop failure or price crash occurs, this debt amplifies the resulting income instability, leading directly to farm distress.

c) Inadequate Credit: Farmers often depend on moneylenders charging high interest, creating debt traps and reducing investment capacity.

d) Uncertain Government Policies: Frequent changes in procurement prices, subsidies, and export-import rules create uncertainty in production planning.

e) Weak Insurance Coverage: Crop insurance schemes are either absent, expensive, or ineffective, leaving farmers exposed to risk.

f) Poor Infrastructure: Inadequate irrigation, cold storage, warehouses, and transport facilities aggravate instability.

5. Socio-Political Factors

a) Rural Indebtedness: Mounting debts reduce the capacity of farmers to invest in better inputs and technologies.
b) Tenancy and Land Relations: Sharecroppers and tenants lack security of tenure, discouraging long-term improvements.
c) Labour Migration: Out-migration of agricultural workers to cities creates labour shortages during peak sowing and harvesting seasons.
d) Social Unrest: Farmers' agitations, protests, and local disputes sometimes disrupt production and marketing.

6. Technological Factors

a) Uneven Adoption of Technology: Green Revolution benefits were concentrated in certain regions, creating regional disparities in productivity.

b) Low Mechanisation: Heavy reliance on manual labour reduces efficiency and increases production risks.

c) Seed and Input Constraints: Lack of timely supply of high-yielding seeds, fertilizers, irrigation facilities, and machinery leads to uncertain productivity.

8.3 TYPES OF AGRICULTURAL INSTABILITY: ANALYSIS

Instability is not a monolithic concept; it is essential to analyze the three forms sequentially, as they represent a causal chain:

Production → Price → Income

8.3.1 PRODUCTION (YIELD/OUTPUT) INSTABILITY

Production instability is the most fundamental type, measured by the extent of deviation of actual output from the long-term trend output.

1. **Measurement**: Statistically, production instability is often measured using the Coefficient of Variation (CV) of output or yield over a period of time, adjusted for trend:

$$CV=\mu/\sigma\times100$$

Where σ is the standard deviation of yield and μ is the mean yield. A higher CV indicates greater instability.

2. **Consequences**: High production instability complicates national economic planning:
    - Buffer Stock Management: Governments struggle to predict required procurement volumes, leading to expensive storage and periodic stock depletion/excess.
    - Infrastructure Stress: Transport, storage, and processing infrastructure is strained during bumper harvests and remains idle during years of deficit.
    - Input Demand Volatility: The demand for fertilizers, seeds, and farm machinery fluctuates violently, making investment decisions difficult for supporting industries.

8.3.2 PRICE INSTABILITY

Price instability is a direct consequence of production instability interacting with market inelasticities.

1. **Short-Run vs. Long-Run Volatility:**
    - **Short-Run:** Driven by immediate supply shocks (e.g., unexpected rain during harvest). This is often acute and highly localised.
    - **Long-Run:** Driven by structural factors like the Cobweb effect, policy shifts, or changes in global prices.

2. **Impact on Economic Efficiency:**

Price volatility is detrimental to efficient resource allocation:

- **Sub-optimal Investment:** When prices are highly unpredictable, farmers are reluctant to invest in productivity-enhancing assets (like pumps, tractors, or advanced seeds), hindering long-term growth.
- **Consumer Welfare:** High food price volatility is regressive; the poor spend a larger proportion of their income on food, making them extremely vulnerable to price spikes (food inflation).

8.3.3 INCOME INSTABILITY

Income instability (Instability) is the most critical measure, as it directly reflects the welfare of the farming community. Farm income (I) is fundamentally volatile because it is the product of two volatile variables, Quantity (Q) and Price (P), which move inversely.

$$I=Q\times P-C$$

Where C is the cost of cultivation.

1. The Paradox of Plenty (High Q, Low P):

A good monsoon leads to high output (high Q). However, due to inelastic demand, prices plummet (low P). If the percentage drop in P is greater than the percentage increase in Q, the farmer's gross revenue (Q×P) falls. Since the cost (C) is already incurred, the net income (I) suffers. The farmer is penalized for his success.

2. The Misery of Failure (Low Q, High P):

A drought leads to low output (low Q). Prices skyrocket (high P). But because the farmer has little or nothing to sell, the high price is irrelevant, and net income falls drastically. The farmer has not only lost the crop but also the investment (C).

Income instability perpetuates the vicious cycle of rural poverty. When income is unstable, debt accumulation becomes common, asset creation ceases, and farmers resort to short-term, unsustainable agricultural practices to survive.

8.4 MEASURES TO REDUCE AGRICULTURAL INSTABILITY

The first line of defense against instability lies in stabilizing the production base. These measures address the inherent biological uncertainty.

A. WATER RESOURCE MANAGEMENT AND IRRIGATION

The expansion of assured irrigation is arguably the single most important factor in reducing yield instability.

- Large and Medium Projects: Although they are costly and time-consuming, extensive canal systems offer dependable water. Water management and fair distribution are essential to their effectiveness.
- Micro-Irrigation: It is essential to promote sprinkler and drip irrigation systems. These are technologically better to traditional flood irrigation because they buffer localized, brief dry spells much more efficiently, conserve water (up to 70% efficiency), and provide targeted water supply.
- Watershed Development: In dryland and rain-fed regions, techniques such as contour bunding, farm ponds, and check dams are crucial for collecting and storing rainfall, replenishing groundwater, and reducing the damage caused by flash floods.

B. AGRICULTURAL RESEARCH AND DEVELOPMENT (R&D)

R&D interventions focus on enhancing the intrinsic robustness of the crop.

- Creating crop types that can withstand several shocks rather than just one is known as "breeding for resilience." This comprises cultivars that can withstand the following:
    a) abiotic stresses: soil salinity, heat, cold, and drought.
    b) Biotic Stresses: Serious pests and viral and fungal illnesses.
- Early-maturing cultivars: These cultivars shorten the crop's exposure to environmental hazards. A crop's risk exposure is reduced if it can be harvested before the month with the highest drought.
- Climate-Smart Agriculture (CSA): Using technology to modify agricultural methods. Promoting conservation or zero tillage techniques, which preserve soil moisture and lower carbon emissions, is one way to do this while also boosting resilience.

C. FARM MANAGEMENT AND DIVERSIFICATION

Farmers must be incentivized to spread their risks across different activities.

- Crop diversification: moving away from monoculture, which relies only on wheat or rice, and toward a variety of high-value crops, such as oilseeds, pulses, fodder, and horticulture and floriculture. A crop's disease-related failure can be offset by another crop's success, balancing out revenue sources.
- Integrated Farming Systems (IFS): Combining the production of crops with related pursuits such as apiculture, dairy, poultry, or fishing. This minimizes income instability and greatly lessens reliance on a single harvest season by generating a steady cash flow all year round.
- Post-Harvest Technology: Post-harvest losses, which frequently represent a type of man-made instability, can be decreased by straightforward measures like better drying methods, on-farm sorting**, and limited processing (such as creating chips from extra potatoes).**

D. WEATHER AND MARKET INFORMATION SYSTEMS

Timely information is a powerful tool against uncertainty.

- **Customized Weather Advisories:** Issuing hyper-local, actionable weather forecasts (based on remote sensing and GIS) delivered directly to farmers' mobile phones. For example, advising them not to spray pesticides if heavy rain is expected within 24 hours.
- **Market Intelligence:** Providing real-time price data from various mandis (markets) helps farmers decide when and where to sell, counteracting the informational asymmetry exploited by middlemen.

8.5 MEASURES TO REDUCE INSTABILITY: ECONOMIC AND POLICY STRATEGIES

Technological measures stabilize yield; policy measures stabilize prices and income. These interventions are crucial for tackling the inherent **market inelasticity**.

8.5.1 PRICE SUPPORT AND PROCUREMENT OPERATIONS

The foundation of income stability policy in many countries, including India, rests on the **Minimum Support Price (MSP)** mechanism.

A) Mechanism: MSP is a predetermined price, announced before the sowing season, at which government agencies (like FCI) commit to purchase any quantity offered by the farmer.

B) Impact on Instability:

- It acts as a safety net, preventing prices from falling below the cost of production during years of bumper harvest (preventing the 'Paradox of Plenty').
- The procurement process creates buffer stocks, which can be released through the Public Distribution System (PDS) during deficit years, stabilizing consumer prices and containing food inflation.

C) Operational Challenges and Limitations:

- **Limited Coverage:** MSP is effectively operational only for rice and wheat in a few select states, leaving producers of pulses, oilseeds, and fruits/vegetables highly exposed to price volatility.
- **Procurement Stress:** Managing massive buffer stocks leads to high carrying costs, storage losses, and sometimes limits on procurement quantity, undermining the MSP guarantee.
- **Distortionary Effects:** It can incentivize over-production of the supported crops (e.g., water-guzzling rice in water-scarce regions), creating regional and environmental imbalances.

8.5.2 CROP INSURANCE

Crop insurance shifts the financial risk associated with natural disasters from the farmer to a financial institution (and the government).

- **Pradhan Mantri Fasal Bima Yojana (PMFBY):** This is a key government intervention designed to provide comprehensive risk cover from pre-sowing to post-harvest.

8.5.3 MARKET REFORMS AND INSTITUTIONAL DEVELOPMENT

Reducing the instability caused by middlemen and fragmented markets is critical.

- Electronic National Agriculture Market (e-NAM): This platform seeks to establish a single national market by linking physical mandis (markets) throughout states. This ensures that the farmer receives a price that reflects national demand rather than just local demand by boosting competition and price discovery.
- Contract farming: This entails pre-season contracts for product at set pricing between farmers and corporate customers (processors/exporters). By doing this, price volatility for the

contractual quantity is essentially eliminated, freeing the farmer to concentrate only on managing yield.

- Farmers are able to deposit their produce in approved warehouses and receive loans secured by the warehouse receipt thanks to warehouse receipt financing. This allows them to select the best selling period by removing the pressure to sell right after harvest, when prices are at their lowest. This addresses the glut-induced short-term pricing instability.

8.5.4 CREDIT AND DEBT MANAGEMENT

Stabilizing the financial environment prevents the conversion of production or price shocks into catastrophic debt crises.

- Universal Banking Access: Providing institutional finance to all farmers in order to lessen their dependency on unscrupulous private moneylenders.
- Debt Relief: Although frequently contentious, certain debt relief measures (connected to catastrophic loss situations) may be required to end the intergenerational debt cycle brought on by persistent income volatility.

8.6 SUMMARY

Due to the industry's distinct reliance on unpredictable weather conditions (biological risk) and the ensuing market expansion brought on by inelastic supply and demand (economic risk), agricultural instability is a recurring problem. We divided this instability into three categories: price instability, which results from the interaction of production shocks and market inelasticity; production instability, which is brought on by weather or pests; and income instability, which has a direct effect on farmer well-being.

Strategies for mitigation must be two-pronged. Reducing the basic risk in production is the goal of technological measures like CSA, diversification, hardy seeds, and irrigation. Economic and Policy Measures (MSP, buffer stocks, e-NAM, and crop insurance) aim to manage the market risk and stabilize income streams. While MSP and procurement provide crucial floor prices, modern tools like crop insurance and market reforms are essential for transferring risk and improving efficiency. Achieving sustainable stability requires integrating these measures into a cohesive, ex-ante risk management framework that empowers the farmer financially and technologically.

8.7 KEY WORDS

- **Inelastic Demand/Supply:** A condition where the quantity demanded or supplied changes very little, even with a large change in price.
- **Coefficient of Variation (CV):** A statistical measure of relative variability, often used to quantify yield instability.
- **Minimum Support Price (MSP):** A guaranteed minimum price set by the government to protect the farmer against price crashes.
- **Pradhan Mantri Fasal Bima Yojana (PMFBY):** India's major scheme for transferring agricultural production risk via insurance.
- **e-NAM:** Electronic National Agriculture Market, a Pan-India electronic trading portal for farm produce.

8.8 QUESTIONS FOR PRACTICE

A. Short Answer Type Questions:

Q1.Explain the reason of instability through Production Constraints.

Q2.What do you mean by Production (Yield/Output) Instability?

Q3.Explain the term Price Instability.

Q4.Elaborate Income Instability.

Q5.Define technological and management strategies.

Q6.What are the economic and policy strategies?

Q7.Explain price support and procurement operations.

B. Long Answer Type Questions:

Q1.Explain the various causes of agricultural instability.

Q2.What are the types of agricultural instability?

Q3.Explain the measures to reduce instability.