PERIYAR UNIVERSITY

NAAC 'A++' Grade with CGPA 3.61 (Cycle - 3)

NAAC A++ Grade – State University – NIRF Rank 56, State Public University Rank 25.

SALEM - 636 011

CENTRE FOR DISTANCE AND ONLINE EDUCATION

(CDOE)

M.A. ECONOMICS

SEMESTER - I

AGRICULTURAL ECONOMICS

(Candidates admitted from 2025 onwards)

PERIYAR UNIVERSITY

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)

2025 admission onwards

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CENTRE FOR DISTANCE AND ONLINE EDUCATION

PERIYAR UNIVERSITY
SEMESTER – I

ELECTIVE – I (3)

23UPECO1E03 AGRICULTURAL ECONOMICS

Course Objectives

1. To provide knowledge base on the features and issues of Agriculture.
2. The course enables the students to understand and evaluate the cropping pattern in an Economy

Unit I: Agricultural Economics

Introduction, Scope and Significance of Agricultural Economics- Inter-Sectoral Linkages – Production Function Analysis - Relevance to Farm Production Economics- Productivity Trends; Low production and Productivity: Causes, Consequences and Measures- Farm size, productivity and efficiency in Indian Agriculture-A.K. Sen's Hypothesis- Role of Technology in Agriculture - Structural Changes in Agriculture.

Unit II: Agricultural Labour

Agricultural Labour: Definition and Characteristics – Rural Labour Market- Rural Unemployment: Types, Consequences and Remedial Measures- Agricultural Wages in India – Male -Female Wage Differentials.

UNIT III: Agricultural Prices and Finance

Agricultural Prices-Reasons for Fluctuations in Prices-Procurement /Support Prices-Minimum Support Price - Buffer Stocks- Commission for Agriculture Cost and Prices: objectives, functions and role in stabilization of Agriculture Prices-Commodity Markets-Agricultural Finance: Meaning, Types, Sources- and Commercial Banks and NABARD- Farm Capital - Meaning, Types, and Marginal Efficiency of Farm Capital and Capital formation in Agriculture

Unit IV Information Technology and Agriculture

Role of Information Technology and telecommunication in marketing of agricultural commodities – Weather Forecasting- electronic auctions- Digital Mandi -Kisan Call Centres -e- Choupal- Use of Geographic Information System and Global Positioning System- Remote Sensing and Drones

Unit V: Globalisation and impact on Agriculture

Role of MNCs- Globalisation of Indian Economy: Problems and Prospects of Indian Agriculture- Impact of WTO on Indian Agriculture- Agreement on Agriculture (AoA) -WTO Agriculture Subsidies Boxes and Criticisms.

Learning Resources Textbooks

Subba Reddy S, Raghu Ram P, T.V Neelakanta Sastry and I. Bhavani Devi (2019) Agricultural Economics, Second Edition, Oxford & IBH Publishing Co Pvt. Ltd

Dantwala M.L (ed) (1991), Indian Agricultural Development since Independence (Oxford and IBH Publishing company private limited, New Delhi).

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Barkley, A., & Barkley, P. W. (2016). Principles of agricultural economics. Routledge.

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UNIT – I

Agricultural Economics

Introduction

Agricultural economics is the study of how resources are allocated, distributed, and employed in farming, as well as the commodities that are produced. Since a steady level of farm surplus is one of the sources of technological and commercial expansion, agricultural economics is relevant to the economics of development. Generally speaking, average earnings are low in nations where a sizable portion of the populace makes their living from agriculture. The fact that the majority of a nation's population works in agriculture does not necessarily indicate that the nation is impoverished; rather, it is more accurate to state that the majority of a nation's citizens must depend on agriculture for a living.

The field of study that connects economics and agriculture is called agricultural economics. In this applied stage of the social science of economics, all facets of issues pertaining to agriculture are examined. It would be appropriate to define agriculture and economics independently before defining agricultural economics as a whole.

Describe agriculture

For many years, agriculture has been linked to the production of staple food crops. As long as farming remained mostly subsistence-based and uncommercialized, agriculture and farming were interchangeable terms. However, food and fibre production is now only one aspect of scientific agriculture following the commercialization of the agricultural industry. The scope of modern agriculture has expanded significantly. In addition to crop production, it encompasses forestry and animal husbandry. Nowadays, it's common practice in the agricultural industry to market, process, and distribute agricultural products. In addition to the agricultural production system, all businesses that supply farmers with manufactured inputs and all businesses

that transform raw agricultural commodities into consumer-desired food and fibre items.

What is Economics?

Originating from the Greek words "Oekos" (a house) and "nomos" (to manage), the word "economics" refers to the management of a household. Overseeing domestic chores is one of the housewife's responsibilities. Making the best use of the resources at her disposal is one of the housewife's responsibilities. Later, the idea was applied to society's utilization of resources to meet its requirements as well as to family resources. varied authors have given the phrase varied definitions. Economics was referred to as the "Science of wealth" by previous economists. Adam Smith described economics as "an inquiry into the nature and causes of the wealth of nations" in his book "Wealth of Nations" (1776).

Marshall claimed that economics was "a study of wealth on the one hand and a part of the study of man on the other and more important side." According to Marshall, wealth is the "material requisites of wellbeing" that provide people the wherewithal to live comfortably and enjoy life. "Economics is the study of how men and society chose, with or without the use of money, to enjoy scarce productive resources that could have alternative uses to produce various commodities over time and distribute them for consumption now and in the future among various people and groups of society," according to a growth-oriented definition of economics provided by contemporary economists.

Agricultural Economics

We can now describe agriculture economics after talking about the definitions of agriculture and economics individually. A very basic definition of agricultural economics would be an applied branch of economics that focuses on all facets of issues pertaining to agriculture. It is a social science that deals with the distribution of limited resources among the uses related to the production, processing, and consumption of farm products. It assists the farmer in

choosing what type of food to produce, which crop to grow to maximize his profile, and at what level to price his products. According to Prof. Gray, "agriculture economics may be defined as the science in which the principles and methods of economics are applied to the special conditions of agriculture industry."

According to A.W. Ashby, "Agriculture economics is an applied science, that is, it is a methodical pursuit of knowledge of economics process and organization in agriculture and of their results, for the process of stabilizing adoptions or modifying and if and when necessary, of changing their results."

Agriculture economics, according to Hibbard, is "the study of relationships arising from the wealth getting and wealth using activity of man in agriculture." Agricultural economics should, however, cover topics that have an indirect impact on farm economic activity and the welfare of the farm population in addition to those that are directly related to land exploitation.

According to Jousier, "agricultural economics is that branch of agricultural science which treats of the manner of regulating the relations of the different elements comprising the resources of the farmer, whether it be relations to each other or to human beings, in order to secure the greatest degree or prosperity to the enterprises."

To put it briefly, agricultural economics is an applied science that focuses mostly on economic issues related to farmers' attempts to earn a living. As is well known, their issues are vast and diverse, but they can be broadly categorized under three primary headings: (i) production; (ii) marketing; and (iii) financing. Therefore, the development of suitable rules that dictate how much land, labour, and capital a farmer should utilize in order to farm as efficiently as possible is the focus of agricultural economics. The variables that affect the prices of the goods he purchases and sells, or, to put it another way, the relationship between agriculture and the rest of the economy, are equally important to agricultural economics.

As an applied science, agricultural economics plays a significant role in developing the strategies, tactics, and processes that can be used to address agricultural issues. Perhaps the most challenging task assigned to the agricultural economist is this one. Thus we can get to the conclusion that "agricultural economics is an applied science and as such concerned with the identification, description and classification of the economic problems of agriculture to the end that these problems may be solved."

For the straightforward reason that land, the foundation of all agricultural endeavours, is extremely scarce, the issue of allocating scarce resources to various uses may be more important in the agricultural sector than in the economy at large. Therefore, in order to give a credible set of methods and procedures by which this most valuable and finite resource is distributed among various productive activities to the maximum satisfaction of society, the theoretical framework of agricultural economics has become more rigorous and deliberate.

Therefore, the nature of agricultural economics is both theoretical and applied. The development of resource principles and their application in various agricultural production activities are the focus of agricultural economics theory, which is an applied science.

Scope of Agricultural Economics

The definitions given above show the breadth of agricultural economics. Almost all of these definitions have the concept of limited resources and a wide range of applications. In this sense, there are not many differences between general and agricultural economics. Agricultural economics uses all of the same analytical methods as general economics. The economics of production, consumption, distribution, marketing, finance, planning, and policymaking are all areas of agricultural economics that are similar to those of general economics. In the agriculture industry, a research is typically conducted at both the macro and micro levels. For the economy's agriculture sector, both static and dynamic studies are essential. According to these definitions, agricultural economics specifically looks at how a farmer

decides between different businesses, like growing crops or raising cattle, and how he decides between different activities within the same business, like which crop to grow and which to drop; how costs are to be kept to a minimum; what combination of inputs are to be chosen for an activity; how much of each crop is to be produced; and what kind of business relationship the farmer must have with those who buy their inputs or sell their goods.

The study of agricultural economics encompasses more than just farm-level farmer behavior. In a sense, this is the microanalysis. There is also a macro component to agricultural issues. The issues that must be addressed, primarily at the macro level, include agricultural instability and agricultural unemployment. In addition to the general issues with agricultural growth, there are issues that are primarily of a macro nature, such as those pertaining to research and extension services, tenure systems, and agreements. Agricultural economics studies these issues, including their causes, effects, and solutions.

Agricultural economics encompasses more than just "mere economizing of resources." As is well known, agriculture plays a significant role in the economy as a whole. It is often known that the different economic sectors are dependent on one another. The expansion of one industry is essential to the expansion of the others.

Therefore, the study of agricultural economics focuses on how the growth of agriculture contributes to the growth of other economic sectors, how capital and labor can move into non-agricultural sectors, and how agricultural development both starts and maintains the growth of other economic sectors. This suggests that agricultural economics studies the principles governing the flow of scarce resources into and out of other economic sectors as well as the flow of these resources from other sectors into the agricultural sector itself. It is not just about the use of scarce resources in agriculture per sector.

In agriculture, several forces are at work. Physicians, chemists, geologists, soil scientists, and others handle some of these physical forces. Physiologists of plants and animals, pathologists, geneticists, entomologists, bacteriologists, and others study biological forces. Because agriculture is a

vocation and a way of life, it is also subject to economic and sociological influences, which are typified by connections that develop between men. Agricultural economists work with these correlations. These connections consist of: 1. Relationships of interaction (competitive, supplemental, or complimentary) among the various business divisions, such as the concurrent production of livestock and cereals on the same farm. 2. The interaction of the various tools used in the manufacturing process, such as the concurrent use of human labour and machines. 3. Value relationships between the inputs used in production and the final result 4. Business ties with the consumers that farmers sell their goods to or purchase their needs from.

The study of each component of agricultural production, whether in reference to one or more of the aforementioned relationships, or to none of them at all, in order to maximize net profit, is then included in the field of farm economics. 7. As can be seen from Jouzier's statement above, he views agricultural economics as (i) the science that deals with the principles that underpin the coordination of all the elements involved in farming (land, labour, equipment, and the various lines of production) in a way that will allow the farmer to secure the maximum net profit, and (ii) the art of putting these principles into practice on a particular farm.

According to Taylor, "agricultural economics deals with the principles which underline the farmers' problem of what to produce and how to produce, it is what to sell and how to sell it in order to secure the largest net profit for himself consistent with the best interest of society as a whole." This is how we can characterize the scope of agricultural economics. In a particular it discusses how to choose land, labour, and equipment for a farm, how to choose crops to grow, how to choose livestock, how to run businesses, and the overall issue of how much of each of these agencies should be combined. The cost perspective is the main method one used to address these issues.

The distribution and consumption issues of farm products are thus included in the scope of agricultural economics. Among the key issues covered by agricultural economics are what should be distributed, to whom, and on what basis, as well as what should be consumed and in what quantity.

Studying agricultural economics also entails understanding how agriculture is governed. "To neglect the public management, public aid and public regulations as parts of the agriculture economics would be almost like leaving mechanics out of a course of physics."

In particular, "the scope of agricultural economics can be stated to include the choice of farming as an occupation the choice of farm and livestock, of machinery and labour of crops and cropping system, the size of the unit of production the grouping of the factor of production, intensify of cultivation, manufacturing , irrigation, soil conservation , selling of agricultural products , land system and rent, agricultural finance and rate of interest wages and employment , prices , costs and profits standard of living and national dividend etc."

Selecting and running the most lucrative business is the primary issue in each of the aforementioned situations. Finding the optimal course of action for the agricultural community's economic interests under the circumstances at hand is the responsibility of agricultural economists.

Based on the aforementioned, we can say that agricultural economics has a very broad reach, encompassing all aspects of a country's operations that have an impact on farmers' attempts to earn a living. At the farm level, agricultural economics focuses on creating strategies for how each productive unit can be set up and run to maximize net returns by disposing of its products and allocating resources to other uses. The marketing of agricultural products, cooperative purchasing of goods and services, and land protection are the issues that are addressed at the sector level. Last but not least, agricultural economics must focus on finding solutions to issues that call for the active involvement of the government, such as those pertaining to international commerce, loan availability, and price regulation.

Significance of Agricultural Economics

The agricultural industry is strategically important to a nation's economic prosperity. Its role in the economic development of less developed nations is crucial, and it has already significantly contributed to the economic success of

industrialized nations. In other words, agriculture and other primary industries are prioritized in areas with low per capita real income. England's history makes it abundantly evident that the Agricultural Revolution came before the Industrial Revolution. The development of agriculture has also contributed significantly to the industrialization of the United States and Japan. Similar to this, many developing nations have already realized the drawbacks of placing too much focus on industrialization as a way to increase real GDP per capita. "Therefore, in terms of inputs and outputs, industrial and agricultural developments are complementary and mutually supporting rather than alternatives."

Given that higher agricultural productivity and output are known to significantly contribute to the nation's overall economic development, it makes sense and is appropriate to give the agricultural sector more attention.

Inter sectoral Linkages

In many nations, agriculture contributes significantly to socioeconomic growth. For most rural residents, it is their main source of income, employment, and food security. Such contributions' future success is primarily dependent on how agriculture directly affects the national economy and how it fosters the expansion of other industries. Therefore, it's critical to comprehend the function of agriculture and how it relates to the rest of the economy. The development literature has extensively examined the connections between economic growth and the agriculture sector. Early on, academics focused more on examining the connection between the industrial and agricultural sectors. As the primary source of resources (food, fiber, and raw materials) for the growth of industry and other non-agricultural sectors, they contended that agriculture only plays a passive role (Rosenstein-Rodan, 1943; Lewis, 1954; Ranis and Fei, 1961). Several of these observers emphasized agriculture's wealth and capacity to provide surpluses to the more significant sectors.

Several development economists tried to highlight that although agriculture's proportion decreased in comparison to industry and services, it increased in absolute terms and developed more intricate ties to the non-

agricultural sectors. A number of economists have emphasized the connections between industrial and agricultural development as well as the ways in which agriculture can spur industrialization (Singer, 1979; Adelman, 1984; Hwa, 1988; Vogel, 1994). They contend that the productivity of agriculture and its institutional ties to the rest of the economy create supply and demand incentives, which promote industrial growth by supplying agricultural products at stable prices. The inter-sectoral links in agriculture become increasingly complex as a result of these developments.

Since industrial stagnation in the middle of the 1960s, the topic has gained attention in India. The sectoral structure of the Indian economy has changed structurally over time. From being primarily agro-based in the 1970s, the economy has become dominated by the service sector since the 1990s. The economy's growth process may be significantly impacted by the structural changes and uneven growth patterns of the agriculture, industry, and service sectors in the post-reform era. These changes are likely to result in significant changes in the relationships between production and demand across different sectors. The connections between agriculture and industry are also anticipated to be significantly impacted by the recent surge in service sector-led growth and the post-reform era's increasing integration with the rest of the globe (post-1991). Interest in re-examining the connections between the two sectors has increased as a result of this. The goal of this article is to analyze the patterns of interconnections between the two sectors in India before and after reforms from three sectoral viewpoints.

Since the start of the planning period, researchers and policymakers have focused heavily on the link between agriculture and industry because of India's mostly agrarian economy and agro-based industrial structure. Because of the agro-based industrial structure, the industry sector had a tight link with agriculture in the pre-independence and early post-independence periods (Satyasai and Baidyanathan, 1997). According to Satyasai and Viswanathan (1999), from 1950–51 to 1965–66, industry’s production elasticity relative to agriculture was 0.13. According to Rangarajan (1982), between 1961 and 1972, a 1.0% increase in agricultural production boosts industrial production by 0.5% and, consequently, GDP by 0.7%.

But from the middle of the 1960s, the industrial sector has grown slowly and then stagnated, which was mostly caused by the astonished agricultural expansion and favorable agricultural TOT, among other things (Patnaik, 1972; Nayyar, 1978 and Bhatla, 2003). One The 1980s and 1990s actually saw a decline in the two sectors' interconnectedness (Bhattacharya and Mitra, 1989; Satyasai and Viswanathan, 1997). For example, Bhattacharya and Rao (1986) discovered that the industry's partial production elasticity to agriculture decreased from 0.15 between 1951/52 and 1965/66 to 0.03 between 1966/67 and 1983/84. In contrast, Satyasai and Viswanathan (1999) discovered that the industry's production elasticity in relation to agriculture has grown from 0.13 between 1950/51 and 1965/66 to 0.18 between 1966/67 and 1983/84, It then held steady at 0.18 from 1984–1985 to 1996–1997. Slow employment growth, a decline in the share of agro-based industries, and a lack of demand for agricultural products have all been cited as the main causes of the deteriorating connections between agriculture and industry (Rangarajan, 1982; Bhattacharya and Rao, 1986; and Chowdhury and Chowdhury, 1995). Sastry et al. (2003) discovered that while backward production linkage has increased, forward production linkage between agriculture and industry has decreased from 1981–1982 to 1999–2000.

Additionally, they discovered that agricultural output had a major impact on industrial output and that the demand connectivity between agriculture and industry had decreased while the demand linkage between industry and agriculture had increased. The fact that the majority of Indian research have adhered to the conventional "two-sector" paradigm in a closed economy raises concerns regarding the methodological soundness and thoroughness of the results. Given that India has been more open since the 1990s reforms and that the services sector has been driving economic growth ever since (or even before), it is reasonable to argue that neither the "two-sector" model nor the close economy framework are suitable for analyzing sectoral linkages in India.

Given that the most notable aspect of the post-reform era is services-led growth, any sectoral linkages analysis that ignores the services sector fails to produce thorough empirical results. Since all economic sectors are directly

or indirectly related to one another, the unethical aspect of employing a two-sector framework and excluding the services sector from the research is that it understates the true connections between the sectors. The connections between agricultural and the services sector are one-way and primarily backward rather than forward, in contrast to the two-way connections between agriculture and industry. According to studies, the need for post-harvest facilities including processing, storage, transportation, communication, and markets has grown as agricultural productivity has improved. There is strong evidence that agricultural productivity is increased by investments in certain specialized services like transportation and communication, storage, rural road construction, banking and financial facilities, trade and lodging, and social services like hospitals, schools, and other infrastructure.

Increases in specialized services have the potential to boost economic growth rates and are also expected to fortify "agriculture-industry" ties. Likewise, when per capita income rises, there will be a greater demand for specialized services that serve as agricultural inputs due to the high-income elasticity of service demand. The demand for farm commodities and value-added agri-products will rise as a result, stimulating agricultural output and causing industrial expansion (Bhatla, 2003). In contrast to agriculture, industry has two-way connections with the services sector, and these connections are significantly stronger than in agriculture (Singh, 2007; Gordon and Gupta, 2004). Furthermore, compared to forward links with both industry and agriculture, the services sector has higher backward links. According to Hansda (2001), the Indian economy is heavily dependent on services, with industry being the most service-intensive sector. This was verified by applying input-output analysis at a highly disaggregated level (115 activities) during 1993–94, with 22 in agriculture, 80 in industry, and 13 in services.

About 25% of the output growth of registered manufacturing in the 1990s came from services inputs, compared to 1% in the 1980s, according to Banga and Goldar (2004). They also found that the growth of the organized manufacturing sector's total factor productivity (TFP) was significantly impacted favorably by the growing use of services in manufacturing. Sastry et al. (2003) used input-output matrices for four time points (1968–69, 1979–80,

1989–90, and 1993–94) and found that while industrial production became less agriculture-intensive and more services-intensive over time, agricultural production became more industry- and services-intensive. These findings therefore suggest that the "agriculture-industry" connections are understated when the services sector is left out of the analysis.

The obvious challenge, given these connections and the recent rise in the services sector, is how to connect the services sector with industry and agriculture and how this will affect the "agriculture-industry" links. The following sections comprise the remainder of the paper. The nature of the connections between industry and agriculture is explained in the next section. A summary of the theories that underlie the connections is given in Section 3. This section examines the patterns of sectoral connections, particularly those between the agricultural and industrial sectors.

Production function Analysis

An input-output relationship is depicted by the production function. It explains how quickly resources are converted into finished goods. In agriculture, there are many different input-output relationships since different soil types, animals, technologies, rainfall amounts, and other factors will affect how quickly inputs are converted into outputs.

Definition: A production function is a technical and mathematical connection that describes how and to what degree a given product depends on the amounts of inputs or services of inputs used at a specific technological level and within a specific time frame. It displays the amount of output that can be generated with varying input levels.

A production function can be represented in a number of ways, including written form, where the inputs that affect the output are listed and described; numerically, where inputs and outputs are listed in a table; graphically, as a graph or diagram; or algebraically, as an equation. A production function may be expressed symbolically as Y=f (X1, X2, X3,……., Xn), where Y represents the output and X1, X2, X3….. Xn are the inputs. However, it doesn't identify which inputs are variable and which are fixed.

Since fixed inputs are crucial to production, they are written as follows: Y=f (X1, X2 /X3…..Xn), where Y is the output, X1 and X2 are variable inputs, and X3…..Xn are fixed inputs.

The production function is defined just for non-negative input and output values, according to the **assumptions of production function analysis**.

• Technical efficiency is a prerequisite for the manufacturing function. This implies that the highest amount of output is expected from any feasible combination of inputs.

• The production function, also known as the input-output relationship, is continuous and single valued.

• A decreasing rate of technical substitution between any two factors, a growing rate of product transformation between any two products, and a lowering marginal product for all factor product combinations are the characteristics of the production function.

• It is anticipated that the returns to scale are declining.

• Every production and product factor are perfectly divisible.

There are three ways to express a production function:

(a) As shown below, it can be represented as an arithmetic table with the input of the elements in the first few columns and the total output of the product in the last column. Here, we only take one input for simplicity's sake.)

Table 1. A Production function

Units of fertilizers used	Total Corn Yield (Bushels)	Additional Corn for Each Additional Unit of Fertilizers (Bushels)
0	26.0	—
1	38.0	12.0
2	47.0	9.0
3	52.5	5.5
4	54.0	1.5

The variable input in the table above is fertilizer, which is applied to a fixed land price along with other fixed inputs. As additional fertilizer units are added, the total corn yield rises (column 2).

(b) A straightforward graph, like the one in Fig. 1, can likewise be used to geometrically depict the production function. The horizontal axis is used to measure the input level, and the vertical axis is used to measure the total output.

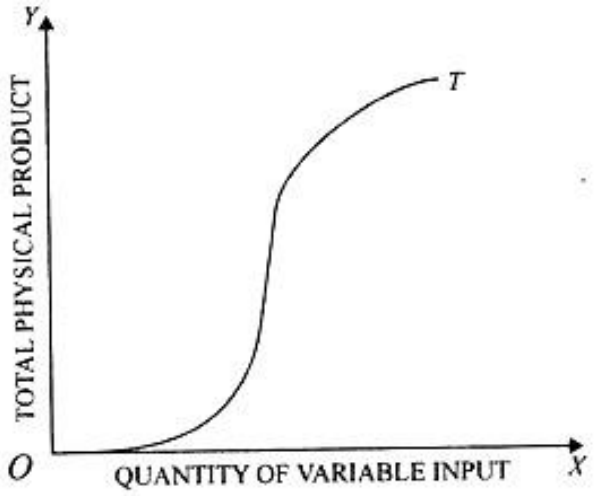

Fig. 1. A Production function

The points on the OT curve represent various output values corresponding to specific input levels. (c) An algebraic equation that uses input as the independent variable and output as the dependent variable can be used to illustrate the production function. It can be written as follows in algebraic form:

$$Y = f(x),$$

where "f" stands for "is a function of," "depends upon, or is determined by," and Y for the result and x for the input. In this case, output is thought to be dependent on just one factor. But its important to realize that in real life, no single element ever determines agricultural output—or any output, for that matter. Instead, it depends on number of variables, including the kind of soil, irrigation, fertilizer usage, seeds, and so forth. The formula for this is

$$Y = f (x1, x2, x3\ldots\ldots\ldots\ldots\ldots xn) + u.$$

According to this function, the degree of unknown or uncontrollable factors (represented by u) as well as all other factors (represented by x1, x2, etc.) affect the outcome. In a single study, it is not possible to take into account every controllable variable at once. As a result, each element may be examined in conjunction with certain fixed factors. For example, if two inputs—fertilizers and seeds—are altered while other variables remain fixed at predetermined levels, a farmer might want to know how the wheat field will change.

Production Function Types

It is important to remember that a production function represents a distinct relationship between the numerous inputs and the total output. In general, when inputs rise, so does the overall output. Like all other functions, growing production functions are those in which the total output rises as the inputs do.

In the actual world, there are also circumstances where increasing inputs may result in a loss in overall output rather than an increase. A diminishing production function is the term used to describe such a production function.

(A) Increasing Production Function

Although mathematicians typically do not mention how production rises as inputs rise for such functions, an economist must pay close attention to this feature. According to him, it's critical to determine whether the rate of production growth in response to successive equi-proportional changes in the total amount of inputs taken together (represented in terms of returns to scale) or to successive changes in the amount of a single input taken in isolation (represented in terms of returns to a variable factor) is increasing, staying the same, or declining. Stated differently, he is particularly curious about whether the marginal returns to a variable component or to scale are rising.

It should be noted that the primary focus of attention in production planning is on the marginal returns to a variable factor. Therefore, we will be

breaking down the growing production function into its component portions in the next paragraphs based on constant, increasing, and decreasing marginal returns to a variable input. (For this, we just take into account how production changes in response to changes in a single input. Other variable inputs are taken to be constant. The analysis is made simpler with this method. Later on, we will observe that the analysis of one input can be readily expanded to include other inputs.

(i) Increasing the production function while maintaining the variable input's marginal returns. For every extra unit of input employed in this function, the overall production rises by the same amount. Take, for instance, the following hypothetical correlation between the amount of fertilizer applied and the overall wheat output.

Table 2. Increasing production function with constant marginal Returns to the variable input

Quantity of Fertilizers (Kgs.)	Total production of wheat (Kgs.) (Y)	Marginal product (Kgs.)
0	1200	60
10	1260	60
20	1320	60
30	1380	60
40	1440	60
50	1500	60

This function will be represented graphically as a linearly growing function, as seen in Fig. 2.

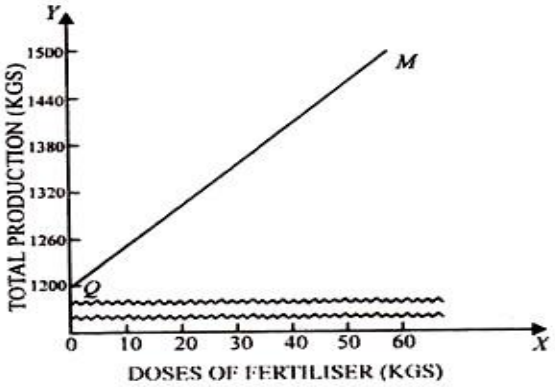

Fig. 2. Increasing production function with constant marginal returns

According to the illustration, 60 kg of fertilizer is contributed with each additional 10 kilo gram dose. of wheat to the entire production. This kind of interaction is uncommon in agriculture.

(ii) Growing the production function as the variable input's marginal returns increase:

In this instance, the output increases at an increasing rate when more and more units of an input are consumed, meaning that each subsequent dose of input results in an increasing addition to the overall output. This kind of relationship typically arises when the production's fixed factors have excess capacity and using more units of the variable input leads to better usage of the fixed factors. This kind of production function is displayed in the following table.

Table 3. Increasing production function with increasing marginal returns to the variable input

Quantity of wheat Seed (Kgs.) (x)	Total production of wheat (Kgs.) (Y)	Marginal product (Kgs.)
10	1000	—
15	1025	25
20	1075	50
25	1150	75
30	1250	100
35	1375	125

This functional relationship is represented graphically as a curve. As the input rises, the curve gets steeper. Figure 3 illustrates how production rises as marginal returns to the variable input rise. As seen in the following diagram, the curve that results from such a production function is concave downward to the X-axis.

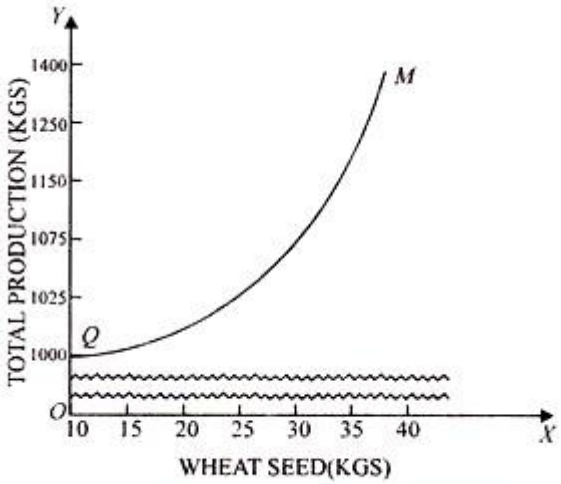

Fig.3 Increasing production function with increasing marginal returns

In agriculture, this kind of link has been noted, although only over relatively small output regions.

(iii) Growing the production function while the variable factor's marginal returns decline: In this instance, we discover that each subsequent increase in output caused by an additional dose of input decreases, even though the overall production rises as the input increases. Stated differently, marginal returns to the input are decreasing even though they are still positive. His kind of growing production function is depicted in the schedule that follows.

Table 4. Increasing production function with diminishing marginal returns to the variable input

Quantity of Fertilizers (Kgs.) (x)	Total production of wheat (Kgs.) (Y)	Marginal product (Kgs.)
0	400	—
10	900	500
20	1300	400
30	1600	300
40	1675	75
50	1725	50

This kind of production function will be represented diagrammatically by a curve that is concave upward with respect to the X-axis. This curve is shown in Fig. 4.

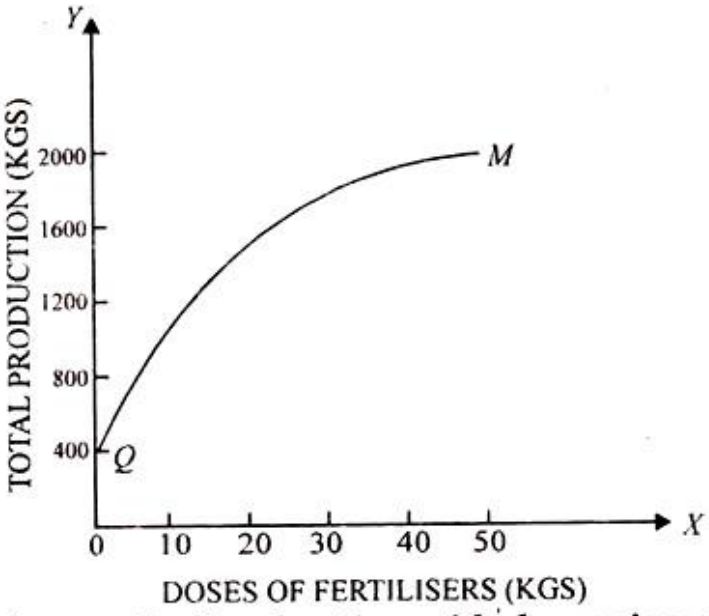

Fig. 4. Increasing production function with decreasing marginal returns

We discover that the curve flattens off as it travels to the right, with each subsequent increase in output brought on by the application of an additional dose of input decreasing.

(B) A declining function of production

A falling production function is one in which an increase in input results in a decrease in total output. One could say that the variable factor's marginal returns are negative, or less than zero. On the basis of either a rising, falling, or stable rate of output decline, the decreasing production function could also be separated into three groups. But as we will see later, no sane producer will ever work in a state (or phase) with falling production function, meaning that overall production will fall as input prices rise.

As a result, there will be no practical use for the exercise involving classifying the decreasing production function according to the kind of its (negative) marginal returns to the variable input. The declining production function is displayed in Table 5: Instead of starting with the first fertilizer dose, we began with the eleventh in this table. This is because assuming that the output will start to decline after the initial fertilizer treatment is somewhat unreasonable.

Table 5. Decreasing production function

Doses of Fertilizers	Output of wheat (Quintals)	Marginal returns (Quintals)
11	1000	—
12	980	-20
13	950	-30
14	910	-40
15	860	-50
16	800	-60

The following diagram shows the decreasing production function:

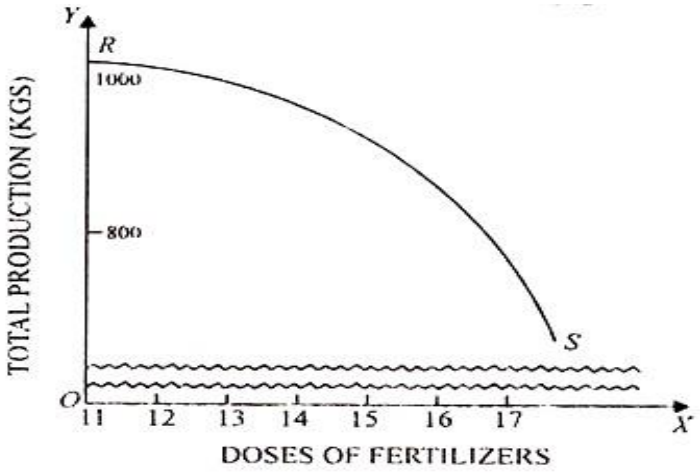

Fig. 5. Decreasing production function

A line or curve with a negative slope is implied by the decreasing production function. Depending on whether the output decreases at an increasing or decreasing pace when more and more dosages of an input are consumed, the curve may be concave or convex to the origin.

Relevance to farm production Economics

In order to maximize the use of farm resources on individual farms and rationalize the use of farm inputs from the perspective of the overall economy, agricultural production economics analysis production connections and rational decision-making principles. It is a branch of the larger field of agricultural economics that focuses on resource efficiency and production

pattern selection to maximize the nation's or farming community's goal function within a resource-constrained framework. It can be described as an applied branch of research that applies economic decision concepts to the management, labour, capital, and land resources used in agriculture. Applying economic reasoning to issues that arise in agriculture is the main area of focus. The productivity of farm inputs is the focus of agricultural production economics. As a result, it addresses resource management, resource administration, resource allocation, resource combinations, and resource use efficiency. The study of factor-product, factor-factor, and product-product interactions, farm size, returns to scale, credit, risk, and uncertainty are all topics covered in agricultural production economics. Thus, agricultural production economics deals with every issue facing farmers that is covered by resource allocation and marginal productivity analysis.

The objectives of agricultural production economics are as follows:
1. Help farm managers decide how best to use resources insight of society's shifting requirements, values, and objectives.

2. Help policymakers assess how different public policies would affect farm productivity, earnings, and resource consumption.

3. Assess how the theory of firm can be applied to enhance farm management and comprehend how the farm behaves as a profit-maximizing entity.

4. Assess how institutional and technical modifications affect resource utilization and agricultural output.

Productivity trends

For a very long time, Indian agriculture remained stationary. For this reason, in the middle of the 1960s, the government implemented a new agricultural plan. The food issue in India has been resolved. However, there is still more to be done. Between 1950–51 and 1999–00, the agriculture sector's compound annual rate of growth (CARG) was 2.8%. The production of food

grains went from 508 million tons in 1950–51 to 208.9 million tons in 1999–00, indicating a CARG of only 2.9%, which was barely enough to fulfil the population's rising food demand due to a 2.2% CARG.

The decline in the non-food-grains sector is mostly to blame for the decline in the increase of agricultural production overall after 1992. The post-liberalization era had a 2.5% annual growth in non-food grain output, down from a 4.8% growth rate in the 1980s. From 2.9% to 2.7%, the average growth rate of food-grain output has decreased slightly. Despite this, as well as the drought that hit different sections of the country for two years in a row, there were no significant food issues because the government had record supplies of food grains. In order to feed the nation's expanding population, planners and policymakers must figure out how to produce a significant breakthrough in agricultural production.

The majority of the output growth during the first 15 years of planning (1951–1966) was attained by cultivating new land. However, over the course of the plan period, the area's growth rate has decreased. As a result, there is very little room to increase production using this method. It appears that the only method to boost agricultural productivity and output is through intensive cultivation, which places a strain on multiple cropping.

In other words, an improvement in yield per acre will have to account for nearly all of the rise in agricultural output in the upcoming years. This will necessitate expanding irrigation facilities and using modern seeds and fertilizers. If there is a significant increase in production, the food crisis can be resolve and long-term self-sufficiency can be attained.

Low production and Productivity

1. General Elements

(a) Overcrowding in Agriculture: An excessive number of people rely on agriculture, which is the true issue facing Indian agriculture. Industries were unable to absorb the natural population growth. Furthermore, the fall in handicrafts led to a greater reliance on agriculture. Due to overcrowding and

the resulting pressure on land, holdings have been divided and fragmented, the man-land ratio has increased or decreased, per capita land availability has decreased, disguised unemployment has occurred, and the marginal product of labour is nearly zero.

(b) Unhealthy Rural Atmosphere: In general, Indian farmers are illiterate, ignorant, superstitious, conservative, and constrained by antiquated institutions and conventions like the joint family system and the caste system. The curses that keep farmers completely content with their archaic method of cultivation are superstition and faith in fate. Even if they just have two square meals per day, they remain content. Because they lack ambition, they have little interest in raising their standard of living through diligence and new investments.

(c) Inadequate Non-Farm Services: The lack of adequate non-farm services, such as marketing and finance, has hurt Indian agriculture. The development of this critically essential industry has been hampered by the lack of marketing and financial facilities.

2. **Institutional Factors:**

(a) Holding Size: In India, holdings are typically quite small, measuring less than two hectares or five acres. Agricultural holdings are not just tiny but also dispersed. Therefore, it is impossible to conduct scientific cultivation using better tools.

(b) Insecurity of Land Tenure: The lack of appropriate incentives has been a major contributing factor to low agricultural productivity. The cultivator frequently does not own the land; he must pay exorbitant rents for the land he cultivates; he lacks a guarantee of tenancy; and the landowner has the right to evict him from his land at any moment. Therefore, the landless worker has little to no motivation to boost productivity.

3. Technological Factors:

(a) Poor techniques of production:

Generation after generation of Indian farmers have been employing antiquated and ineffective production techniques. Using appropriate and sufficient manures is the only way to boost productivity. However, both chemical fertilizers and farmyard manure are often underutilized in India. It is clear that high-quality seeds are essential for raising agricultural productivity. However, for many centuries, Indian farmers have been utilizing seeds of extremely low quality.

(b) Inadequate Irrigation Facilities:

The fact that majority of farmers nationwide must rely on rainfall and that only a small percentage can benefit from artificial irrigation is one of the main reasons why Indian agriculture is so underdeveloped.

Causes for low productivity

The following broad categories can be used to classify the reasons behind India's low agricultural productivity:

(1) Natural Factors

(2) Technological Factors

(3) Institutional or Structural Factors and

(4) General Factors.

Natural Factors:

In India, nature—particularly rainfall—dominates agriculture. During the monsoon season, it is considered a gamble. Sometimes we have too much rain, which causes floods that cause extensive damage and destruction. Other times, the rains are insufficient or distributed unevenly. Other natural disasters, such as hailstorms, cold, or insect and pest attacks, might affect Indian agriculture.

The Indian farmer is severely hampered in increasing agricultural output by these weather-related disasters. Although farm productivity cannot be rapidly increased, it can unpredictably be harmed or decreased by inclement weather, pests, or illnesses. Furthermore, not every land has been created by nature to be of the same quality; naturally, fields with variable fertility provide diverse outputs.

Technological Factors:

These elements include, but are not limited to, the use of irrigation water, improved seeds, improved tools and utensils, fertilizers, and manures. Indian farmers continue to lag behind those in other developed nations in all of these areas.
Naturally, poverty is a contributing factor in its non-use, but it's also crucial to note that Indian farmers' attitudes aren't improving. Some farmers have only lately begun to use more advanced tools, such as steel ploughs, sugarcane crushers, and water-drawing oil pumps.

A 10–20% improvement in yield can be achieved by using better seeds. Regretfully, though, the majority of farmers continue to utilize regular seeds rather than the enhanced ones. The application of nitrogenous and phosphatic fertilizers can also result in a technological advancement in Indian agriculture, just as it has in Japan. Additionally, these are not being embraced quickly. It is frequently observed that farmers are reselling fertilizers to traders at black market prices after the government subsidizes their purchase.

Better seeds, tools, fertilizers, and other equipment won't be useful if they aren't paired with a consistent and sufficient supply of water. Indian agriculture has been described as a gamble in the monsoon due to a lack of irrigation facilities. In India, irrigation covers just around 22% of all farmed area. Without irrigation water, most farmers must rely on the monsoon season, and without constant irrigation, only one crop can be grown.

Output is obviously low both per worker and per acre. In addition to the dearth of irrigation facilities, there is the paradoxical issue of inadequate use of those that are there. Due to the complete lack of financial institutions, the

farmer is forced to rely on the village moneylender, who charges outrageous fees. The All-India Rural Credit Survey Report, 1950–51, states that moneylenders extend almost 90% of all agricultural credit. Just 6.4% of it is covered by the institutional credit.

To fully address the credit needs of Indian farmers, the cooperative credit movement has not grown sufficiently. "The small cultivator is tightly bound by the vicious cycle that leads to poverty, debt, and high interest rates." As a result, the agricultural output program suffers.

The adage "too many cooks spoil the broth" is relevant to Indian farming. We know from experience that the number of people working in agriculture is inversely related to its production. The land is under too much population pressure, which leads to small, unprofitable, and dispersed holdings. The total area seeded per person is only roughly 0.86 acres. An estimated 25% of Indian agricultural workers are excess, meaning they are experiencing disguised unemployment.

Unproductive dependents made up of excess labour lower agricultural incomes that could have been saved and invested. The persistence of antiquated methods and the inadequate utilization of necessary inputs like fertilizers and land irrigation are caused by a lack of investment. Low agricultural productivity is the inevitable outcome of this.

Institutional or Structural Factors:

These elements generally have to do with India's flawed landholding system. In India, an average agricultural holding is only about five acres. It is possible that even this tiny holding is not in a single location. It is frequently dispersed and found in various locations within tiny portions of one or two acres.

It can be challenging to move a standard plough because the operational holding is frequently so small. The cultivator wastes time moving from one plot to another due to the small, dispersed holding. According to calculations, two bullocks could plow roughly 13 acres of ground. Nearly every

farmer has two bullocks, but since their field may only be five acres, the bullocks may be unused to the amount of eight acres. Similar underutilization occurs with regard to the implements, ploughs, etc. Naturally, the pressure of the people on land and the inheritance system are the causes of India's extensive land subdivision and fragmentation.

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The lack of sufficient incentives for land cultivators has been a significant contributing factor to low production. If the person cultivating the land is also the landowner, incentives may be stronger. However, in India, the hind belonged to these landowners under the Zamindari and Jagirdari systems until recently. Zamindari has been abolished, it is true. At the same time, many tenant-cultivators still face exorbitant rents and lack tenure security. States have passed tenancy laws, but they haven't been properly enforced.

These laws are practically equivalent to none at all. Tenant-cultivators may not be able to enhance land, save soil, employ irrigation-improved crops and fertilizers, or otherwise create new agricultural capital under such conditions.

General Factors:

Three sub-divisions can be used to concisely categorize the general causes.

First, there is agricultural overcrowding. Because population is elastic and land is inelastic, the amount of land available per person is always decreasing. For example, from just over 100 cents in 1901 to only about 62

cents in 1991, the area of land per cultivator has decreased. Second, many Indian farmers lack the drive to improve their lot in life because they are caste-ridden, stupid, illiterate, superstitious, and conservative. Therefore, it is accurate for Mrs. Kusum Nair to say that "Indian farmers look at the stars to worship them, not to pluck them."

Thirdly, a variety of non-farm services that farmers depend on have also been inadequate. These services cover things like marketing, warehousing, processing, transportation, and agricultural credit requirements. Farmers continue to rely on non-institutional organizations such as moneylenders, dealers, commission agents, adatias, dalals, etc. for nearly all of these services. All of these organizations take advantage of farmers to the point where they have very little money left over to increase capital formation on their property, which results in low productivity.

"The main causes of low agricultural productivity in India are, in short, soil erosion, water logging, lack of irrigation facilities combined with inadequate and unpredictable rainfall, excessive pressure on the soil, individual farmer inefficiency, social institutions, subdivision and fragmentation, exploitative nature of the land-tenure system, outdated agricultural techniques, lack of finance and good marketing arrangements, and indifference and inefficiency of the administration."

Consequences and Measures

India, being an agricultural nation, requires assistance in farming and the agricultural sector. Although there are several reasons why Indian agriculture is so underproductive, we have enumerated the main ones here. In this industry, where nearly half of India's workforce is employed and works around the clock, productivity must be increased. The main issue facing Indian agriculture is its low production. This is because it has a direct impact on farmers' incomes, contributes to food insecurity, and hinders our country's economic development. However, there are remedies for problems as well; this article will also include ideas to enhance Indian agriculture.

Overdependence on Monsoons & Erratic Irrigation

Despite having the most sophisticated irrigation system in the world, approximately 60% of Indian agriculture still depends on the erratic monsoon season. India's climate is extremely unpredictable because both sudden floods and droughts can result in significant crop losses, negatively affecting farmer income and productivity. Even irrigated land requires assistance with problems including poor drainage, floods irrigation, and insufficient water supplies.

Extremely Dispersed Land Holdings

Since more than 92% of Indian farmers operate on small, marginal land—roughly 1-2 acres per farmer—it is challenging to implement capital-intensive technological advancements. Small sizes eliminate the need for tools and machines, which could increase output by 30–40%. The owners' unwillingness to sell their holdings (small lands) has also contributed to the failure of several consolidation attempts.

Slow Adoption of High Yielding Varieties

Despite the abundance of high-quality, high-yielding, and climate-resilient seeds available in the Indian agricultural market, farmers and small farm owners continue to underutilize them. Only 35–40% of farmers are adopting these seeds, according to data research, because of low knowledge and expensive costs (due to the monopoly). One of the main reasons for low agricultural output is the use of inferior seeds.

Imbalanced Fertilizer Application

The Green Revolution in India has led to a rise in the usage of chemical fertilizers, which harm the soil but are frequently overused and unbalanced. Over time, chemical fertilizers that use nitrogen rather of potash or phosphorus lose their effectiveness, necessitating higher dosages to get the same results. The use of artificial fertilizers reduces natural fertility, raises expenses, and contaminates the land.

Antiquated Crop Yield Prediction

Farmers struggle to estimate production volumes and crop prices because they lack the necessary facilities and instruments for accurate forecasting, and because crop predictions are often delayed or erroneous. They will undoubtedly need additional time to make well-informed sowing decisions for increased profitability if they make an incorrect crop yield forecast. This has a significant effect on farmers' productivity and results in inconsistent agricultural earnings.

Absence of Farm Input Quality Control

India is an agricultural country, hence quality control laws pertaining to seeds, fertilizer, and pesticides are not very strict. Over time, the increasing quantity of phony, expired, or deteriorated inputs is harming crop quality and yields, which in turn is harming the soils. Strong regulations are needed in Indian agriculture to increase output and benefit farmers.

Grossly Inadequate Cold Chain Infrastructure

Our fruits and veggies are completely wasted since we must have the best or necessary cold storage. Due to a lack of refrigerated transportation or processing facilities close to producing sites, around 40% of India's fruit and vegetable production is wasted annually before being consumed. Improved cold chain infrastructure will lower price risks, avoid distressed sales, cut down on food losses, and undoubtedly increase farm profits.

Restricted availability of post-harvest amenities and credit

Our farmers frequently require assistance in obtaining loans as well as access to sufficient facilities for processing and storage. This keeps farmers in a debt cycle, discourages investments in agriculture, and results in post-harvest losses. Building rural infrastructure, encouraging cold chains, and creating farmer-friendly financial programs can all increase productivity.

Insufficient support services and infrastructure in rural areas

Poor rural infrastructure, such as restricted access to roads, electricity, and communication networks, is a problem for Indian agriculture. This hinders

market linkage limits access to necessary services and hinders agricultural development. For Indian agriculture to increase rural productivity, a strong network of support services and rural infrastructure are essential. To increase agricultural output and farmer income, India needs a multifaceted approach encompassing important areas like markets, infrastructure, irrigation, and technology. Additionally, you should consider using calcium nitrate fertilizer in your farming if you wish to increase agricultural productivity.

Improvements to irrigation infrastructure

In order to reduce reliance on the monsoon season, Indian agriculture must first improve access to irrigation. In addition to updating irrigation infrastructure with an emphasis on water use efficiency, governments and other institutions can construct local water storage systems using check dams, farm ponds, and tanks.

Cold Storage Expansion

Expanding cold storage and warehousing facilities close to production hubs is crucial for reducing post-harvest losses and providing farmers more flexibility in when to sell their crops. Access to larger markets will also be made possible by additional transportation connections.

Developments in Technology

The development and dissemination of high-yielding, climate-resilient crop varieties, as well as branded soil testing procedures and micronutrient supplements to tailor soil fertility enhancement, must be accelerated in Indian agriculture. Additionally, governments ought to concentrate on teaching farmers scientific precision-agriculture methods and technologies.

Encouraging free trade

In order to promote free trade and commerce, it is crucial to de-regulate agricultural markets and repeal outdated APMC legislation. Farmers

can choose to sell their produce through channels that offer better economics and attract private sector investment by allowing open markets and contract farming possibilities.

Weather Protection

In order to give farmers individualized risk coverage alternatives and safeguard them from weather-related whims, pest attacks, and post-harvest price crashes depending on production costs, it is redesigning crop insurance programs. Even in the event of crop failures, this protects revenues and promotes investments.

Land Consolidation

To achieve economies of scale, governments must encourage the consolidation of land holdings through pooling systems and incentives. In addition to all of these ideas and methods to enhance Indian agriculture, governments and farmers should work to eradicate the problems and reasons behind poor productivity in order to guarantee comprehensive economic and social growth.

Size of farm

Given the importance of agriculture in rural economies and its capacity to alleviate poverty and foster equitable growth, the relationship between farm size and productivity has long been a focus of agricultural study. The type of crop being produced, cultivation costs, farm management techniques, input and market accessibility, and other factors all affect the relationship between farm size and productivity.

A dichotomy between high- and low-income countries has been demonstrated by empirical evidence on the relationship between farm size and productivity: a positive association in rich countries and a negative relationship in poor countries. However, recent studies conducted in low-income nations have shown how measurement error, which results from under sampling major enterprises, distorts a more nuanced relationship.

The research reveals a U-shaped link between the two, with productivity first declining as small farms get bigger and then increasing as businesses expand and take advantage of economies of scale and available gear. In light of this link, they determine that a farm should be 24 acres in size, as opposed to the present average of 2.5 acres. This would result in a 42% increase in farm productivity and a 68% increase in output per worker, while also reducing redundant labour in the agricultural labour force by 16%. In order to absorb extra labour in the market, governments should try to expand farm size and productivity in tandem with increased industrialization, even though ten-fold increases in farm size are unlikely to happen naturally.

Efficiency and productivity in Indian agriculture

1. Weather and Climate Trends

The weather and climate of India have a big impact on our capacity to produce food and the related expenses. The monsoon rains, temperature swings, and regional climate changes are only a few of the weather patterns that have a significant impact on agricultural productivity and prices.

Monsoon Rainfall and Farming

Since the monsoon rains provide the majority of our yearly precipitation, they are extremely important to Indian agriculture. On the other hand, too much rain can harm crops and flood fields. The monsoon usually accounts for 70–90% of our total precipitation. The monsoon has been acting strangely lately, causing droughts and floods. For example, the delayed arrival of the monsoon in 2021–2022 led to lower agricultural yields, which in turn caused food prices to rise by a substantial 12%. On the other hand, a return to typical monsoon conditions in 2022–2023 resulted in a 4.73% drop in crop prices.

Agriculture and Temperature Variations

Crop growth can be disrupted by temperature fluctuations, which are characterized by scorching summers and freezing winters. High summer temperatures limit crop water availability, and cold winters hinder crop growth.

Research shows that a mere 1°C increase in temperature can reduce crop production by 4% to 5%. A 1°C warming is predicted to reduce crop yield by 4.5% to 9% by 2050.

Regional Climate and Farming

The climates of India's many regions vary, which affects which crops are appropriate for cultivation. For instance, areas with plenty of rainfall, such as the Western Ghats and coastal regions, are ideal for growing tea, coffee, and spices. On the other hand, the Thar Desert experiences little precipitation, which makes crop cultivation difficult. According to research, places such as the Western Ghats and coastal regions account for 10% to 15% of India's agricultural GDP. On the other hand, less than 1% comes from the Thar Desert.

Agriculture and Crop Prices

Prices are directly impacted by changes in the availability of food; when there is a shortage, prices rise, and when there is an abundance, prices fall. This idea is still valid today. For example, a more constant food supply brought forth by the typical monsoon conditions in 2021 moderated the increase of food prices. Just 2.9% was the CFPI's growth in 2021–2022. On the other hand, India's food costs skyrocketed in 2022 due to the delayed and inadequate monsoon. In 2022–2023, the Consumer Food Price Index (CFPI) increased by 7.8%, up from 2.9% the year before. India's weather and climate have a significant influence on food prices and agriculture. Regional climate differences, temperature fluctuations, and the monsoon all affect food output and prices. Making wise decisions to protect our food security requires an understanding of these processes.

Fertility and Soil Quality

Fertility and soil quality are essential for Indian farming. They have a significant impact on our capacity to produce food. The composition, nutritional levels, pH, and organic matter concentration of the soil all affect its health. Crop growth in our nation is influenced by these elements. In order to

boost food production and guarantee food security, the Indian Council of Agricultural Research (ICAR) stresses the significance of preserving soil health. To keep an eye on nutrient levels, they advise routine soil testing. With 52% of Indian soils lacking in nitrogen, 50% in phosphorus, and 36% in potassium, ICAR states that nutrient deficiencies in Indian soils are a serious problem.

For farming, the soil's texture and ability to retain water are also crucial. According to the Indian Agricultural Research Institute (IARI), soil can be either clayey or sandy. Crop growth is impacted by clayey soil's ability to retain more water than sandy soil. Crop prices are influenced by soil fertility. Farmers want to grow more when the price of products like sugarcane, rice, and wheat increases, which puts strain on the soil. Higher crop demand results in higher fertilizer use to preserve soil health, according to ICAR.

Soil health is also influenced by government policies. Irrigation and fertilizer subsidies may encourage excessive use, which could damage the soil. To preserve soil health, the government does, however, also support sustainable farming methods including organic farming. Farmers have been given Soil Health Cards by the government since 2015. These cards offer details on nutrient requirements and soil health. These cards, which have been distributed to more than 120 million farmers, have improved harvests and reduced the usage of chemical fertilizers.

According to ICAR, India's soil health is improving as a result of these initiatives. In many places, soil organic carbon levels are increasing, and farmers are employing more organic fertilizers. In India, the fertility and condition of the soil are crucial for agricultural. Soil health is influenced by a number of factors, including crop demand, governmental regulations, and sustainable practices. Soil health is improving thanks to government programs like the Soil Health Card Scheme, but ongoing observation is still required.

Innovation and Technology

The quality and fertility of the soil are crucial in farming. They determine how sustainable farming can be and how effectively crops thrive. With more

people to feed globally, innovation and new technology are becoming essential to improving the fertility and health of soil. Let us examine the ways in which farming practices, crop prices, and technology interact, particularly with regard to enhancing soil management.

- ***The Value of Fertility and Soil Quality***

  The ability of soil to sustain plants and animals, maintain clean water and air, and provide a healthy environment for people is known as soil quality. The ability of soil to provide plants with the nutrients they require to flourish is known as fertility. Because they have a direct impact on crop growth, health, and environmental preservation, both are essential for productive farming.

- ***Innovation and Technology Promoting Soil Health***

  New technology has recently transformed soil care practices, enabling farmers to improve soil fertility and health. One such example is precision agriculture. It determines precisely how much water and fertilizer crops require using devices like drones, sensors, and GPS mapping. This helps maintain healthy soil and increases farming efficiency. Additionally, farmers can monitor soil conditions in real time with soil sensors and monitoring systems. This enables them to promptly address problems such as pH imbalances or nutrient deficiencies. In addition to increasing crop yields, these technologies assist farmers in conserving resources and preserving the environment.

- ***Commodity Prices' Effect on Soil Management***

  Farmers' decisions about soil care are influenced by crop prices. In order to promote soil health, farmers may be more inclined to spend money on organic fertilizers or cover crops when crop prices are high. Farmers may, however, choose less expensive ways to preserve soil fertility when costs are low. The Food and Agriculture Organization (FAO) estimates that implementing sustainable soil management techniques may boost global food yields by as much as 58%. Furthermore, a study that

was published in the Journal of Environmental Quality discovered that crop yields might improve by 12% for every 1% increase in soil organic matter.

Soil fertility and quality are changing significantly due to innovation and technology, giving farmers more sustainable crop-growing options. In the ever-changing world of agriculture, farmers may improve food production, protect the environment, and adjust to changing crop prices by implementing sustainable methods and utilizing technology.

Infrastructure for Irrigation

Because it enables farmers to cultivate crops in regions with limited water supplies, irrigation is essential to modern farming. The construction of irrigation systems has increased agricultural output and increased the amount of land available for farming. Currently, over 40% of our food comes from irrigation, which is utilized on more than 20% of the world's cropland. However, irrigation also requires a large amount of water. More than 70% of the freshwater used globally comes from it. We must figure out how to make irrigation more effective and environmentally friendly as the world's food needs increase.

Fortunately, innovative new technologies are available to enhance irrigation. For instance, precision irrigation reduces waste by up to 40% without compromising crop development by using sensors and data to determine when plants should be watered. Drip irrigation, which uses tubes to deliver water directly to plant roots, is another innovative technology. In this manner, more water reaches the plants and less evaporates, perhaps leading to a 30% increase in yields. In addition to these innovative concepts, financing is available for irrigation projects in nations that require it. For example, $1.5 billion has been allocated to these projects in developing nations by the Green Climate Fund. The cost of food and the efficiency of farming are significantly impacted by these developments. Because farmers spend less and produce more when irrigation is more effective, food can be more affordable, particularly in areas where it is difficult to obtain. Additionally, constructing irrigation

systems boosts rural economies and creates work for farmers, particularly small-scale farmers who frequently face challenges due to weather-related changes.

A.K. Sen’s Hypothesis

Dr. A.K. Sen, a well-known Indian economist, gathered and examined data on farm production and size in the 1960s. Sen concluded that there is an inverse relationship between farm size and productivity in India as a result of these investigations. He emphasized that impoverished communities had no other employment options. Therefore, they would rather produce their own modest plot of land. Villagers invest their entire life and energy into cultivating their own land. Large farms, however, are not like that. Owners of large farms are wealthy. They can make money from a variety of other ways. Therefore, they hire outsiders to work their own land. These outsiders don't work hard to cultivate such areas because they will receive the same level of pay regardless of production. Sen therefore proposed that this resulted in low output on large farms and high productivity on small farms in India. A number of Indian economists, including Professors Dipak Majumdar, A.K. Khusro, C.H. Hanumantha Rao, and G.R. Saini, endorsed Sen's proposal. But soon after, Indian agriculture was transformed by the green revolution. Sen made the assumption that labor is the most significant agricultural investment while discussing the connection between farm size and production. However, HYV seeds, chemical fertilizers, and advanced machinery began to be used in Indian agriculture following the green revolution. The agricultural sector in India underwent a tectonic change. It changed from being labor-intensive to capital-intensive. Sen's argument thus became less significant and legitimate. The majority of economists worldwide now prefer to think that, although there may have formerly been a negative correlation between farm size and productivity in Indian agriculture, this relationship no longer exists.

Technology's Place in Agriculture

The Indian economy is centred on agriculture and related industries. During its G20 presidency, the Indian government is appropriately supporting technology-enabled sustainable farming, including natural, regenerative, and organic systems, with this and a sustainable future in mind. Nonetheless, India's agricultural sector still faces a number of opportunities and challenges, including meeting the demand for and affordability of certain crops, enhancing the nutritional value, productivity, and quality of its produce, lowering production costs and the environmental impact of farming, and adapting to climate change and its effects on agriculture. Using seed technology is one way to achieve this.

Since the National Seeds Corporation was founded in the 1960s, India has had a rich history and heritage of seed technology. Since then, India has advanced significantly in the creation and uptake of a number of seed technologies, including transgenics, tissue culture, hybridization, and genetic markers. The science and practice of enhancing the genetic and physiological characteristics of seeds to improve their performance under various growth settings is known as seed technology. With minimal extra expense, seed technology can provide substantial benefits for sustainable agriculture. With unrealized potential to serve as the seed hub for G20 nations, the size of the Indian seed business is projected to be between $4.0 and $6.0 billion. In the agricultural sector, technology plays a vital role in helping farmers overcome obstacles and enhance their operations. In essence, the benefits of technology include lower environmental impact and higher crop output. It also contributes to bettering small-scale farm laborers' working circumstances.

They include:

Increased crop productivity: By using precision agriculture techniques, technology helps farmers enhance crop yields while cutting waste and improving operational efficiency.

Reduced usage of insecticides, fertilizer, and water: Farmers are better able to decide when and how much to apply thanks to technology. They can lessen their influence on the environment and waste in this way.

Decreased impact on natural ecosystems: Technology lessens the adverse environmental effects of agriculture by increasing efficiency and lowering the use of dangerous chemicals.

Reduced chemical runoff into rivers and groundwater: Farmers can monitor and manage chemical use with the use of technology, which lowers the chance of waterway contamination. Both the environment and public health are significantly impacted by this.

Improved facilities for employees: Farm workers now enjoy more comfortable and secure working circumstances thanks to technology applications.

Increased productivity and reduced costs: Agritech helps farmers cut expenses and improve the sustainability of their operations by increasing productivity and decreasing waste.

Artificial intelligence-based climate and weather prediction: Technology aids farmers in determining when to grow and harvest their crops. It gives a clear picture of how important weather forecasting is to farming. In this manner, they lessen the possibility of crop loss as a result of erratic weather.

Biotechnology-developed resilient crops: Farmers can use technology to produce crops that are more resilient to environmental factors, disease, and pests. Consequently, it raises yields and lowers the chance of crop loss.

Sensors for agriculture: Technology gives farmers access to real-time information on temperature, soil moisture, and other elements that affect crop growth. This enables them to make well-informed choices regarding crop care, fertilization, and watering schedules.

Safer growing environments and safer foods on the market: Technology makes agriculture more sustainable and efficient, which results in safer growing environments and healthier foods for customers.

Minimize ecological and environmental impact: Technology helps lessen the detrimental effects of agriculture on the environment and nearby ecosystems by cutting back on waste and the usage of dangerous chemicals.

Changes in Agriculture's Structure

The process of altering an economy's production structure is referred to as "structural transformation." The shift from an agrarian to an industrial culture and from artisanal manufacture to mass production was exemplified by the Industrial Revolution of the 1700s in England and the 1800s in continental Europe and North America (Clark 1951). Services from business, finance, and the government also became more crucial as economies expanded and became more urbanized. Structural change in developing nations began considerably later, primarily in the 1900s. In certain instances, the process happened less gradually—even suddenly and differently. However, the overall trajectory was much the same: from primarily agrarian to a combination of industrial, service, and agrarian economies. Two fundamental characteristics developed in tandem with this overall tendency (Kuznets 1957). The first was the movement of laborers and people from rural to urban areas. The second was an increase in total factor productivity brought about by the transition from conventional to contemporary production methods. The agriculture industry itself has undergone a less evident but no less significant structural change (Timmer 1988).

Modernization of production and market transactions, as well as integration with other economic sectors and even other nations, are some characteristics that it shares with the overall structural transformation (WDR 2008). The relative decline of basic agriculture, the growing significance of agribusiness—which encompasses the value added for agro-related industries, agricultural trade, and distribution services—and the increasing proportion of high-value agricultural products in international trade relative to traditional exports have all been indicators of the structural transformation of the agricultural sector.

Although remarkable in many regions and states, India's agricultural accomplishments have fallen short of their promise. The primary cause of this is our leaders' complacency with our accomplishments, especially those in science. We typically draw satisfaction from the fact that we are no longer experiencing food scarcity by contrasting our current food situation with the food shortage of the middle of the 1960s. Instead of comparing the accomplishments of agriculture with those of other sectors in India and other countries, we are stuck in the 2000s or recent years, comparing agriculture to that of 1965–1967. The advancements in space, IT, telecom, services, cars, medical science, transportation, and other fields are not comparable to what has been accomplished in agriculture. We are far more different in every area of life between 1965–1967 and the 2000s than in agriculture, however we do not evaluate agricultural accomplishments by the difficult standards. Agricultural accomplishments are undoubtedly significant when compared to the mid-1960s, but they pale in comparison to other metrics.

The current government has "Sabka Saath Sabka Vikas" as part of their vision for New India. Since 44.2% of the workforce in the nation works in agriculture and depends on it for their living, the transformation of the agriculture sector is essential to realizing this goal (NSO 2019). Agriculture workers' incomes differ significantly from those of non-agricultural workers (Chand et al. 2015; Chand 2019). The nation's small and marginal farmers and agricultural labourers are the main victims of poverty and undernutrition. Rural suffering is a major source of worry.

There won't be much progress in closing the income gap between agriculture and non-agriculture and easing rural suffering if current agricultural patterns continue. Growth in the agricultural sector has been shown to be highly advantageous for lowering poverty and raising per capita income (Virmani 2008). In addition to inclusive growth, agriculture is important for the nation's quality of life, sustainability, health and nutrition, and climate change. All of these elements highlight the necessity of a fresh perspective on agriculture as the twenty-first century progresses.

The new agricultural vision includes the following elements:

1. Growth to Efficiency

2. Creation of Employment

3. Food Security to Nutrition and Health

4. Transitioning from Shortage to Surplus Management

5. Knowledge-Intensive Agriculture with High Input

6. Sustainability and Climate Change

7. Manufacturing and Manufacturers

8. Reforms, Regulations, and Policy Interventions

UNIT – II

AGRICULTURAL LABOUR

Introduction

Agriculture plays a crucial role in India's economy, serving as a cornerstone for the country's future. A significant and troubling issue within the Indian rural economy is the plight of agricultural workers. Their numbers are high and continue to grow rapidly, yet they endure lives marked by severe poverty. This group represents the most disadvantaged, exploited, and overlooked segment of rural society. The challenges of underemployment and excessive population are evident in the everyday realities and living conditions of these laborers. They receive remarkably low wages, face harsh working conditions that place a tremendous burden on them, and their employment is often inconsistent, leading to frequent spells of unemployment.

The rise in the number of cultivators, agricultural labourers, and agricultural workers involved in crop production has been one of the most notable aspects of India's rural economy. The everyday lives of agricultural labourers simultaneously exhibit the characteristics of underemployment, underdevelopment, and surplus population. Their job is highly irregular, their pay is typically low, and their working circumstances place an undue burden on them. The most overlooked group in India's rural structure is the agricultural workforce. Their employment is inconsistent and their salary is minimal. Since they lack training and expertise, they also have no other options for employment. Socially, many agricultural labourers are members of scheduled tribes and castes.

They are a suppressed class as a result. They lack organization and are unable to defend their rights. Despite forty years of planning, their economic situation has not improved for all of these reasons.

Agricultural labourers must be defined in order to be identified. Because they cannot be defined using the definition of industrial labour, it is also necessary to define them separately.

(i) There is no way to distinguish between skilled, semi-skilled, and unskilled agricultural labourers. The nature of agricultural labour is such that workers must perform multiple types of tasks, making it nearly hard to categorize each worker into a distinct group. Furthermore, there is less room for job specialization than on large farms and non-agricultural sectors due to the prevalence of small farms.

(ii) The kind of employer-employee relationships that are seen in manufacturing industries cannot exist in agriculture. This is especially evident in a backward economy when family labour is often used and agriculture is not practiced as a business but rather as a means of livelihood. Given the unique characteristics of agriculture, a precise definition of agricultural labour is impossible. To get a general notion of what an agricultural worker is, it will be helpful to consult some efforts made by specialists in this area.

In developing nations, labor is the most plentiful resource, therefore labor returns are crucial to the growth of these nations. The labor markets in developing nations have been the subject of a significant quantity of literature during the past fifty years. The majority of this knowledge is based on empirical research. This literature has given rise to two extreme viewpoints. According to one perspective, labor markets function very differently from those in developed nations because they are flawed. This market's characteristics are interlocking with factor markets, which causes labor markets to be segmented. As a result, the excess labour can be identified by its (i) overt and covert unemployment characteristics, (ii) caste and gender discrimination in employment and pay, (iii) seasonal movement to other areas, etc. Another opinion that has surfaced is that labour markets in these nations are almost ideal (almost like the Marshallian market20), but they differ from those in industrialized nations. Similar technologies, fewer government intrusions, little to no labour unionization, and straightforward labour contracts are characteristics of these marketplaces. Therefore, combining aspects of

both of these viewpoints can help us better understand how labour markets operate.

In terms of employment, the rural economy is the most prevalent sector of the Indian economy. Of the entire rural workforce, "rural labour" makes up the largest segment. In addition to the agricultural sector's productivity crisis, many small farmers are losing their meagre land holdings when they use special schemes like SEZs24 to acquire land for industrial expansion, which puts them in the category of "rural landless labour." Rural labourers are the poorest segment of the rural population, with little to no ownership of means of production. In addition to having low incomes and asset bases, the vast majority of them are members of the Scheduled Tribe and Scheduled Caste communities, which make up the majority of the unorganized sector in rural areas. Additionally, they are among the lowest socioeconomic groups in rural society and the majority of them lack literacy (NCEUS25, 2007: P. 7). These are the people whose issues go unnoticed in the age of globalization and liberalized policies, while a tiny percentage of "shining India" receives all the attention. Due to their vulnerability, they suffer more during periods of global recession when their regular workload is severely cut. They consequently experience chronic malnutrition during periods of sharply rising food grain costs. Therefore, in order to make the development process inclusive, these individuals must be made partners in it through the adoption of labour-centric policies that are specifically tailored to rural areas.

Type of Agricultural Labour

Bonded or Semi-Free Labourers

People who remained to labour in nearly every situation were referred to as "Agrarian Serfs" by Merchant and Wadia. According to a Royal Commission for Labour and Employment study, the need for money was what bound individuals who were bound. Without any means of defense, he started working for the man who had given him his money. The money isn't returned, and it shouldn't be. The person who lent the borrower the money has made

him a lifelong bondslave. He receives so little money and food that he is treated like a medieval serf. These individuals were either bought, sold, or pawned by enslavers. Even worse, the bond was never paid back, and as a result, some generations after that were also shackled. Additionally, the labourer could not be allowed to travel far from his house if the master could not find him a job.

Dwarf-Holding Labourers:

This group included part-time farmers, farmworkers, small-scale landowners, and renters. They stood out from the others because they were different from the other farmworkers. The pitiful income from their main job encouraged them to work on a farm.

Women and other family members frequently worked on farms. According to Dr. Patel's estimation, India had 32 million small-scale farmers in 1931. Bihar, Bengal, Punjab, Uttar Pradesh, and other areas were home to the majority of them.

Under-Employed Landless Labourers:

In contrast to bonded labourers, who were obligated to their employers, dwarf-holding labourers were affixed to the land. The main reason in each instance was a dearth of other work options. After the landowners severed their ties with them, landless farm labourers were forced into this type of agricultural labour. Thomas and Ramakrishnan contend that the cost of the workers' freedom was too high to make up for the absence of a safe place to live, regardless of who was in charge of their release.

Full-Time Landless Labourers:

People who worked on plantations and for affluent and successful farmers made up the group. At first, it was challenging to find enough labour because most farms are situated in isolated areas with sparse people. The slave trade compelled planters to devise a new method of obtaining labour. Because there was no strong labour union and plantation owners knew one another

well, the workers on the plantations were essentially bound or semi-free labourers.

Definition and Characteristics of Agricultural labour

"All people who are engaged as hired labourers in agricultural activities for 50 percent or more of the total number of days worked by them during the preceding year" is the definition of agricultural labour given by the First Agricultural Labour Enquiry Committee (1950–51). The nature and amount of employment served as the foundation for the Committee's definition.

Using income as the foundation, the second Agricultural Labour Enquiry Committee (1956–1957) defined an individual as an agricultural labourer if their primary source of income in the preceding year was agricultural wages.

According to the two Committees, an individual who was employed and paid in cash or in kind was classified as an agricultural labourer. Additionally, the following activities were classified as "agricultural operations": Tilling, planting, harvesting, raising any horticulture product, dairy farming, raising livestock, beekeeping, poultry, and other farming-related activities including transporting harvested goods to markets are all included in farming.

A worker "who is generally untrained and unorganized and has little for his livelihood other than personal labour" is considered an agricultural labourer, according to the National Commission on Labour. Therefore, this group includes people whose primary source of income is wage employment. There are two subcategories within it:
(i) landless agricultural labour, and (ii) very small cultivators whose main source of earnings, due to their small and submarginal holdings, is wage employment. Landless labour in turn can be classified into two broad categories as (a) Permanent labour, attatched to a cultivating household, and (b) Casual labour. This group can be sub-divided into three subgroups, namely, cultivators, share croppers and lease holders.
Permanent or attached labourers generally work on annual or seasonal basis and they work on some sort of contract. Their wages are determined by

custom or tradition. On the other hand, temporary or casual labourers are engaged only during peak period for work. Their employment is temporary and they are paid at the market rate.

They are not attached to any landlord. Under the second group come small farmers who possess very little land and, therefore, have to devote most of their time working on the lands of others as labourers. Share-croppers are those who, while sharing the produce of the land for their work, also work as labourers. Tenants are those who not only work on leased land but also work as labourers.

The Agricultural Labour Enquiry Committee differentiated between the "attached" and "casual" labourers. The farmer is those who are employed for a period of time i.e., on annual or seasonal basis by the assignment of lodging on the farm, who are under some sort of contract with the employers, and in whose case the mode of payment is determined by custom or tradition. They are to work for their employers and are not ordinarily free to seek employment elsewhere, while the latter, i.e., the casual labourers are engaged in the peak period and attend to rush work only Such labourers are free to leave one job for another whenever they please and they are paid at the market rate. In most cases, the difference between the two classes is stated initially in terms of period for which a man is engaged and whether or not he receives daily wages. The most satisfactory definition (which includes small and marginal farmers whose condition is no better than landless agricultural labourers) appears to be the one given by the Committee on Labour Welfare (1969), which defined agricultural labour as "One whose principal means of livelihood is wage income arising out of farm labour and other allied activities

Rural labour market

The aforementioned complexity and diversity of the rural economy make it challenging to define rural labour in a way that is widely accepted. The fact that many rural households engage in substantial home-based self-employment activities also contributes to the challenge. Additionally, when wage employment is used, the distinction between the employer and the hired

is not only thin but also hazy because the status of the "hired" and the "hirer" frequently changes as a result of seasonal job availability on the one hand and the corresponding relocation on the other. Because of this, there was uncertainty in the 1980s and 1990s regarding a working definition of "rural labour," specifically whether it should include only those who offer their manual labour for pay or whether it should also include those who engage in petty self-employment, or non-manual labour. In light of this context, we now briefly examine the definitional framework used by India's specially established rural labour inquiry committees and three major data sources. We specifically look at three prominent organizations: (i) the Labour Bureau's Rural Labour Enquiry (Survey Reports) in 1983; (ii) the National Commission on Rural Labour in 1991; and (iii) the National Sample Survey Organization (NSSO).

"Rural labour" was described by the Rural Labour Enquiry Report28 (e.g., 1983) as manual labour performed in agricultural and/or non-agricultural occupations in exchange for monetary or in-kind payments or salary. Self-employed people and small and marginal farmers were not included in the rural labour group. According to the RLEs, a household was classified as a "rural labour household" if paid manual wage labour accounted for a larger percentage of total revenue throughout the year. In contrast, rural labour was described by the National Commission on Rural Labour (NCRL) (1991) as "those living and working in the rural areas subsisting partially or totally from wage income."

However, the NCRL contended that since their living conditions are similarly substandard, independent contractors who operate in the petty production system ought to be categorized as rural labour. Both (i) wage-paid manual labourers involved in agricultural and non-agricultural activities and (ii) small and marginal farmers, tenants, sharecroppers, and artisans who fall under the self-employed category would be included in the definition of rural labour (NCRL, 1991, P. 9). However, "manual labour working in agricultural and/or non-agricultural occupations in return for remuneration paid either in cash or in kind (excluding exchange labour)" was another definition of rural labour given by the NSSO survey for 1999–00.

Rural Unemployment

When someone actively looks for work but is unsuccessful, they are said to be unemployed. The level of unemployment reflects the state of the economy. The most common indicator of unemployment is the unemployment rate. The number of jobless persons divided by the working population, or those who are employed, is known as the unemployment rate.

Unemployment rate = (Unemployed Workers / Total labour force) × 100

Employment and unemployment are defined by the National Sample Survey Organization (NSSO) based on an individual's activity status. The Ministry of Statistics and Program Implementation's NSSO uses three methods to measure unemployment in India:

Daily Status Approach: Under this method, a person's unemployment status is calculated for each day of a reference week. A person is considered unemployed for the duration of the day if they do not have any profitable employment, even for just one hour.

Weekly Status Approach: This method draws attention to the record of individuals who, on any day of the week before the survey date, did not have gainful employment or were unemployed for even an hour.

Usual Status Approach: This is an estimate of the number of people who were unemployed or did not have gainful employment for a significant portion of the 365 days.

Near 98 percent of India's rural workers are casual wage workers, and the great majority (62.2 percent) work in agriculture. In the years following the green revolution, agriculture's ability to accommodate more workers started to wane (Bhalla, 1987). The ability of agriculture to absorb labour was further diminished with the following expansion of green revolution technologies, which increased reliance on mechanized activities. However, India's agricultural workforce has decreased over the past 20 years (from 68.6 percent in 1983 to 56.6 percent in 2004–05) as a result of concentrated attempts to increase non-agricultural employment (via policies for rural

industrialization that are specifically targeted). Assam, Madhya Pradesh, Mizoram, Bihar, Meghalaya, Arunachal Pradesh, and Chhattisgarh are among the states where more than 60% of the workforce is still employed in agriculture, while other states have seen a more striking decline in the proportion of agriculture in total employment (Kerala, 35.1 percent; Tripura, 37.2 percent; Tamil Nadu, 45.1 percent; and Punjab, 48.4 percent).

One of the main factors affecting the livelihood chances for the disadvantaged segments of society has been the delayed rate of structural transformation in the Indian economy. In terms of gender, women are more disadvantaged than males, even as men relocate and find new jobs in rural areas. Labor from SC and ST households is comparable (NCEUS, 2007). Between 1994 and 2000, the agricultural sector's job growth rate was a pitiful 0.2 percent annually. Low governmental investment (such as irrigation, drought proofing, agricultural research, and extension) is blamed for the slowdown in employment growth. This has led to the de-intensification of farming in arid regions and the adoption of labour-saving technologies in other regions.

The rural labour market is seeing an increase in unemployment due to the stagnating or diminishing capacity of agriculture to absorb labour and the absence of alternative employment options in non-agricultural industries, particularly for low-skilled workers. Agricultural labourers, both male and female, had 51 days of unemployment in 2004–05, up from 30 days in 1993–94. According to gender, the corresponding numbers ranged from 26 to 47 days for females and from 33 to 53 days for males. From 9.7 percent in 1993-94 to 16.2 percent in 2004-05, the unemployment rate31 (for both males and females combined) on a current daily status (CDS) basis has sharply grown.

Male CDS unemployment increased from 9.7 percent to 15.6 percent, while female CDS unemployment increased from 9.8 percent to 17.3 percent. According to normal main status (UPS), the disguised unemployment rate was set at 20 percent for men and 23.7 percent for women. The comparable percentages for "casual labour" among men and women were 19.1 and 19.8 percent, respectively. The high rate of underemployment and unemployment among rural workers highlights the importance of policies like the National

Rural Employment Guarantee Act (2005) in addressing the employment gap for rural workers (NCEUS, 2007).

Almost 8.3 percent of Indian job searchers were unemployed at the end of 2022. On December 31, 2022, the unemployment rate was 7.7 percent in rural areas and 10 percent in urban areas. This information was made public by the Centre for Monitoring Indian Economy (CMIE), which determines and reports the nation's jobless rate every day. The ratio of all estimated unemployed people to all estimated labour force members for a given month is known as the unemployment rate.

In general, urban unemployment rates continue to be greater than rural ones. However, compared to urban unemployment, rural unemployment is seen to be more severe primarily because its causes are more entrenched and therefore more challenging to alleviate. The primary causes of rural unemployment are thought to be factors like shrinking land holding sizes, a lack of infrastructure, particularly irrigation infrastructure, a lack of other employment options, and the ongoing depletion of forest resources. These are either hard to change overnight or irreversible.

The central Indian belt is the area most negatively impacted in terms of creating rural jobs because to its undulating terrain, lack of perennial streams, reliance on the forest for daily needs, and lack of irrigation infrastructure. The Adivasi people's homeland is located in this region as well.

Low holding size

According to the Department of Agriculture & Farmers Welfare's 2015–16 Agriculture Census, the average size of operational holdings fell from 2.28 hectares in 1970–71 to 1.08 hectares in 2015–16. More than 68.5% of all cultivators are marginal farmers, who own less than one hectare of land. Their average holding size is 0.38 hectares. Unless there are irrigation facilities for a second crop, this tiny quantity of land cannot support all of the labourers in the homes after the Kharif (monsoon) season. The entire household's labour force is not fully utilized, even during the Kharif season. Because of this, the

majority of marginal farmers search for paid work as agricultural labourers during the Kharif season.

Lack of irrigation facilities

According to the agriculture census data, irrigation covers over 49% of India's net sown land. It is approximately 54% of the land owned by marginal farmers. However, the situation appears to be dire in the central plateau. All-season irrigation facilities are available on about 19% of Jharkhand's land and only 7% of Odisha's land.

For marginal farmers, the conventional irrigation models—like big dams or river lift irrigation schemes—are either impractical or ineffective. Among the alternate alternatives are modest diversion structures, soil moisture conservation, and in-situ water harvesting. However, it is necessary to create irrigation prototypes that are tailored to the specific context of the many regions in the central plateau.

Lack of other work opportunities

In the past 20 years, the overall production of food grains has increased by 48% (Union Ministry of Agriculture & Farmers Welfare, 2020). Without a doubt, increased food production has led to job creation in rural agriculture. That production boost, though, hasn't been enough to employ all of the rural labour force. Rural unemployment has increased as a result of mechanization and a 17% increase in the population during the same time period.

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was enacted to provide employment opportunities for rural job seekers, but over time, its focus shifted to asset creation, making it more supply-driven rather than meeting the employment demand of job seekers in rural areas. Another problem with MGNREGA was its low wage rate, which in many states was lower than the state minimum wage rate. This resulted in villagers migrating to cities in search of menial jobs.

Depleting forest resource

In central India, forests have been a significant source of jobs for villages. Villagers gather and sell a variety of non-timber forest products from the forest in addition to working as labourers for the forest department. The non-timber tree species in the forests have suffered since the colonial era due to the forest department's only focus on timber species. Non-timber forest products are becoming less accessible.

Need for long-term planning, sustained action

The aforementioned reasons contribute to India's chronic rural unemployment, particularly in central India. Therefore, to change this condition, long-term, consistent action and careful preparation are required. Establishing irrigation infrastructure and bringing more small and marginal farmers under a second crop could be important strategies. To create context-specific irrigation and water collecting prototypes for the entire region, however, this requires extensive and sustained involvement.

Unemployment Trends

According to figures from the CMIE, India's unemployment rate as of June 8, 2021, notwithstanding lockdown and mobility restrictions, is 12.81%. According to the Centre for Monitoring Indian Economy (CMIE) report, the employment rate dropped from 37.6 percent in March to 36.8 percent in April, while the unemployment rate in India increased from 6.5 percent in March 2021 to 8 percent in April 2021 to 14.7% at the end of May.

After hitting a record high of 29% in March 2020 due to the country's lockdown, India's unemployment rate dropped to 7% in September 2020, but it subsequently rose to 9.1% in December 2020. While the employment rate increased to 37.9 percent from 36.9 percent in December 2020, the unemployment rate once again decreased to 6.5 percent in January 2021 from 9.1 percent in December 2020. Numerous industries have been forced to

close as a result of the lockdown to limit the coronavirus outbreak, which has increased unemployment nationwide.

Types of Unemployment in India

In India, there are seven types of unemployment. The types of unemployment are discussed below:

Disguised Unemployment: This kind of unemployment occurs when there are more employed persons than are truly needed. Disguised unemployment is typically found in the agricultural or unorganized industries. When a worker's skills and the jobs that are available in the market are not aligned, structural unemployment results. It is crucial to give them relevant training since many Indians do not find employment that matches their skills or because they lack the necessary skills. This is a result of low educational attainment.

Seasonal Unemployment: Unemployment occurs when people are unemployed during specific times of the year. For example, workers in India hardly ever have a job all year round.

Vulnerable Unemployment: People who experience this kind of unemployment are classified as unemployed. Since people don't have official job contracts, they work informally, and as a result, no labor records are ever maintained. It is one of the most common types of unemployment in India.

Technological Unemployment: The circumstance in which technological advancements cause people to lose their jobs. According to World Bank estimates from 2016, 69% of Indian occupations were anticipated to be at risk of automation annually. Cyclical unemployment is defined as unemployment brought on by the business cycle, in which the number of unemployed people increases during recessions and falls as the economy expands. India's cyclical unemployment rate is very low.

Frictional Unemployment: The situation where people lose their occupations as a result of technical improvements. 69% of Indian jobs were predicted to be at risk of automation each year, according to World Bank estimates from

2016. Cyclical unemployment is characterized as unemployment caused by the business cycle, where unemployment rates rise during recessions and decline during economic expansions. The cyclical unemployment rate in India is extremely low.

Consequences of Unemployment

A major economic problem, unemployment has a profound impact on society and the economy. For IB and undergraduate economics students, it is essential to comprehend these ramifications. With the use of real-world examples and a glossary of important concepts, this research note offers a thorough examination of the negative effects of unemployment on the economy, individuals, and society.

Loss of Gross Domestic Product (GDP)

The total value of goods and services generated in a nation is represented by its GDP. Underutilization of labour, a crucial component of production, brought on by unemployment lowers the output of products and services.

Loss of Tax Revenue

Due to their decreased spending, unemployed people do not pay income taxes, which lowers sales tax receipts. As a result, the government's financial ability to finance investments and public services is diminished.

Increased Cost of Unemployment Benefits

To assist persons who are unemployed, governments frequently offer unemployment benefits. Increased claimants due to high unemployment rates result in higher public spending.

Loss of Income for Individuals

People who are unemployed lose their income, which lowers their purchasing power and lowers economic consumption as a whole.

Greater Disparities in the Distribution of Income

The gap between the rich and the poor can get wider due to unemployment. While the unemployed lose a substantial portion of their income and wealth, those who are employed preserve or grow their fortune.

Personal and Social Consequences of Unemployment

Increased Crime Rates

Long-term unemployment, in particular, might raise crime rates because people may turn to criminal activity in times of need or lack of opportunity.

Increased Stress Levels

Due to loss of self-esteem and financial instability, unemployment frequently causes psychological stress, which can result in mental health problems.

Increased Indebtedness

People without jobs might use credit to cover necessities, which could result in more debt and unstable finances.

Homelessness

Unemployment-related income loss might make it difficult to pay for housing, which can lead to homelessness.

Family Breakdown

Unemployment-related psychological and financial stress can cause family disintegration, including a rise in divorce and domestic abuse.

Unemployment in increasing poverty:

Unemployment is one of the most significant economic reasons that can contribute to poverty, however there are many more. With about 1.1

billion unemployed people in just the top 10 most populous countries, unemployment is a serious issue on a global scale. Poverty is exacerbated by the direct and indirect effects of unemployment in many economies worldwide.

1. Loss of Earnings:

Loss of income is the most evident and direct way that unemployment contributes to poverty. If left unchecked, this might result in debt from borrowing funds to cover savings and requirements, or possibly famine and homelessness.

2. Keeping the Poverty Cycle Alive:

Future generations will have a heavier workload because of the current rates of youth unemployment, which raise the possibility of future poverty. Unemployment shocks like these cause people to become impoverished. In a Brazilian case study, it was discovered that children in the household experienced a great deal of stress when their parents were unemployed. If both parents are unemployed, children are more likely to leave school to work. These children will have lesser levels of human capital if they do not complete the necessary education, which will put them in uncertain employment situations down the road. Generational poverty will undoubtedly be the result of these repercussions.

3. Criminal Activity Increased:

As demonstrated by the examples above, unemployment not only reduces income and hence contributes to poverty, but it also increases criminal activity. Increased rates of crime and vandalism have been connected to high unemployment, especially among young people. In order to provide for their families, people may turn to violent and illegal means of subsistence when they are unable to make a living legally. Just 10% of criminals claim that their primary motivation for engaging in unlawful activity is unemployment.

People are more likely to become criminals when they resort to violence as a means of escaping poverty, and the rise in crime and violence exacerbates political instability in a nation.

4. Unemployment for a Long Period of Time:

The likelihood of someone losing their job for an extended period of time rises when they are unemployed. People who reside in underprivileged neighbourhoods deal with subpar housing, underfunded schools, and restricted access to services and public transportation. A person's chances of finding work again are decreased by these outcomes.

Remedial Measures for Unemployment

Use of Labour-intensive Technology

In order to create enough jobs in both the rural and urban sectors of the economy, labour-intensive technology must be adopted by both the organized and unorganized sectors. The employment elasticity of agricultural output growth has decreased as a result of increased agricultural mechanization in certain states. Naturally, the rise of output may be slowed by the employment of labour-intensive procedures that result in decreased worker productivity in both industry and agriculture. Therefore, there may be a similar trade-off between output growth and employment. We believe that given the severity of the unemployment issue, some output growth should be foregone in order to create additional jobs.

Accelerating Investment in Agriculture

The lack of capital formation or investment in agriculture has also been a major factor in the sluggish expansion of employment in the rural and agricultural sectors. It is important to remember that investments have a multiplier impact that works through both forward and backward linkages in addition to directly creating jobs.

Diversification of Agriculture

Crop cultivation must give way immediately to more labour-intensive and higher-paying industries like horticulture, vegetable production, floriculture, animal husbandry, fisheries, etc. Additionally, there is a significant job potential in the fields of education, health, and employment generation when agro-processing industries are promoted for export. In addition to encouraging the development of human capital, which boosts productivity, expanding health care and education will also create a significant number of job possibilities.

Development of the rural areas

This will lessen the burden on jobs in metropolitan regions by reducing the movement of rural residents to urban areas.

Overhaul of Education system

The government must closely monitor the educational system and work to develop innovative strategies for producing skilled workers. From this vantage point, industry cooperation, vocational training, and raising educational standards may be the way forward.

Need for National Employment Policy (NEP)

In addition to labour and employment, this would include a variety of multifaceted initiatives addressing a wide range of social and economic challenges impacting numerous policy domains. The 2030 Agenda for Sustainable Development's objectives would be greatly aided by the policy, which would be an essential instrument.

Decentralized Development

It has been noted that some areas have a disproportionately high jobless rate. The government should encourage businesses to establish operations in certain regions by offering tax benefits in order to address this geographic discrepancy.

Urban MGNREGA needed

A parliamentary standing committee has advised the Union government that in order to assist people in recovering from the significant loss of jobs and income that followed the coronavirus outbreak, India should create an urban national job guarantee program modeled after the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

Other Measurements:

1. Rapid GDP Growth: The general problem of employment can be handled through faster growth. To greatly improve the nation's job situation, GDP growth rates between 8% and 9% are needed during the next ten years.

2. Control of Population Growth: To guarantee that there is adequate work for everyone who wishes to work, population growth must be controlled. Implementing a population control policy that is both meaningful and effective—such as family planning programs, etc.—is therefore crucial.

3. Development of the Agricultural Sector: In order to increase labour productivity and improve the standard of living for a significant section of the existing labour force, the agriculture sector must be expanded. An agricultural revolution must be brought about by better practices, larger irrigation systems, changed land laws, and more government funding.

4. Encouragement of Small Businesses: Numerous measures, such as liberal finance, technical training, raw material provision, infrastructural upgrades, and product promotion, must be implemented to support the small company sector.

5. Infrastructural Improvements: The expansion of the economy as a whole depends on the infrastructure, which includes the roads, irrigation, electricity, and other services. The industrial and agricultural sectors can function at their

best when there is improved infrastructure. There will be additional work opportunities as a result.

6. Special Employment Programs: Special employment programs that seek to provide self-employment or paid jobs should be established.

7. Improvement of Employment Exchanges: The employment exchanges, which are spread out over the country, are a great way to connect job searchers with possible employers. These employment exchanges ought to function more effectively.

8. Creation of Self-employment Chances: The government should provide a range of resources, including as funding, skill development, supply availability, and product marketing, in order to boost the number of opportunities for self-employment.

9. Educational Reform: The present educational system has to be more extensive and ought to incorporate apprenticeships or long-term training. Educational institutions must be more diverse in order to support the educated unemployed and improve the skills of the unemployed through apprenticeship programs or specialized training. The Pradhan Mantri Kaushal Vikas Yojana, also referred to as Skill India, was introduced by the Indian government on July 16, 2015, as a program for standards and skill development. Following successful completion of the program's training and evaluation, learners receive a financial prize and a government certification that will aid in their job search for a better future.

10. Planning for Human Resources: It is crucial to project the future demand for educated labor and base admissions decisions for different professional programs on those projections. Consequently, the market will not have an excess of educated labor.

Agricultural wages in India

In India, agriculture is mostly a labor-intensive industry. A significant portion of the overall cost of growing a crop is spent on agricultural labor. The amount spent on labor (including family and hired labor) varies from 20 to 50 percent of the overall cost of cultivation, depending on the type of crop. Given the importance of labor in the cultivation process, changes in the wages offered to farm workers become crucial for the typical Indian farmer. India's agricultural workforce is made up of farmers (or cultivators) and agricultural laborers.

Trends in agricultural wages

Between 1998–1999 and 2017–2018 (till February 2018), the average daily income for an agricultural worker rose from INR 43.90 to INR 228.36. They increased from INR 50 per day to little under INR 90 per day in real terms. This suggests an average yearly growth rate of over 9% in nominal terms and 3.14 % in real terms. The national time series has a structural discontinuity. We employed the Bai and Perron (2003) method, which endogenously finds a structural break in time-series data by evaluating the optimal set of potential breaks to minimize the squared residuals, to check for the presence of a structural break. January 2007 was determined to be the breaking point based on the results. After the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was introduced in 2005, agricultural laborers' daily salaries increased significantly, according to Nagaraj et al. (2016) and Berg et al. (2012).

They claim that the program led to a labor shortage in agriculture, particularly during the busiest growing seasons. In the sections that follow, we examine this design and its function. The largest legislatively based public works program in the world is the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). With the exception of regions that were entirely urban, it was pushed out throughout nearly all of India in 2008–

09 after being announced in September 2005 and introduced in February 2006 in 200 districts. It is a social security provision that guarantees everyone over the age of 18 who looks for work the "right to work" (MoRD, 2017).

The program offers underemployed and surplus rural laborers direct supplemental income employment. Specifically, the scheme

• Assures anyone who requests it of 100 days of unskilled manual labor in a fiscal year at a specific notified minimum wage rate (determined by the central and state governments), which was later extended to 150 days in drought-affected areas by the ruling central government due to the start of two consecutive droughts in 2014 and 2015;
• Anyone living in a rural region who is at least eighteen years old is eligible to work under MGNREGA. Anyone who wants (and is willing) to perform manual labor without specialized skills can sign up;
• Employment under MGNREGA is a legal entitlement, and a person is entitled to unemployment benefits if no work is available within 15 days after applying for a job.

Under MGNREGA, an average of 2,257 million person days of work were created in each fiscal year between 2008–09 and 2018–19. The initiative benefited between 14 and 16 percent of all Indian workers.

MGNREGA and farm wages

It should be noted that the predicted structural break in farm pay for January 2007 occurs between the start of MGNREGA (February 2006) and its nationwide rollout (March 2008). Around this interval, there are noticeable trends in farm wages. Between 1998–1999 and 2006–2007, the average annual salary growth rate was 4% in nominal terms and roughly 0.92 percent in real terms. However, these growth rates were 13.06 percent in nominal terms and 4.78 percent in real terms over the post-break period from 2006–07 to 2017–18.The national government of India notifies each Indian state of the daily salary rates offered under the MGNREGA plan. Since 2005-06 (when

MGNREGA was first rolled out as a pilot scheme), these wage rates have undergone several changes.

These pay rates were set in accordance with the Minimum Wage Act's minimum wage rates for agricultural labor from 2005–06 to 2008–09. The central government separated minimum wages from program pay in 2009. It later started indexing the scheme's earnings to CPIAL in 2011–12. Since then, the Government of India's Ministry of Rural Development has announced wage rates for every state at the beginning of each fiscal year, taking into account variations in the CPI-AL. According to Drèze and Khera (2017), this suggested that the MGNREGA salary rates have been established in real terms.

The national average wage rate under the plan was estimated by averaging the wage rates at the state level. We discover intriguing findings when we compare the real agricultural wage rate that is in place throughout the nation with the average daily MGNREGA wage rate8 (Figure 5). First, both pay rates seem to move in tandem over a longer time frame. Second, with the exception of 2009–2010, the agricultural wage rate has continuously exceeded the MGNREGA wage rate, and this disparity has been growing recently. The MGNREGA wage really seems to function similarly to a base wage rate for all farm wages when it comes to nominal wage rates.

UNIT - III

AGRICULTURAL PRICES AND FINANCE

Agricultural Prices

Agricultural goods are generally tradable, and every nation engages in the trade of some agricultural products. Without intervention, it is anticipated that the domestic prices of these products will fluctuate in line with global prices. Nevertheless, it is widely recognized that agriculture faces significant intervention, which creates discrepancies between global and domestic prices, leading to variations in agricultural prices across countries. As a result, it is frequently argued that global prices hold little relevance for the advancement of agriculture in nations that intervene in the pricing of their agricultural products. The Government of India implemented Agricultural Price Policy to guarantee that farmers receive adequate compensation for their agricultural products and continue to invest in agriculture. In India, Agricultural Price Policy establishes the Minimum Support Price for agricultural products.

Agricultural development has been viewed as a measure of grassroots quality of life, identifying it as a sector for the people. Concerning the significance of agriculture in a wider socio-economic context, the three fundamental goals of the nation's economic advancement—output growth, price stability, and poverty reduction—are most effectively achieved through the growth of the agricultural sector. Should public investment and market infrastructure in agriculture remain insufficient, there may be a critical issue of competitiveness and sufficient supply response.

No question, India is a significant producer of various agricultural goods. Regarding the volume of production, India ranks first globally in milk and second in wheat and rice. Consequently, we must focus on enhancing quality while preserving our advantage in quantity. In a contemporary

economy, it is unimaginable that the function of middlemen can be completely removed. This highlights the importance of regulating middlemen to enhance their efficiency, competitiveness, and accountability. It is essential to transition to a scenario in which an effective system of market intermediaries is established in the agricultural sector.

The existing system of subsidies does not address the primary issue in agriculture, which is uncertainty. While insurance mechanisms may help alleviate weather-related uncertainty, the experience thus far, particularly with what has mainly been credit insurance for agriculture, has been discouraging. The commercialization of agriculture can only advance when institutional frameworks like insurance are deeply integrated into the agriculture sector.

To benefit the farming community from the new global market access opportunities, the internal agricultural marketing system in the country also needs to be integrated and strengthened. In particular, the market system has to be revitalized to i) provide incentives to farmer to produce more; ii) convey the changing needs of the consumers to the producers to enable production planning; iii) foster true competition among the market players and iv) to enhance the share of farmers in the ultimate price of his agricultural produce. Agricultural prices cover prices of agricultural products (output prices) and prices of requisites for agricultural production (input prices) at various stages of marketing.

In India, the primary goal of the Government's price policy for agricultural products is to guarantee profitable prices to the farmers for their output, with the intention of promoting greater investment and production. In 1964, under L. K. Jha, the Jha Committee's Report on Foodgrain Prices marked the initial effort in establishing a price policy for agriculture in the nation. In January 1965, the Agricultural Prices Commission (APC) was established based on the suggestions of the Tha Committee. Currently, the Commission is referred to as the Commission for Agricultural Costs and Prices (CACP) and is tasked with setting administered prices on an annual basis. By the end of each year, minimum support prices for key agricultural

commodities are declared, which are determined after considering the recommendations made by the Commission for Agricultural Costs and Prices (CACP). While suggesting prices, the CACP considers all significant factors, such as.

i) Cost of Production
ii) Changes in Input Prices
iii) Input/Output Price Parity
iv) Trends in Market Prices
v) Inter-crop Price Parity
vi) Demand and Supply Situation
vii) Effect on Industrial Cost Structure
viii) Effect on General Price Level
ix) Effect on Cost of Living
x) International Market Price Situation
xi) Parity between Prices Paid and Prices Received by farmers (Terms of Trade).

Of all the factors, the production cost is the most concrete factor, encompassing all operational and fixed requirements. The government implements the Price Support Scheme (PSS) for commodities, facilitated by different public and cooperative organizations like FCI, CCI, JCI, NAFED, Tobacco Board, etc., for which the MSPs are established. For commodities excluded from the PSS, the government also coordinates market intervention upon specific requests from the States for specific quantities at mutually agreed prices. Any losses incurred are shared equally between the Central and State Governments, on a 50:50 bases.

Features of Agricultural Prices in India

1. Non-Remunerative Prices: prices that do not generate profit fail to offer any motivation for exerting effort, utilizing improved resources, increasing production, and earning greater returns. Farmers need to sell their products at lucrative prices to achieve higher earnings.

2. Role of Supply in Agricultural Prices: While the prices of agricultural products are influenced by both demand and supply factors, the supply levels of any agricultural product significantly impact its agricultural price. This is due to the idea that the demand for these products is mainly inelastic, resulting in an increase in supply leading to lower income for the farmers.
3. Uncertainty: the unpredictability resulting from seasonal changes deters farmers from embracing new agricultural methods and from assuming risks. A relatively stable price will give the farmers a feeling of safety to enhance their farming.

4. Distress Sale: Farmers engage in distress sale right after harvesting the crops because they do not have the ability to store those crops.

5. Middlemen: The majority of small and marginal farmers in our nation sell their crops to middlemen who take advantage of them by offering a price that is lower than the market price.

6. Incomplete information: Most of the farmers are not aware about the information regarding the prevailing prices. This makes the farmer sell their product at a non- remunerative price and incur losses.

7. Insufficient infrastructure: Elements such as a structured market, accurate market data, communication, and transportation systems are absent in our country, which hinders farmers from effectively marketing agricultural products.

Objectives of Agricultural Price Policy

Its main objectives are summarized below:

(i) To Ensure Relation between Prices of Food-grains and Agricultural Goods: The primary goal of agricultural price policy is to maintain a suitable relationship between the prices of food grains and non-food grains, as well as among the agricultural products, so that the terms of trade between

these two economic sectors do not fluctuate drastically in favour of one over the other.

(ii) Protecting farmers' interests: The Agricultural Price Policy in India removes the necessity for intermediaries by implementing land reforms, creating institutions that directly aid farmers, etc.

(iii) Maintaining a reasonable price for agricultural products: Another aim of the Agricultural Price Policy is to make certain that food is exchanged at a price that is advantageous to both farmers and consumers.

(iv) Increasing agricultural production: When farmers gain from their seasonal harvest, they are more inclined to keep investing in agricultural services. The Agricultural Price Policy in India guarantees that the Minimum Support Prices are fulfilled.

(iv) To Control Seasonal Fluctuations: Another aim of price policy is to manage cyclical and seasonal variations in price increases to the least extent possible.

(v) Integrate the Price: The agricultural price policy should also strive to achieve a higher integration of prices among the different regions in the country so that a consistent flow of marketable surplus can be sustained and exports of agricultural products can be encouraged consistently.

(vi) Promote Capital Formation: Only when farmers receive profitable prices from the sale of their agricultural products will they be capable of saving a portion of their earnings.

Reasons for fluctuations in Prices

Fluctuations in agricultural prices can be linked to several factors, which can be generally divided into influences from the supply side, the demand side, and external factors. Below are some of the main reasons:

Supply-Side Factors

Weather Conditions: Weather is essential in agriculture. Droughts, floods, and other severe weather occurrences can greatly affect crop production, resulting in price variations.

Pest and Disease Outbreaks: Infestations or illnesses can diminish the availability of specific crops, resulting in increased prices.

Production Costs: Alterations in the prices of inputs like seeds, fertilizers, labor, and fuel may influence production volumes and costs.

Technological Advances: Enhancements in farming technology can boost production, which could result in decreased prices if supply surpasses demand.

Government Policies: Subsidies, tariffs, and trade agreements may impact the availability of agricultural goods, affecting prices.

Market Access and Infrastructure: The capability of farmers to reach markets and move goods can affect supply and pricing.

Demand-Side Factors

Consumer Preferences: Changes in consumer preferences and dietary patterns can result in a rise or fall in demand for specific agricultural products.

Population Growth: A growing population can result in greater demand for food, causing prices to rise.

Economic Conditions: Economic growth or recession can affect purchasing power and the demand for agricultural products.

Global Markets: Global demand for specific goods can influence domestic prices, particularly for crops aimed at export.

External Factors

Global Events: Events such as geopolitical conflicts, pandemics, or trade disagreements can interrupt supply chains and affect prices.

Currency Fluctuations: Alterations in currency values can impact the competitiveness of agricultural exports and imports, affecting local prices.

Speculation: Speculative trading in agricultural futures may result in price fluctuations, as traders respond to anticipated alterations in future supply and demand.

Support Prices

Minimum Support Prices

(1) Minimum Support Prices (MSP): The minimum support prices declared annually by the CACP consider the factors mentioned above. The cost factor receives special attention. The cost concept includes all types of cultivation expenses, including the imputed value of inputs owned by farmers. The key cost concepts utilized by CACP are the C2 and C3 costs. C2, cost includes all actual expenses in cash and kind incurred in production by actual owner plus rent paid for leased land plus imputed value of family labour plus interest on value of owned capital assets plus rental value of owned land net of land revenue. C3, cost is equal to C_2 + 10 percent of cost to account for managerial remuneration to the farmer.

Thus the formula for Minimum Support Price (MSP) can be expressed as

$$\Rightarrow MSP = C(C2 + C3)$$

Swaminathan Formula: The M. S. Swaminathan Committee, known as 'The National Commission on Farmers,' suggested in its report submitted in 2006 that the MSP should be set at a level 50 percent higher than the weighted average cost of production (C).

$$\Rightarrow C2 + 50\%$$

The central government annually declares the minimum support price (MSP) for 23 key agricultural products, comprising 7 cereals, 5 pulses, 7 oilseeds, and 4 commercial crops.

Minimum Support Price is a price set by the Government of India to safeguard the producer-farmers from severe price declines during years of

high production. The minimum support prices serve as a guaranteed price for the farmers' produce from the Government. The primary goals are to assist farmers in avoiding distress sales and to acquire food grains for public distribution. The government declares MSPs for 23 significant crops as part of this initiative.

(2) Fair & Remunerative Price: Fair and remunerative price (FRP) is the lowest price at which sugar mills are to buy sugarcane from farmers, based on the suggestions of the Commission for Agricultural and Prices and declared by the Cabinet Committee on Economic Affairs.

• FRP is utilized in the sugarcane sector to substitute the MSP; it is founded on the Rangarajan Committee's report regarding the restructuring of the sugarcane industry.

How is FRP decided?

The FRP is based on the recovery of sugar from the cane. For the sugar season of 2021-22, FRP has been fixed at Rs 2,900/tonne at a base recovery of 10 per cent.

• Sugar recovery is the ratio between sugar produced versus cane crushed, expressed as a percentage.

• The higher the recovery, the higher is the FRP, and higher is the sugar produced.

(3) Procurement Price: The cost at which the government acquires grains from producers. The primary distinction between MSP and procurement price is that MSP is announced during the sowing season, whereas procurement price is revealed after the harvest. Typically, the procurement price exceeds the minimum price.

(4) *Issue Prices:* It is the cost at which the government distributes food grains through ration shops. Issue prices are lower than procurement prices because consumers who buy grains from ration shops typically come from the less affluent segments of society. Since 2002-03, the issue price for Antyodaya Anna Yojana categories has remained constant. Under AAY, a household is

eligible to receive 35 kg of foodgrains. An individual from a priority household is eligible for 5 kg of foodgrains each month. The prices in this scheme are 3 per kg for rice, 2 per kg for wheat, and 1 per kg for coarse grains.

Implementation of MSP

For the implementation of administered prices, such as MSP, Procurement price, and Issue price, the government takes the following actions:

(i) Entrusting the Task to Different Agencies: The Food Corporation of India (FCI) carries out price support activities for the majority of food grains. The National Agricultural Cooperative Marketing Federation (NAFED) conducts these operations for coarse cereals, pulses, and oilseeds. The Cotton and Jute Corporations of India are assigned the responsibility of price support operations for cotton and jute, respectively.

In the situation of sugarcane, sugar mills must compensate the producers with a minimum price at the very least. For tobacco, the Tobacco Board holds the duty of enforcing the price policy decisions. Comparable specialized Commodity Boards are in place for rubber, coffee, tea, spices, coconut, oilseeds, and vegetable oils, as well as horticulture, among others.

(ii) Establishment of National Crop Forecasting Centre (NCFC): It was created by the Government in January 1999 to monitor any unusual changes in the prices of essential commodities, which encompass wage goods and other products frequently used by the average consumer, and suggest government action in the marketplace when appropriate. NCFC will implement an early warning system to indicate potential supply deficiencies. This has proven essential thus far in the instances of onion, pulse, and edible oil prices.

(iii) Setting up of High Powered Price Monitoring Board: It was established in 1999 to keep track of the crucial commodity prices and to predict the necessity for government intervention in the market.

(iv) Buffer stocks: A buffer stock scheme is a governmental strategy aimed at stabilizing prices in unstable markets. This involves actions in purchasing and selling. The Food Corporation of India and NAFED accumulate buffer stocks of necessary grains and utilize them during periods of scarcity, as a shortage of any item results in a rise in its prices. The government shields Indian consumers from such price rises of essential goods by employing its buffer stocks.

(v) Warehousing: Storage facilities in the shape of warehouses are offered by the government. For instance - warehouses of FCI. The warehousing service assists farmers in keeping their agricultural products until they are moved to markets.

(vi) Regulated markets: Most state governments oversee agricultural markets within their states to avert unstable variations in agricultural prices.

(vii) Credit facility: Loans at reduced interest rates are offered by the government so that farmers can keep their harvest during periods when prices are low and sell them after several days.

Buffer Stock

Uncertainty is a fundamental aspect of agricultural production that leads to production shocks and fluctuations in the prices of agricultural products. Over the years, based on historical experience and/or political and economic factors, the Indian government has developed various strategies to address volatility in food supply and prices. One of these strategies is the maintenance of a buffer stock of food grains. In India, the concept of buffer stocking food grains is viewed as a means to implement strategic food and agricultural domestic support policies through which the government serves multiple aims, such as offering famine relief, ensuring food security for consumers, and providing production incentives for farmers. As per the standards, food reserves are kept under two categories: operational and strategic. Operational reserves are held to satisfy the distribution needs under

the public distribution system and other welfare programs. FCI holds stocks of grains beyond what is necessary for fulfilling operational requirements, and these additional stocks are referred to as strategic stocks. These are kept to guarantee price stability in the country and to address any urgent grain demands. The government establishes the buffer stock guidelines, stipulating the minimum amounts of food grains to be held in the central pool at the start of each quarter, specifically for January, April, July, and October.

As per current regulations, five million tonnes (3 million tonnes of wheat and 2 million tonnes of rice) must be reserved as strategic reserves, while states are required to hold operational stocks that are twice the average off-take of food grains in the previous three months.

Buffer stock denotes a reserve of a commodity utilized to counteract price volatility and unexpected crises. The idea of buffer stock was initially presented during the 4th Five Year Plan (1969-74). The Government of India (GOI) sustains a buffer stock of food grains in the Central Pool for: fulfilling the established minimum buffer stock standards for food security, monthly distribution of food grains for provision via Targeted Public Distribution System (TPDS) and Other Welfare Schemes (OWS), addressing emergency situations that arise from unpredicted crop failures, natural calamities, etc. , and price stabilization or market intervention to increase supply to assist in moderating the open market prices.

The Cabinet Committee on Economic Affairs establishes the minimum buffer standards quarterly. The buffer stock numbers are typically assessed every five years.

The government has enlisted the National Agricultural Cooperative Marketing Federation of India Limited (NAFED), Small Farmers Agri-business Consortium (SFAC), and Food Corporation of India (FCI) to acquire pulses for the buffer stock.

In addition to the buffer norms, the Government has established a strategic reserve of wheat (since 2008) and rice (since 2009). In 2015, the

government established a buffer stock of pulses amounting to 1. 5 lakh tonnes to manage the price fluctuations of pulses.

Presently, stocking norms fixed by the Government comprise of:

- Operational stocks: for meeting monthly distributional requirements under TPDS and OWS.
- Food security stocks/reserves: for meeting the shortfall in procurement.
- Food grains stock in the Central Pool consists of stock held by the Food Corporation of India (FCI), states participating in the Decentralised Procurement Scheme, and the state government agencies (SGAs) for both buffer and operational requirements.

What are the Benefits and Challenges of Buffer Stocks?

Benefits:

Food Security: To ensure the availability of food grains for the public, especially the vulnerable sections, during adverse conditions like droughts, floods, or other crises.

Price Stabilisation: To maintain stable prices of essential food grains in the market by regulating supply. In 2022-23, the Food Corporation of India (FCI) released 34.82 lakh tonnes of wheat to boost market supplies. The FCI's open market sale scheme significantly reduced retail inflation in cereals and wheat.

Support to Farmers: Assures farmers of a minimum price for their produce, which helps in stabilising their income and encourages continued agricultural production.

Disaster Management: Provides immediate relief during natural disasters by supplying food grains without delay. E.g . During Covid-19 supply of free ration.

Challenges

Storage Issues: India faces significant challenges in terms of inadequate storage facilities, leading to wastage and spoilage of food grains.

Procurement Imbalance: There is often an imbalance in the procurement of different grains, leading to excess stocks of some and shortages of others.

Financial Burden: Maintaining large buffer stocks entails high financial costs related to procurement, storage, and distribution.

Inefficiencies in Distribution: The PDS often faces issues like leakages, pilferage, and corruption, which hinder the effective distribution of buffer stocks.

Quality Concerns: Ensuring the quality of stored food grains over extended periods is a significant challenge.

Way Forward

Diversify Procurement Practices: Government procurement is presently restricted to rice, wheat, and a select few pulses and oilseeds. Broadening this to encompass additional vital food products, such as basic vegetables and skimmed milk powder (SMP), might further aid in stabilizing prices. The Union government aims to considerably enhance onion irradiation to prolong the longevity of its buffer stock, applying a safe, controlled dose of radiation that inhibits sprouting and diminishes perishability.

Scientific Evaluation of Buffer Stock Norms: Utilize econometric techniques and time-series information to systematically assess and establish standards for both operational and strategic buffer grain inventories, grounded in decennial census statistics and food grain allocation obligations.

Dynamic Buffer Norms: India's present quarterly buffer stock criteria ought to adopt a more flexible method that aligns with real-time information. Make use of data from the Department of Agriculture, Cooperation, and Farmers

Welfare, along with the National Sample Survey Office, to modify buffer stock amounts according to elements such as crop yield predictions, global market trends, and possible disruptions.

Technological Integration: Explore integrating technology like block-chain for transparent and secure buffer stock management. Additionally, consider utilising weather forecasting data from the India Meteorological Department to preemptively adjust buffer stocks based on potential weather events impacting production.

Financial Prudence: Ensuring that the financial burden of maintaining buffer stocks is managed through better budgeting and reducing procurement inefficiencies.

Private Sector Participation: Explore collaboration with private players to leverage their expertise in areas such as storage facilities, logistics, or risk management strategies, alongside FCI's management of buffer stocks.

Unbundle Competing Objectives: Separate the goals of price stabilisation, food security, and production incentives to avoid conflicts and inefficiencies in buffer-stocking operations.

Commission for Agriculture Cost and Prices

The Commission for Agricultural Costs & Prices (CACP since 1985, earlier named as Agricultural Prices Commission) came into existence in January 1965. Currently, the Commission comprises a Chairman, Member Secretary, one Member (Official) and two Members (Non-Official). The non-official members are representatives of the farming community and usually have an active association with the farming community. Commission for Agricultural Costs and Prices (CACP) in its Price Policy report for Kharif Crops for 2018-19 season has suggested bringing a legislation conferring on farmers the ‘Right to Sell at MSP’ to instill confidence among framers so that their produce is not sold/ procured below Minimum Support Price (MSP) and farmers are not exploited by traders.

Government has increased MSPs substantially for all mandated crops including paddy for the season 2018-19. MSP of paddy (common) has been increased by Rs. 200 and fixed at Rs 1750 per quintal and paddy (grade A) has been increased by Rs 180 and fixed at Rs 1770 per quintal for 2018-19 season which provide adequate return over cost of production.The National Commission on Farmers (NCF) headed by Dr. M. S. Swaminathan has recommended that the MSP should be at least 50 percent more than the weighted average cost of production. However, when the National Policy for Farmers, 2007 was finalized, this recommendation of providing 50 per cent returns over cost of production was not included. Dr. M. S. Swaminathan in his Report on NCF had discussed different dimensions of fixing MSPs, but while finalizing National Policy on Farmers, the then Government had accepted the current established methods.

The Union Budget for 2018-19 had announced the pre-determined principle to keep MSP at levels of one and half times the cost of production. Accordingly, Government has increased MSPs for all mandated crops with a return of at least 50 percent over cost of production for the season 2018-19. This decision of the Government was also a historic one as it redeemed the promise of fixing the MSPs at least at a level of 50 per cent return over cost of production.

The Agricultural Costs and Prices Commission is a statutory panel under the Government of India's Ministry of Agriculture and Farmers' Welfare. It is an expert body that recommends Minimum Support Prices.

The body recommends to the Cabinet Committee on Economic Affairs the MSPs for the notified Kharif as well as the Rabi crops. CACP submits its suggestions to the government in the form of Price Policy Reports per year. This is done separately for the 6 groups of commodities, namely: Kharif crops, Sugarcane, Rabi crops, Oil Palm, Raw Jute, and Copra.

Objectives

The Commission recommends measures to make the price policy effective. This includes providing incentives to farmers:

- To adopt improved technologies and
- To develop a production pattern that meets national economic requirements.

The Commission ensures the rational use of land, water, and other production resources.

The Commission keeps the developing price situation under review. It makes appropriate suggestions as needed.

The Commission undertakes studies on different crops. It keeps information on agricultural prices and other related data.

The Commission advises the government on any problems relating to agricultural prices and products.

The Commission integrates non-price measures with price recommendations to ensure competitive agriculture.

The Commission takes into account the changes in terms of trade between the agricultural and non-agricultural sectors.

Functions

To run the agricultural market efficiently, CACP functions with a stable price strategy. It gives assurance of remuneration which indirectly helps with the agricultural production and productivity simultaneously.

This Commission is very useful for the farmers in drawing a fair minimum price for their crop production. Sometimes the condition of the market is unstable which can cause loss to the farmers but CACP has come as a rescue for the farmers helping them earn a particular figure every time from the government.

It is not like the government sets the MSP by itself, but a series of discussions take place by the committee before setting the MSP. The CACP gives MSP for nearly 23 commodities including different types of grains, four commercial crops, five types of pulses, and seven types of seed oils.

CACP has the right to make surprise visits to different states for assessing the products and pricing and their crops.

One of the objectives of CACP is to analyze the economic status of the country and submit the price for the crop in the form of Price Policy Reports (PPR) every year to the Government.

The report submitted must comprise of the commodities like the Rabi crops, Kharif crops, Sugarcane, Copra, and Raw Jute.

Every year, the Commission for Agricultural Costs and Prices (CACP) submits recommendations to the Government of India in the form of a Price Policy Report for five commodity groups. Kharif, Rabi, raw jute, sugarcane, and copra are all crops.

The commission prepares a comprehensive questionnaire before preparing the price mentioned above in Policy Reports. This is then sent to all state governments, as well as relevant national-level organisations and Ministries, to solicit feedback.

Meetings with farmers from various states, state governments, and national-level organisations such as NAFED, Cotton Corporation of India (CCI), Jute Corporation of India (JCI), and others are also held. Meetings are also held with traders, processing companies, and the major Central Ministries.

During its visits to the states, the commission also conducts on-the-spot assessments. This is required for identifying the barriers that farmers face in marketing their products and increasing crop production levels.

The CACP makes recommendations based on all of these inputs, which are then submitted to the government.

The Cabinet Committee on Economic Affairs (CCEA) makes the final decision on MSPs and other important recommendations made by the Commission for Agricultural Costs and Prices only after receiving feedback from them on the CACP report.

Stabilization of Agriculture Prices

For farmers and consumers to be protected against price volatility, agricultural prices must be stabilized. This is frequently accomplished by governments and organizations using tactics including market intervention, price support programs, and buffer stocks.

For instance, the Price Support Scheme (PSS) and Price Stabilization Fund (PSF) are two of the programs that are integrated under the Pradhan Mantri Annadata Aay SanraksHan Abhiyan (PM-AASHA) in India. These programs are designed to give farmers fair pricing for their produce while maintaining consumer affordability of necessities. Furthermore, buffer stocks are essential for preserving price stability since they release grains during shortages and buy them during surpluses.

Stabilizing agricultural prices involves various strategies aimed at reducing volatility, ensuring fair prices for farmers, and protecting consumers from price shocks. Here are some key approaches:

1. Price Support Programs

Governments often implement Minimum Support Price (MSP) policies, guaranteeing farmers a fixed price for their produce to shield them from market fluctuations.

2. Buffer Stock Management

Agencies procure surplus during harvest seasons and release it during shortages to maintain a steady supply and stabilize prices.

3. Subsidies and Incentives

Providing subsidies for inputs like seeds, fertilizers, and equipment reduces production costs, leading to more predictable prices.

4. Crop Insurance

Offering insurance schemes helps farmers mitigate losses due to unforeseen factors like natural disasters, enabling them to sustain production levels.

5. Export-Import Regulations

Adjusting export and import policies based on domestic needs ensures price stability by avoiding shortages or surpluses.

6. Market Infrastructure Development

Establishing better storage facilities, transportation, and market linkages helps reduce wastage and improves price realization for farmers.

7. Digital Market Platforms

Online platforms like India's e-NAM (National Agriculture Market) promote transparency by connecting farmers directly with buyers, reducing exploitation by middlemen.

8. Price Stabilization Funds

Governments set aside funds to intervene during sharp price changes, ensuring prices do not spike or plummet excessively.

9. Demand Forecasting

Using data and technology to predict demand helps adjust production levels and avoid overproduction or shortages.

Commodity market

The commodities market is a marketplace for the exchange of fundamental goods and raw resources. Because it makes it easier to trade commodities including agricultural products, precious metals, crude oil, and more, it is essential to the world economy.

Commodity Types

Natural resources such as gold, silver, crude oil, and natural gas are examples of hard commodities. Agricultural goods such as wheat, rice, coffee, and animals are referred to as soft commodities.

How It Operates

Both physical and derivative contracts, such as futures and options, can be used to trade commodities.The National Commodity and Derivatives Exchange (NCDEX), the Indian Commodity Exchange (ICEX), and the Multi Commodity Exchange (MCX) are the three main commodity exchanges in India.

Benefits of Commodity Trading Portfolio Diversification: Purchasing commodities acts as a hedge against inflation and reduces risk.

Price Discovery: Based on the dynamics of supply and demand, the market establishes fair prices.

Agricultural Finance

Meaning

Agricultural finance refers to the provision and management of financial resources specifically tailored for the agriculture sector. It encompasses all financial services, including credit, insurance, savings, and investments, that support agricultural activities like crop cultivation, livestock farming, and agribusiness.

Key Components

Credit: Loans provided to farmers for purchasing inputs like seeds, fertilizers, equipment, and machinery.

Insurance: Protection against risks like crop failure due to natural disasters or market fluctuations.

Subsidies and Grants: Government support to reduce the financial burden on farmers.

Savings and Investments: Financial products that allow farmers to save surplus income and invest in better technologies.

Infrastructure Development: Financing rural infrastructure like irrigation systems, storage facilities, and transportation networks.

Types

Based on its duration, goal, and the organization offering it, agricultural finance can be divided into many categories. The primary kinds are as follows:

Considering the Goal:

Production finance is the money used to buy labor, equipment, seeds, fertilizer, irrigation, and other inputs required for farming operations.

Loans for ***long-term investments*** like buying land, tractors, or setting up irrigation systems are referred to as investment finance.

Credit given for the storage, transportation, or sale of agricultural goods is known as ***marketing finance.***

Based on Duration

Short-Term Finance: Loans used for seasonal necessities like agricultural cultivation or livestock feeding that are normally paid back within a year.

Medium-Term Financing: Usually used for small land improvements or farm equipment, repayment terms span from one to five years.

Long-term finance refers to loans with payback durations longer than five years, typically utilized for significant investments such as purchasing real estate or constructing infrastructure.

According to the Source: Institutional finance, which is offered by government programs, cooperatives, or banks (such as NABARD in India). Subsidies and loans for agriculture are two examples.

Non-Institutional Finance: Unofficial agreements and higher interest rates may be associated with loans from moneylenders, dealers, or family members.

Microfinance: Provided to small-scale farmers without access to traditional banking services by specialized organizations.

Sources

The varying demands of farmers are met by agricultural finance, which comes from a variety of sources. Here are the primary sources:

Organizational Resources

These financial institutions are governed and structured as follows:

Commercial banks: They offer loans for farm growth, inputs, and equipment.

Cooperative banks: They offer credit at reduced interest rates and are specifically designed to meet the needs of farmers.

Regional Rural Banks: In order to finance farming and related operations in rural areas, Regional Rural Banks (RRBs) were established.

Government Schemes: Programs offered by the government include loans through NABARD (National Bank for Agriculture and Rural Development) and the Kisan Credit Card and KCC.

Microfinance Institutions: Small loans are provided by microfinance institutions to farmers who do not have access to conventional banking services.

Non-Institutional Sources:

These include unofficial and unregulated channels such as:

Moneylenders: Although they are easily accessible, their loans frequently have high interest rates.

Friends and Family: Borrowing from close networks can be convenient but may be limited in scale.

Traders and Commission Agents: Some farmers accept upfront payments from traders, frequently in exchange for later sales of their produce at lower prices.

Corporate Finance: Agriculture companies occasionally give farmers credit as part of their procurement programs.

NGOs and Charitable Organizations: They provide financial aid or loans for sustainable agricultural practices.

Commercial bank

A commercial bank is a financial institution that provides a range of services, including accepting deposits, offering loans, and facilitating transactions for individuals, businesses, and governments. They play a crucial role in the economy by mobilizing savings and channeling them into productive investments.

Types

In India, commercial banks are classified into two categories:

Scheduled Commercial Banks (SCBs): These are listed in the 2nd Schedule of the Reserve Bank of India Act, 1934, and meet specific criteria like maintaining a minimum paid-up capital.

Non-Scheduled Commercial Banks (NSCBs): These do not meet the criteria for inclusion in the 2nd Schedule and operate under different regulations.

Commercial banks can be also categorized into different types based on the nature of their functions and ownership. Here are the primary types:

Public Sector Banks: These are owned and operated by the government.

Examples include the State Bank of India (SBI) and Punjab National Bank (PNB).

Private Sector Banks: Owned and operated by private entities or individuals.

Examples include HDFC Bank and ICICI Bank.

Foreign Banks: These are banks that are headquartered in another country but operate in India through branches. Examples include Citibank and HSBC.

Regional Rural Banks (RRBs): Established to provide banking services in rural areas. They focus on agricultural development and rural economies. Examples include Tamil Nadu Grama Bank and Andhra Pradesh Grameena Vikas Bank.

Cooperative Banks: These are owned and operated by their members, typically catering to specific communities or regions. Examples include Saraswat Bank and Cosmos Bank.

Functions of commercial banks

Primary Functions of Commercial Banks

In order to support economic growth and development, commercial banks' main duties center on raising money from the general public and distributing it to borrowers who need it for a range of financial requirements. Commercial banks' operations are divided into two categories: primary and secondary.

The primary functions of commercial banks include:

Accepting Deposits: Both people and corporations can deposit money into commercial banks' checking and savings accounts as well as time deposits like certificates of deposit (CDs).

Providing Loans: Banks provide loans to people and companies for a range of uses, including project funding, business startup, and house purchases.

Issuing Cheques: Customers can write checks for payment using the cheque book that banks supply.

Clearing cheques: Banks process cheques written by their customers and those deposited by other banks.

Maintaining Accounts: Banks keep track of their clients' account information, such as balances, interest accrued, and transaction history.

Providing Safekeeping Services: Customers can keep valuables and crucial documents in safe deposit boxes provided by banks.

Providing Currency Exchange: For clients who need to swap one currency for another, banks offer currency exchange services.

Providing Overdraft Facilities: Customers who need to borrow money temporarily to pay for unforeseen bills can do so using overdraft options offered by banks.

Secondary Functions of Commercial Banks

Due to shifting consumer demands, technological developments, and prevailing economic conditions, commercial banks' traditional roles have given way to their current ones. They may also be referred to as commercial banks' secondary functions. Examples of how contemporary functions have changed from traditional functions include the following:

Facilitating Payments: Commercial banks have expanded their payment services to include online bill payment, mobile banking, and person-to-person payments since the introduction of electronic payments.

Issuing Credit and Debit Cards: Although they weren't always available, credit and debit cards are now a commonplace feature of contemporary banking. Checks and traveler's checks were the main forms of payment that banks used in the past.

Managing Investments: A greater variety of products, including mutual funds, exchange-traded funds (ETFs), and online trading platforms, are now part of commercial banks' investment offerings.

Providing Foreign Exchange Services: Although commercial banks have always provided foreign currency services, demand for these services has grown as international trade and travel have expanded.

Offering Insurance Products: To adapt to their clients' evolving needs, banks have increased the range of goods they offer by adding insurance products including life and property insurance.

Providing Financial Advice: As consumers look for more direction and assistance in handling their finances, banks have extended their financial advise offerings to encompass debt management, retirement planning, and investment advice.

Examples in India: Some well-known commercial banks include the State Bank of India (SBI), HDFC Bank, and ICICI Bank.

NABARD

India's top development bank, the National Bank for Agriculture and Rural Development (NABARD), was founded in 1982 with the goal of advancing equitable and sustainable agriculture and rural development by providing financial and technical assistance.

Key Functions and Roles

Promoting Rural Development: By offering financial and technical assistance to a range of sectors, NABARD plays a vital role in advancing equitable and sustainable agriculture and rural development.

Apex Development Bank: With an emphasis on rural areas and the agricultural sector, it functions as India's top development bank.

Supervisory Body: For State Cooperative Banks (SCBs) and Regional Rural Banks (RRBs), NABARD serves as the highest supervisory authority.

Financial and Developmental Role: With its financial, developmental, and supervisory functions, NABARD affects practically every facet of the rural economy.

Refinance Support: NABARD helps banks refinance their loans to the agriculture industry.

Building Rural Infrastructure: Building rural infrastructure and encouraging rural business are two of NABARD's activities.

Microfinance and SHGs: Through Joint Liability Groups (JLGs) and Self-Help Groups (SHGs), NABARD encourages microfinance and rural entrepreneurship.

Climate Change: Nearly one-third of NABARD's total disbursements have been allocated to climate change adaptation and mitigation initiatives, demonstrating the agency's significant involvement in these fields.

Partnerships: To put creative ideas into practice, NABARD has partnered with financial institutions, non-governmental organizations, and other national bodies.

NABARD's Origin and Establishment

Established under Act: NABARD was established under the NABARD Act 1981, passed by the Parliament of India.

B. Sivaraman Committee: The establishment of NABARD was based on the recommendations of the B. Sivaraman Committee.

Came into Existence: NABARD came into existence on July 12, 1982.

Headquarters: NABARD's headquarters are located in Mumbai.

NABARD's Focus Areas

Agriculture and Related Sectors: Agriculture and other industries, such as fisheries, improving rural livelihoods, and renewable energy, are the main focus of NABARD.

Natural Resource Management: It also emphasizes the management of natural resources, such as forests and water.

Rural Connectivity: Rural connectivity is one of 39 activities that NABARD offers state governments financial support for under three general headings.

Digital Transformation: NABARD is working to use high-speed broadband to digitally improve rural communities.

Modernization of PACS: In the country's Primary Agricultural Credit Societies (PACS), NABARD is leading the charge for full modernization.

Farm Capital

Meaning

Farm capital represents the value of capital used in the production of agricultural commodities, regardless of whether the capital is owned or leased. The three components of farm capital are land and buildings, livestock and poultry, and farm machinery and equipment.

Types

We can classify capital in agriculture into various categories as given below,

Working and Investment Capital

Operating or working capital and fixed or investment capital are the two main categories of agricultural capital. The first is the cost of inputs such as seeds, fertilizer, labor, and irrigation fees. The second, however, stands for investment in permanent assets including land, equipment, and well construction. Investment capital stands for long-term farm investments, whilst working capital is associated with short-term investments.

Private and Social Capital

Private and social capital are further categories for capital. Private capital includes all assets owned by private individuals, including land,

tractors, pump sets, draught animals, and agricultural farms. The category of social capital includes the money spent by municipal, state, or other government organizations on dams, canals, and barrages. A region's socioeconomic development is aided by both types of capital.

Marginal Efficiency of Farm capital

In his Theory, John Maynard Keynes coined the phrase "marginal efficiency of capital," which he described as "the rate of discount which would make the general present value of the sequence of annuities given by the returns expected from the capital asset during its life just equal its supply price." The net rate of return anticipated from the acquisition of extra capital is known as the MEC. It is computed as the anticipated profit that a business will make after accounting for input costs and capital depreciation. Expectations regarding future demand and input costs have an impact on it. When a company is considering an investment project, it considers the MEC and capital expenditures. The MEC needs to be higher than the rate of interest, r, for investment to take place. This is because the present value PV of future returns to capital needs to be higher than the cost of capital, C_k. These variables can be expressed as follows:

$$PV = \sum_{i=1}^{n} \frac{R_i}{(1+r)^i}$$

where n is the number of years during which the capital will be productive, and R_i is the net return in year i;

$$C_k = \sum_{i=1}^{n} \frac{R_i}{(1+MEC)^i}$$

where C_k is the upfront capital outlays; this equation defines the MEC.

Capital formation in Agriculture

In agriculture, capital creation is the process of adding resources, technology, and infrastructure to the physical stock in rural areas. This

procedure is essential to implementing cutting-edge technology, assuring sustainable agriculture, and turning a profit for the industry.

Gross and Net Capital Formation

The overall addition to capital stock, including inventory and fixed capital, over the course of a year is referred to as gross capital creation. It covers changes in stocks as well as gross fixed capital formation. The amount of addition to capital stock after depreciation or capital consumption is taken into account—that is, the amount of fixed capital stock used up during the year's production process—is known as net capital creation. Therefore, after subtracting depreciation from gross capital, net capital formation is the result. The amount of fixed capital depleted throughout the production process is represented by depreciation. It is intended to cover value loss from both predictable obsolescence and regular wear and tear, and it is based on the anticipated economic life of individual assets.

Fixed Capital Formation

There are two categories of fixed capital: net and gross. Net fixed capital is the result of subtracting depreciation from gross fixed capital. Let's examine the elements that make up gross fixed capital. First, we include the expenditures (i.e., purchases and own account production) that are made by i) industries, ii) governments, and iii) private non-profit organizations to add commodities to their portfolios of fixed assets. Second, we take into account the net additions of used and scrapped products (i.e., buy less sale). Thirdly, we include: i) purchases of durable goods for civilian use that are both reproducible and non-reproducible (apart from land, mineral deposits, timber tracts, fisheries, and the like); ii) ongoing construction projects and capital repairs; iii) expenditures for land improvement; iv) the acquisition of breeding stock, draught animals, dairy cattle, and the like; and iv) transfer costs related to the purchase and sale of land, mineral deposits, timber tracts, etc. Fourth, comparable household expenditures on home building are also accounted for. But keep in mind that we do not include government spending on durable military equipment. India's Cooperative Laws.

Household Capital Formation

A household's acquisition of new capital, a rise in the stock of producer households, and the purchase of new residential buildings by households (excluding the purchase of a secondhand building) are all considered forms of household capital formation. Individuals, non-government non-corporate businesses like farms and non-farm businesses, unincorporated businesses like partnerships and sole proprietorships, and non-profit organizations like charitable trusts, religious endowments, and educational institutions are all considered to be part of the household sector.

Role of Capital Formation in Agriculture

Investment in agriculture, land development, soil conservation, rural roads, agricultural machinery, storage, and other items are all included in the idea of capital formation in agriculture. Over time, a return on such investments is anticipated. Since it improves the operator's efficiency and agricultural output, capital formation in industrialized nations also includes investments made in research, education, and technical training for the development of human capital. Many theories about capital formation in developing nations have been proposed in a large body of literature. For instance, Ragnar Nurkse notes that while the incentives to invest control the demand for capital, the ability and inclination to save control the supply of capital. Arthur Lewis ascribes poor saving to low investment, which is caused by the low profit to national income ratio. H. W. Singer asserts that people's motivation to save and invest is hampered by a dearth of investment alternatives. Other variables that are frequently cited as contributing to inadequate capital formation include institutional impediments and a lack of entrepreneurship.

An essential component of economic progress is capital formation. As Nurkse correctly noted, capital production is the only way to break the cycle of poverty in developing nations. Capital formation is what drives increased output, revenue, and employment by enabling the continued use of the resources that are already accessible. Given that agriculture dominates the

Indian economy, capital formation in this sector is essential to the country's economic growth.

Productivity in agriculture and related industries rises when a sufficient amount of capital is used. In terms of the amount of food, milk, and other consumables consumed per person, India has lagged well behind developed economies. In addition to increasing food production and availability, adequate capital development in agriculture can raise the purchasing power of the nation's farmer households.

Technical advancement brought about by capital accumulation supports large-scale production economies. Numerous advantages accompany the development of agricultural technologies, including: i) increased yield, ii) timely completion of farm operations, iii) optimal land utilization, iv) innovations in crops and cropping patterns, and v) agricultural diversification. Market expansion is a result of capital formation. The farmer has more marketable surplus that can be sold in the market since capital formation leads to increased productivity. In a population-growing state like India, capital formation plays a significant role in raising agricultural output.

Enhancing the quality of the produce is another benefit of capital formation. Consequently, this can increase the potential for exporting and breaking into international markets. It could potentially enhance a nation's balance of payments. India can play a significant role in the global market for farm products because of its enormous agricultural land area and labor force. For this reason, capital formation in agriculture is unavoidable. Self-sufficiency in agricultural produce and consumables can result from capital formation in agriculture. In the end, this can reduce the weight of foreign debt and eliminate the need for foreign aid. Sufficient capital formation can alleviate the burden of inflationary pressure. As is well known, increased production is a direct result of capital use. Over time, capital formation can eliminate price volatility and bring about price stability. This can have a significant role in lowering poverty and making food more affordable.

The gross domestic product (GDP) is increased through the capital formation process. Therefore, the main tool to raise per capita income and move the economy out of an underdeveloped condition is capital production.

UNIT – IV

INFORMATION TECHNOLOGY AND AGRICULTURE

Introduction

E-agriculture, or information and communication technology in agriculture, is a subset of agricultural technology that focuses on better information and communication procedures. E-agricultural is more precisely defined as the ideation, design, development, assessment, and implementation of novel approaches to the use of information and communication technologies (ICTs) in rural areas, with an emphasis on agriculture. From cutting-edge Internet-era technology and sensors to more traditional tools like satellites, televisions, radios, and fixed phones, ICT encompasses devices, networks, mobiles, services, and applications. Key elements of e-agriculture include the provision of standards, norms, techniques, and instruments; the building of institutional and human capacities; and policy support.

Role of Information Technology and Telecommunication in marketing of agricultural commodities

Information Technology (IT) and telecommunications are essential in revolutionizing the marketing of agricultural products. They facilitate improved communication, optimize processes, and boost the overall effectiveness of agricultural supply chains.

Market Access and Information

***Real-Time Market Prices*:** IT and telecommunications resources enable farmers to obtain current information regarding market prices, both in their

local area and internationally. Farmers can access daily or weekly prices for their produce from various markets via mobile phones, the internet, or SMS services, enabling them to make informed choices about the optimal time and place to sell their goods for the highest price.

Market Trends and Forecasting: By utilizing data analytics and digital platforms, farmers gain insights into market trends, demand predictions, and price variations, enabling them to modify their production and marketing approaches as needed.

E-commerce Platforms: Internet platforms (like NAFED, e-Choupal, etc.) enable farmers to market their goods directly to consumers or companies, removing middlemen and possibly securing greater profits. These platforms serve as a link between producers and purchasers.

Improved Communication Channels

Mobile Networks and SMS*:* Mobile phones and SMS services are extensively utilized to deliver essential information to farmers. They can get updates on weather predictions, optimal farming methods, pest invasions, and price notifications, aiding them in making prompt choices about their crops and marketing approaches.

Telemedicine/Extension Services: Farmers can utilize telecommunication tools to obtain expert guidance on pest management, crop illnesses, and market trends. Extension services, typically provided via mobile applications or helplines, assist farmers in making improved choices about farming methods and sales strategies.

Supply Chain Management

Effective Logistics and Monitoring: IT tools, including GPS, RFID, and barcoding, enhance the tracking and management of agricultural products throughout the supply chain. This results in quicker and more effective distribution, lowering spoilage and cutting expenses related to logistics.

***Cold Chain Management*:** For perishable agricultural goods such as fruits and vegetables, IT systems can oversee temperature-sensitive shipping and storage. Telecommunication systems enable real-time tracking of temperature and humidity, guaranteeing that products are delivered fresh and in ideal condition to the market.

***Data-Informed Demand and Supply Alignment*:** IT assists in synchronizing demand and supply through facilitating data-informed evaluations of manufacturing capacities and market requirements. This can reduce waste and enhance production processes.

Financial Services and Payments

***Digital Payments*:** IT allows farmers to conduct cashless transactions, minimizing the risks linked to managing physical currency. Mobile payment platforms and digital wallets simplify the process for farmers to receive payments from buyers, as well as to access government assistance and loans.

***Access to Credit and Insurance*:** Telecommunications and IT-driven platforms enable farmers to obtain credit and insurance services, enhancing their financial security. Farmers have the option to request loans or insurance via mobile applications or websites, and they can also check their loan status and insurance claims online.

Supply of Inputs and advisory

Services Availability of Inputs: IT platforms can streamline the procurement of crucial agricultural supplies such as seeds, fertilizers, pesticides, and tools. Farmers can obtain information about the highest quality products and services offered in the market.

Agronomic Advisory Services:IT platforms offer extension services that deliver expert advice on crop management, pest management, irrigation,

and post-harvest processing, helping farmers enhance the quality of their produce and its sale ability.

Agricultural Data Collection and Analysis

Big Data and Analytics: The gathering of extensive agricultural data, including weather trends, soil conditions, and crop yields, can be examined through IT systems. Through the use of predictive analytics, farmers can enhance their production and marketing strategies. Insights based on data assist farmers in determining the optimal times for harvesting, marketing, and selling their goods.

Satellite and Remote Sensing Technologies: Technologies for satellite imaging and remote sensing assist in tracking crop health and evaluating land appropriateness for different crop types. This information can also assist in forecasting yields, leading to improved preparation for market needs.

Transparency and Trust

***Blockchain Technology*:** In certain instances, blockchain is utilized to enhance transparency i n agricultural deals. By monitoring the journey of agricultural goods from producer to end- user, farmers, purchasers, and consumers can trust in the legitimacy and traceability of the product. This is especially beneficial for high- value goods like organic produce or certified items.

***Fewer Intermediaries*:** Through the use of IT and telecommunications, farmers can link direct ly with buyers or consumers, minimizing the influence of intermediaries and guaranteeing th at they obtain a greater portion of the final sale price.

Digital Literacy and Capacity Building

Training and Skill Enhancement*:* IT facilitates the provision of training sessions and webinars that inform farmers about market trends, innovative technologies, and best agricultural practices. Farmers can discover how to utilize digital platforms for enhanced marketing techniques, honing their skills and boosting their profits.

The function of IT and telecommunications in promoting agricultural products is revolutionary. It enables farmers to obtain market data, optimize supply chains, enhance financial transactions, and directly engage with buyers. These technologies enable farmers to make improved decisions, boost their earnings, and enhance the efficiency of agricultural markets by cutting down inefficiencies, limiting intermediaries, and providing valuable insights. With the ongoing advancement of technology, there is great potential for additional innovation and enhancement in agricultural marketing.

Weather Forecasting

Weather forecasting is essential in agriculture as it significantly enhances productivity, minimizes losses, and supports sustainable farming methods. With the availability of timely and precise weather information, farmers are empowered to make educated choices regarding planting, irrigation, pest management, and harvesting. Below is an overview of how weather forecasting is utilized in agriculture and its significance:

1. ***Optimal Planting and Harvesting Times***

- *Planting Windows:* Weather forecasts assist farmers in determining the optimal time for planting crops through the analysis of temperature, rainfall, and frost predictions. Precise forecasts enable farmers to plant their crops during the most favourable weather conditions, thereby maximizing crop growth.
- *Harvest Timing:* Forecasting is also beneficial for farmers in deciding the appropriate time to harvest their crops. For example, in anticipation of a heavy rainstorm, farmers might expedite the harvesting process to avoid spoilage or potential crop damage.

2. ***Irrigation Management***

- *Water Conservation:* Weather forecasting plays a crucial role in assisting farmers in determining the ideal timing for irrigating their fields based on the predicted rainfall. In case of heavy rain forecasts, farmers can opt to postpone irrigation to save water and cut down on unnecessary expenses. On the other hand, if drought conditions are anticipated, they can prepare for more frequent irrigation sessions.
- *Drought and Flood Management:* Farmers can implement proactive strategies by predicting droughts or floods, which may include modifying irrigation systems or adopting measures to safeguard crops against potential flood damage.

3. ***Pest and Disease Management***

- *Pest Control:* Weather conditions significantly influence the life cycles of pests. For example, warm and humid environments can facilitate the proliferation of pest populations, whereas arid and breezy conditions may mitigate their dispersal. By analysing weather patterns, agricultural practitioners can anticipate pest outbreaks and implement preventive strategies, including the application of pesticides or the deployment of traps.
- *Disease Prediction:* Certain climatic conditions, such as elevated humidity levels and moderate temperatures, facilitate the emergence of plant diseases, including mildew and blight. By forecasting weather patterns, farmers can anticipate potential disease outbreaks and implement proactive measures, such as the application of fungicides or modifications to crop management strategies.

4. ***Frost and Freeze Protection***

- *Frost Prediction:* Frost poses a significant threat to delicate crops, particularly in the early spring and late autumn seasons. Meteorological predictions can indicate the likelihood of freezing

temperatures, enabling agricultural producers to implement protective measures such as covering plants, employing wind machines, or establishing irrigation systems to mitigate the risk of frost-related damage.

Protection Strategies: Farmers may employ frost-resistant crop varieties or modify their planting schedules to mitigate the risk of frost damage.

4. ***Risk Management and Insurance***

- *Climate Risks:* Weather predictions enable agricultural producers to navigate climate- associated hazards, including floods, droughts, and extreme weather events. By utilizing both long-term climatic data and short-term forecasts, farmers can make informed choices regarding crop selection, insurance options, and various risk management approaches.
- *Crop Insurance:* Numerous agricultural producers depend on crop insurance that is contingent upon weather conditions, utilizing meteorological data such as precipitation and temperature to assess compensation in cases of unfavourable weather events. Enhanced precision in forecasting can significantly augment the efficacy of these insurance programs.

5. ***Climate Change Adaptation***

- *Changing Patterns:* As climate change leads to alterations in weather patterns, the importance of precise weather forecasting has become increasingly critical. Agricultural producers can leverage climate projections to foresee variations in temperature and precipitation, thereby enabling them to modify their farming practices in response to evolving environmental conditions.
- *New Crop Varieties:* As climatic conditions evolve; agricultural producers may be required to adopt crop varieties that are more resilient to drought or capable of withstanding higher temperatures. Reliable weather predictions enable them to adequately prepare for these shifts.

6. ***Crop Growth Monitoring and Yield Prediction***

- *Monitoring Conditions:* Weather data plays a crucial role in assessing the environmental factors that impact crop development, including temperature, precipitation, and sunlight exposure. By comprehending the effects of these variables on crops throughout different growth phases, agricultural practitioners can enhance their farming techniques.
- *Yield Forecasting:* Dependable meteorological data is used to predict potential agricultural yields, which aids in planning for harvesting, storage, and marketing strategies.

7. ***Technology in Weather Forecasting for Agriculture***

- *Satellite and Remote Sensing:* Satellite data plays a crucial role in the large-scale observation of weather patterns, while remote sensing technology offers real-time insights into soil moisture, temperature, and the health of crops. These advanced tools enable farmers to obtain accurate information regarding weather conditions, thereby facilitating more informed decision-making for their agricultural practices.
- *Mobile Apps and Weather Stations:* Numerous agricultural practitioners are increasingly utilizing mobile applications or localized weather stations that deliver precise forecasts. These instruments leverage data sourced from national and regional meteorological organizations, customized for particular areas, thereby enabling farmers to obtain prompt notifications regarding alterations in weather conditions.
- *Decision Support Systems (DSS):* Sophisticated systems merge meteorological data with various factors such as soil moisture, past crop yields, and pest activity to provide farmers with essential insights. This combination enables farmers to make more precise and timely decisions regarding their agricultural practices.

9. ***Disaster Preparedness***

- *Severe Weather Alerts:* Severe weather phenomena, including cyclones, storms, and heatwaves, can profoundly affect agricultural output. The practice of weather forecasting offers timely alerts, enabling farmers to take proactive measures in response to these events, such as relocating crops, strengthening infrastructure, or safeguarding livestock.
- *Post-Event Recovery:* Following a natural disaster, precise weather information is crucial for farmers to evaluate the extent of the damage and strategize for recovery. Additionally, weather forecasting plays a vital role in determining when conditions will normalize, allowing farmers to recommence their agricultural operations.

Weather forecasting plays a transformative role in agriculture, empowering farmers to make informed decisions that enhance crop yields, minimize losses, and promote sustainability. By providing insights into optimal planting and harvesting times, as well as facilitating effective irrigation management, pest control, and climate risk assessment, reliable weather forecasts equip farmers with essential tools to boost productivity and lessen their susceptibility to unfavorable weather events. As advancements in technology progress, the field of weather forecasting is expected to further develop, delivering farmers increasingly accurate, localized, and actionable information to refine their agricultural practices and address potential risks.

Electronic Auctions

Electronic auctions in the agricultural sector represent digital platforms that facilitate the interaction between buyers and sellers of agricultural goods through a transparent, efficient, and instantaneous bidding process. These online systems enable farmers, cooperatives, traders, and purchasers to trade agricultural commodities within a competitive auction framework, eliminating the necessity for intermediaries or conventional physical marketplaces. The following outlines the operational mechanisms of electronic auctions and their advantages for the agricultural industry.

How Electronic Auctions Function in Agriculture

1. *Registration and Product Listing:*

- Agricultural producers, including farmers and cooperatives, initiate their participation by registering on an electronic auction platform.
- Sellers then present their agricultural goods, such as grains, fruits, vegetables, and dairy products, along with critical details regarding quality, quantity, and pricing conditions.

2. *Bidding Mechanism:*

- Buyers, which may include wholesalers, retailers, processors, or fellow farmers, are permitted to submit bids for the available products.
- The auction may take place in real-time or within a predetermined timeframe, contingent upon the specific platform and its established auction regulations.

3. *Transparency in Bidding:*

- Electronic auctions promote a transparent bidding environment where prices are visible, allowing buyers to observe competing bids. This level of transparency guarantees that the final price is indicative of the prevailing market demand and supply dynamics.

4. *Finalization of Transactions:*

- Upon the conclusion of the auction, the highest bidder secures the lot, and the transaction is finalized through an online payment system. Subsequently, arrangements for logistics and delivery are made.
- Numerous platforms also offer additional services post-auction, including transportation, certification, and payment management.

Types of Electronic Auctions in Agriculture

1. ***Forward Auctions:***

   The predominant form involves several purchasers placing bids on items presented by a vendor. The vendor establishes an initial price, and the purchasers engage in competition to submit the highest bid.

2. ***Reverse Auctions:***

   In a reverse auction, various sellers engage in competition to provide the most favorable price tailored to the requirements of a buyer. For instance, a buyer may seek a particular commodity at a competitive rate, prompting sellers to progressively reduce their prices in an effort to secure the contract.

3. ***Double Auctions:***

   Both buyers and selleres are able to place bids concurrently. The prices vary in response to the offers from both parties, facilitating immediate negotiation.

The Advantages of Electronic Auctions in Agriculture

1. ***Increased Market Access:***

Global Reach: Farmers have the opportunity to market their products to a wider audience, encompassing both domestic and international consumers, thereby eliminating the necessity for intermediaries. This advancement significantly enhances market accessibility, particularly for smallholder farmers who often face challenges in reaching larger markets.

Diversification: It enables farmers to engage with a diverse array of buyers, including local merchants and global importers, thereby expanding their potential market reach.

2. Fair Pricing and Transparency:

Competitive Pricing: A transparent bidding system allows the prices of agricultural commodities to accurately represent the current demand and supply dynamics within the market, thereby promoting equitable pricing for both purchasers and vendors.

Reduced Exploitation: Electronic auctions minimize the potential for price manipulation and exploitation, which can occasionally arise in conventional markets, by removing intermediaries from the transaction process.

3. Cost-Effective

Reduced Transaction Costs: Electronic auctions substantially lower transaction costs by eliminating the necessity for physical market visits, traditional auctions, and intermediaries. This innovation allows farmers to avoid traveling to remote markets and circumvent the involvement of middlemen, who typically charge substantial commissions.

Efficient Logistics: Numerous electronic auction platforms provide comprehensive logistics services, assisting both buyers and sellers in optimizing delivery procedures and minimizing transportation expenses.

4. Time-Saving

24/7 Access: Electronic auctions operate continuously, enabling both buyers and sellers to engage in auctions at their convenience. This feature removes the constraints associated with traditional physical market hours, which are often time-sensitive.

Real-Time Bidding: The auction process occurs in real-time, facilitating expedited transactions and prompt decision-making. This efficiency is particularly crucial in the agricultural sector, where commodities are often time- sensitive and require swift agreements.

5. *Improved Bargaining Power*

Farmers have the opportunity to benefit from competitive bidding, which may lead to an increase in the prices of their goods. Additionally, sellers can establish minimum price thresholds to guarantee that they obtain equitable remuneration for their products. Buyers, conversely, have the ability to engage in price competition, thereby obtaining the most advantageous terms, which subsequently strengthens their purchasing power.

6. *Access to Information and Data*

Electronic auction platforms frequently offer significant market intelligence, encompassing price trends, historical data, and demand projections. This information enables farmers to make more informed choices

regarding the timing and nature of their sales, ultimately resulting in improved planning. Consumers gain advantages from comprehensive product descriptions, quality certifications, and customer reviews, all of which enhance their decision- making process when making purchases.

7. Market Efficiency

Electronic auctions enhance the efficiency of the transaction process by facilitating the stages of listing, bidding, and concluding sales. This improvement is particularly advantageous during periods of variable supply and demand, where rapid responses to market changes are crucial.

Challenges and Barriers

1. Digital Literacy

A significant obstacle is the insufficient level of digital literacy among agricultural producers, particularly in rural regions. In the absence of a proper grasp of online platforms, these farmers may find it challenging to engage in electronic auctions. Therefore, it is essential to implement training and awareness initiatives aimed at enhancing farmers' proficiency with these technologies.

2. Technology Infrastructure

In numerous rural regions, the availability of internet connectivity is often inconsistent or entirely lacking. For farmers to fully leverage the advantages of electronic auctions, it is essential that they have access to dependable digital infrastructure. Implementing mobile-based solutions and utilizing satellite internet can effectively mitigate these connectivity challenges.

3. *Trust and Security*

Farmers might exhibit reluctance in placing their trust in online platforms, especially in areas where digital payment systems and e-commerce are in the nascent stages of development. Establishing secure transaction methods and fostering trust among stakeholders is essential for the effective implementation of electronic auctions.

4. Market Adoption

The initial adoption of electronic auctions may be observed among certain farmers and buyers; however, achieving widespread acceptance is likely to require a considerable duration. Establishing a robust user base comprising both buyers and sellers is essential for fostering a dynamic online marketplace.

5. Price Volatility

The pricing of agricultural products within an auction system is subject to variability influenced by the dynamics of the auction process. This variability can benefit sellers when demand is elevated; however, it simultaneously presents a risk for farmers, as they may encounter reduced prices during periods of market decline.

Examples of Electronic Auction Platforms in Agriculture

1. e-Choupal (India)

e-Choupal serves as a prominent illustration of an electronic auction platform that facilitates connections between farmers and buyers via an online network. It offers essential services such as market price information, opportunities for direct sales, and weather forecasting.

2. Agri Digital (Australia)

AgriDigital is an Australian-based platform that facilitates electronic auctions specifically designed for grain producers. This platform enables farmers to sell their products directly to purchasers within a secure and transparent framework.

3. Mandi (India)

The Indian government has introduced digital initiatives such as the National Agriculture Market (eNAM) to facilitate electronic auctions for agricultural products. This platform enables farmers to list their produce and

engage directly with buyers across various regions, thereby enhancing their market accessibility. Commodities, enhancing transparency, efficiency, and cost-effectiveness in the process. Through the utilization of technology, farmers gain access to improved market opportunities, obtain equitable prices, and diminish their dependence on intermediaries. Nevertheless, to fully realize the benefits of electronic auctions, it is crucial to tackle challenges related to digital literacy, infrastructure, and security. As the integration of these technologies expands, electronic auctions are likely to assume a more prominent position in the global agricultural marketplace.

Digital Mandi

A Digital Mandi represents an online system that transforms the conventional agricultural marketplace, known as a mandi, facilitating the buying and selling of agricultural products by farmers. These digital platforms are designed to enhance the efficiency, transparency, and convenience of agricultural commerce by linking farmers directly with various buyers, including wholesalers, traders, processors, and consumers, via the internet or mobile applications. By providing immediate access to market prices, minimizing the role of intermediaries, and simplifying transaction processes, digital mandis can enable farmers to obtain more favorable prices for their goods while also lowering associated costs.

Key Features of Digital Mandis

1. Online Listings of Produce

Farmers have the opportunity to register their agricultural products on the digital mandi platform, where they can provide information regarding quantity, quality, pricing, and delivery conditions. This system enables farmers to present their offerings to a wider audience of potential buyers, overcoming the constraints typically associated with traditional physical markets.

2. Real-Time Market Prices

Digital marketplaces offer real-time market price data for a variety of commodities across multiple regions. This level of transparency enables

farmers to make well- informed choices regarding the optimal timing and location for selling their products, thereby maximizing their potential earnings.

3. Direct Buyer-Seller Interaction

Digital mandis differ from conventional markets by allowing farmers to sell their products directly to consumers, thereby minimizing the involvement of intermediaries. This direct interaction facilitates online negotiations between farmers and buyers, enhancing operational efficiency and lowering transaction expenses.

4. Auction System

Certain digital marketplaces employ an electronic auction system in which buyers submit bids for the available agricultural products. The bid that is highest at the conclusion of the auction secures the purchase, and the entire transaction is conducted online. This mechanism can enable farmers to achieve more favorable prices for their products by fostering a competitive bidding environment.

5. Payment Integration

Several digital mandi platforms feature built-in payment systems that facilitate secure and transparent transaction processes. This allows farmers to receive payments directly into their bank accounts or digital wallets, thereby minimizing the potential for fraud and delays in payment.

6. Logistics and Delivery Support

Various platforms provide logistics services designed to assist farmers in transporting their goods to buyers' locations, frequently featuring reduced rates or options for bulk transport. This approach effectively reduces transportation expenses and guarantees that products arrive at the market promptly and efficiently.

7. Quality Certification and Traceability

Certain digital marketplaces provide quality certification services,

enabling farmers to have their products certified according to organic or other specific standards. Additionally, traceability features facilitate the monitoring of produce from the farm to the consumer, allowing buyers to confirm the quality and authenticity of the products.

8. Agri-Advisory Services

Many digital marketplaces offer a range of value-added services, including market analysis, weather predictions, crop health assessments, and pest management information, thereby assisting farmers in enhancing both their productivity and profitability.

Benefits of Digital Mandis for Farmers

Better Price Discovery

Digital mandis offer instantaneous price information from various markets, enabling farmers to determine the most advantageous locations for selling their crops. This system empowers farmers to engage in transactions at prices determined by market dynamics, thereby mitigating the potential for exploitation by intermediaries.

Reduced Dependence on Middlemen

Digital platforms facilitate the removal of intermediaries, who typically extract significant commissions or margins from agricultural producers. This results in increased income for the farmers. Furthermore, these platforms enable direct negotiations between buyers and farmers, fostering the establishment of mutually advantageous agreements.

Wider Market Reach

Digital marketplaces enable farmers to tap into both national and international markets, thereby expanding their potential customer base and decreasing dependence on local market dynamics. This platform allows farmers to sell their goods to wholesalers, processors, or directly to consumers, which is particularly advantageous for those offering niche or premium products.

Transparency and Trust

Digital platforms enhance transparency within the transaction process by ensuring that both buyers and sellers have equal access to information concerning pricing, quantity, and quality. Furthermore, the provision of real-time updates on product listings and market trends contributes to the establishment of trust and reliability within the system.

Convenience and Accessibility

Digital marketplaces provide the advantage of facilitating transactions from the comfort of one's home or agricultural site, a feature that is particularly advantageous for farmers situated in isolated or rural regions. Furthermore, mobile applications allow farmers to engage with the platform via their smartphones, thereby ensuring accessibility for individuals with constrained resources.

Fairer Payment Systems

Digital platforms facilitate expedited and secure payment processes, thereby minimizing the delays and risks associated with non-payment that are frequently encountered in conventional markets. Additionally, farmers are able to receive payments directly into their bank accounts or digital wallets, which diminishes their dependence on cash transactions.

Efficient Logistics

The incorporation of logistics services within digital mandis facilitates seamless transportation arrangements for farmers, thereby optimizing time management and minimizing expenses. Furthermore, effective delivery mechanisms are instrumental in guaranteeing that products arrive at their destinations promptly and in optimal freshness.

Government Initiatives: Digital Mandi Platforms in India

eNAM (National Agriculture Market)

eNAM represents a governmental initiative spearheaded by the Ministry of Agriculture and Farmers Welfare in India. This online trading platform facilitates connections between farmers and buyers as well as traders nationwide. By consolidating multiple physical mandis (markets) into a single online interface, eNAM enables farmers to engage in commerce with a wider array of potential buyers. Furthermore, eNAM enhances the agricultural market's efficiency and inclusivity through features such as transparent price discovery, electronic payments, and logistics management.

APMC Reforms:

The government has actively promoted the digitization of Agricultural Produce Market Committees (APMCs) to enhance transparency and mitigate inefficiencies. As a result of these reforms, numerous APMCs have implemented digital platforms that facilitate connections between farmers and buyers, enabling electronic bidding, online registration, and payment processing.

Kisan Suvidha App:

The Kisan Suvidha App is a mobile application supported by the government, designed to furnish farmers with essential information regarding weather conditions, market prices, seeds, fertilizers, and various government initiatives. While it does not function as an auction platform, it serves to enhance digital mandis by supplying market intelligence, weather predictions, and advisory services that assist farmers in making informed marketing choices.

Challenges of Digital Mandis

1. Digital Literacy

A number of farmers, particularly those situated in rural regions, often

possess insufficient knowledge or skills to utilize digital platforms proficiently. Consequently, there is a pressing need for continuous training and the implementation of digital literacy initiatives.

2. Infrastructure Issues

In many rural areas, dependable internet access remains a significant obstacle, hindering the availability of digital mandis. Implementing solutions like mobile-based platforms or satellite internet services may effectively mitigate this issue.

3. Trust and Security

Concerns regarding fraud and delayed payments may arise, especially in markets where the adoption of digital transactions is limited. It is essential for platforms to establish strong security measures to safeguard the interests of both buyers and sellers.

4. Regulatory and Legal Framework

Digital mandis have gained significant traction; however, the legal and regulatory frameworks governing them in numerous countries remain in a state of development. It is essential to ensure that these platforms adhere to agricultural trade regulations and standards.

Finally, Digital mandis signify a crucial advancement in the modernization of agricultural markets, enhancing the efficiency, transparency, and accessibility of agricultural transactions. These platforms facilitate improved market access for farmers, ensuring fair pricing and enabling direct sales to buyers, thereby empowering farmers and fostering a more equitable agricultural environment. Despite existing challenges such as digital literacy, infrastructure limitations, and issues of trust, the growing utilization of digital mandis has the potential to significantly transform agricultural markets and enhance the livelihoods of farmers.

Kisan Call Centres

Kisan Call Centres (KCCs) represent a governmental effort in India aimed at delivering agricultural guidance, information, and assistance to farmers. These centers serve as a direct and accessible platform for farmers to engage with agricultural specialists and obtain solutions to their farming challenges. The main objective of KCCs is to close the knowledge divide between farmers and agricultural professionals by offering timely and pertinent information on a range of agricultural topics, ultimately enhancing productivity and increasing farm incomes.

Key Features of Kisan Call Centres

1. 24/7 Accessibility

Kisan Call Centres provide 24/7 access, enabling farmers to reach out for support, guidance, or information at any time. This service is operational year-round, ensuring that assistance is available even during off-seasons when farmers may have questions or require help with crop management.

2. Expert Advice

Agricultural call centers employ a range of experts, including agronomists, plant pathologists, entomologists, and other specialists, who offer professional guidance to farmers on diverse agricultural topics. The counsel provided encompasses various domains, such as crop production, management of pests and diseases, fertilizer application, irrigation techniques, climatic factors, and optimal agricultural practices.

3. Multi-Language Support

Kisan Call Centres offer support in various languages to accommodate the linguistic diversity present in India. This approach guarantees that farmers from various regions, who communicate in different languages, are able to utilize the available services.

4. Wide Range of Services

Crop-Specific Recommendations: Agricultural practitioners can access detailed information regarding optimal practices tailored to specific crops, encompassing sowing methods, pest management strategies, irrigation requirements, and appropriate harvesting periods.

Meteorological Information: Farmers are provided with weather forecasts and recommendations for modifying agricultural practices in response to prevailing weather conditions.

Commodity Pricing: KCCs offer up-to-date market prices for a range of agricultural products, enabling farmers to ascertain the current market value of their harvests.

Government Initiatives and Financial Aid: The call centers disseminate information regarding various governmental programs, subsidies, and insurance options available to farmers.

Soil Quality and Fertilization Guidance: Recommendations on soil analysis, nutrient management, and the effective application of fertilizers assist farmers in enhancing soil quality and increasing crop productivity.

5. Helpline Number

Kisan Call Centres can be reached via a national toll-free helpline at 1800-180-1551, facilitating easy access for farmers seeking assistance without the concern of incurring call costs.

6. Personalized Assistance

Every inquiry initiated by a farmer is addressed by a specialist who delivers tailored responses that correspond to the farmer's particular question. This approach guarantees that the guidance offered is pertinent and practical.

In instances where a query exceeds the capabilities of the call center, it is escalated to a subject-matter expert for additional assistance.

Benefits of Kisan Call Centres

1. ***Immediate Access to Information***

Farmers are no longer required to wait for expert field visits or depend on informal communication from peers. They can now obtain essential information instantaneously through the helpline.

2. ***Reducing Dependency on Intermediaries***

Kisan Call Centres play a crucial role in minimizing the influence of middlemen, who frequently take advantage of farmers by providing misleading guidance. By facilitating direct access to experts, the reliance on intermediaries is significantly reduced.

3. ***Empowerment through Knowledge***

With readily available information, farmers are better equipped to make informed choices regarding their agricultural practices. This knowledge enables them to implement modern farming techniques, enhance productivity, and mitigate losses.

4. ***Timely Support during Critical Times***

In urgent situations, such as pest outbreaks, droughts, or diseases, farmers can promptly seek expert advice, thereby averting potential crop damage and loss. Access to real-time weather updates and guidance allows farmers to effectively plan their activities, bolstering their resilience against adverse conditions.

5. ***Enhanced Agricultural Productivity***

By offering scientifically validated recommendations on various facets of crop production, pest management, and fertilizer use, Kisan Call Centres contribute to increased agricultural productivity and improved farm income.

6. ***Inclusivity for Rural Farmers***

Kisan Call Centres facilitate the dissemination of knowledge and resources to remote and rural regions where agricultural extension services may be scarce. This ensures that even farmers in the most isolated areas can access crucial information.

7. ***Support for Other Aspects of Farming***

KCCs also extend their guidance to non-crop-related matters, including livestock management, aquaculture, and farm diversification, thereby fostering the comprehensive development of farming communities.

8. ***Promotion of Sustainable Agriculture***

Kisan Call Centres provide advice on sustainable farming methods, organic practices, and soil health, encouraging farmers to embrace environmentally friendly and sustainable agricultural techniques.

Challenges and Limitations

1. ***Awareness***

Although Kisan Call Centres are operational, a significant number of farmers, particularly those situated in isolated regions, remain uninformed about their existence and the potential advantages they offer. It is essential to implement awareness initiatives to encourage greater utilization of this valuable resource among the farming community.

2. ***Technology Access***

Farmers lacking access to telecommunication devices or internet connectivity may find themselves unable to take advantage of Kisan Call Centres. Nevertheless, initiatives have been introduced to facilitate access for users of basic mobile phones, ensuring that a broader segment of the agricultural population can benefit from the service.

3. ***Limited Local Expertise***

While the call centres address a diverse array of agricultural concerns, certain inquiries may necessitate on-site evaluations or local expertise that the call centres are not equipped to provide adequately.

4. ***Language Barriers***

Despite the multilingual support offered by Kisan Call Centres, regional language obstacles may persist in specific instances, particularly concerning less widely spoken languages or dialects.

5. ***Dependence on Call Centres***

An excessive reliance on the guidance provided by call centres may inadvertently hinder farmers' motivation to pursue local, practical assistance from agricultural extension services or field officers.

Success Stories and Impact

1. ***Enhanced Agricultural Productivity***

Farmers utilizing Kisan Call Centres have reported significant increases in agricultural productivity by adhering to expert guidance on crop management and pest control strategies.

2. ***Effective Pest and Disease Control***

Farmers have managed to effectively mitigate pest outbreaks and diseases through timely recommendations from Kisan Call Centres, thereby averting substantial crop losses.

3. ***Improved Market Returns***

Access to market price data has enabled farmers to market their products at more favorable prices, thereby diminishing the role of intermediaries and ensuring equitable profits.

4. ***Promotion of Sustainable Agriculture***

Kisan Call Centres have played a pivotal role in encouraging numerous farmers to implement organic farming methods and soil health management

practices, thereby fostering sustainable agricultural development.

Future Prospects

The capacity of Kisan Call Centres (KCC) to further enhance agricultural development is significant. Prospective advancements may encompass the following areas:

1. Integration with Digital Platforms: Merging KCC services with digital platforms and mobile applications could facilitate more engaging and interactive offerings, such as video consultations and virtual field assessments.

2. Enhanced AI and Data Analytics: By incorporating artificial intelligence and machine learning, Kisan Call Centres could deliver more tailored guidance informed by data regarding weather trends, soil conditions, and satellite imagery.

3. Expansion to Other Languages: Given the extensive linguistic diversity in India, broadening multilingual support to encompass all regional dialects would enhance accessibility for the entire farming community.

Kisan Call Centres serve as a vital resource for equipping farmers with the necessary information and assistance to facilitate informed decision-making. By offering direct communication with agricultural specialists, these centres enhance productivity, diminish reliance on intermediaries, and promote the economic prosperity of farmers. Despite existing challenges such as limited awareness and access to technology, persistent initiatives aimed at improving these services are crucial for sustaining their effectiveness in revolutionizing agriculture in India.

e-Choupal

ITC Limited launched e-Choupal, a special online platform that connects rural farmers directly to the Internet for the purchase of agricultural and aquaculture goods such soybeans, wheat, coffee, and prawns. The problems of

Indian agriculture, which are typified by dispersed farms, inadequate infrastructure, and the participation of middlemen, are addressed with e-Choupal. [1] To provide farmers with current marketing and agricultural information, the program sets up PCs with Internet connectivity in rural India.

Use of Geographic Information System and Global Positioning System e-Choupal

e-Choupal represents a strategic initiative by ITC Limited designed to enhance the capabilities of farmers in rural India by facilitating their access to vital information, resources, and services. A significant technological component of e-Choupal is the Geographic Information System (GIS), which plays a crucial role in optimizing agricultural practices and fostering improved connections to markets.

Role of Geographic Information System

1. ***Weather Forecasting and Climate Information***

Geographic Information Systems (GIS) play a vital role in delivering localized meteorological data to agricultural producers. This information is essential for effective agricultural planning, given that weather patterns significantly affect crop development and yield. By utilizing GIS technology, farmers can access real-time weather information specific to their area, enabling them to make informed decisions regarding the best timing for planting, irrigation, and harvesting activities.

2. ***Soil and Crop Health Monitoring***

GIS serve as a valuable tool for assessing soil health and tracking crop conditions across various geographical areas. By combining soil health information with spatial mapping, agricultural practitioners can receive tailored guidance regarding the most effective fertilizers, ideal planting methods, and pest management strategies suited to their particular environment.

3. ***Precision Agriculture***

Geographic Information Systems facilitate precision agriculture, allowing

farmers to enhance the management of resources, including water, fertilizers, and pesticides, through the analysis of comprehensive spatial data. This approach promotes more efficient and sustainable agricultural practices. For example, irrigation systems can be refined by identifying regions that necessitate increased water application versus those that require reduced amounts, informed by the moisture content of the soil and the landscape's topographical features.

4. ***Market Information and Pricing***

e-Choupal offers farmers the ability to access information regarding market prices across various regions by utilizing GIS system. This access enables farmers to make well-informed choices about the optimal locations for selling their products to achieve the highest prices. Furthermore, GIS facilitates the monitoring of market trends and connects farmers to local marketplaces, which in turn diminishes the potential for exploitation by intermediaries.

5. ***Supply Chain Management***

GIS play a crucial role in enhancing the efficiency of the agricultural supply chain. By monitoring the transit of goods from agricultural producers to market venues, e-Choupal is able to minimize transportation expenses and optimize the logistics associated with agricultural commodities. This timely delivery of produce to markets ultimately contributes to increased profitability for farmers.

6. ***Disaster Management***

GIS helps to the management at the time of disasters and the assessment of risks. In regions susceptible to floods, droughts, and various natural disasters, GIS technology facilitates the identification of at-risk areas, forecasts potential hazards, and delivers timely alerts to farmers regarding impending disasters. This proactive approach enables better preparation for such occurrences and helps to reduce possible damages.

7. ***Land Mapping and Land Use***

It is empower agricultural practitioners to accurately delineate their land and its utilization. This capability enhances the comprehension of land suitability

for diverse crops and optimizes farm management strategies. Furthermore, it facilitates informed decision-making regarding crop rotation, land preparation, and cultivation methodologies.

8. Extension Services and Education

e-Choupal employs GIS-based platforms to deliver extension services to agricultural producers. These services equip farmers with educational materials, guidelines, and best practices specifically designed for their geographic context. For instance, occurrences of pest infestations or disease outbreaks in particular areas can be monitored and communicated to farmers via GIS mapping, accompanied by practical recommendations.

The incorporation of Geographic Information Systems (GIS) within the e-Choupal initiative provides farmers with extensive spatial data that significantly improves their decision-making processes. GIS is instrumental in various aspects, including weather prediction, crop health assessment, market accessibility, and disaster readiness, thereby enhancing agricultural efficiency and sustainability. This application of GIS technology fosters a more interconnected, knowledgeable, and empowered agricultural community in rural India.

e-Choupal, a project initiated by ITC Limited in India, represents an innovative digital platform aimed at empowering farmers by granting them access to vital information, products, and services that enhance productivity and improve their livelihoods. A key factor contributing to the success of e-Choupal is its incorporation of technology, particularly the Geographic Information System (GPS). The integration of GPS technology within e-Choupal plays a crucial role in augmenting the efficiency and effectiveness of the services provided to farmers.

Role of GPS in e-Choupal

1. Precision Agriculture

GPS technology is essential in precision agriculture, enabling farmers to enhance their farming practices through data-driven decisions that are

specific to their geographical locations. The integration of GPS with complementary technologies, such as soil sensors and satellite imagery, empowers farmers to make well-informed choices regarding crop management, including optimal timing and locations for the application of water, fertilizers, and pesticides.

e-Choupal employs GPS-based mapping to deliver customized solutions for farmers, facilitating the monitoring of soil health, moisture content, and other vital information that significantly influences crop development and productivity.

2. ***Tracking and Monitoring of Farm Produce***

GPS-enabled logistics facilitate e-Choupal's ability to monitor the transportation of agricultural products from rural areas to market destinations, thereby promoting efficiency and punctuality in the supply chain. This system mitigates delays, minimizes spoilage, and addresses logistical challenges, ultimately contributing to increased income for farmers by safeguarding against losses incurred during transit.

Additionally, with the implementation of GPS tracking, e-Choupal is capable of overseeing the real-time location of agricultural goods and delivering timely updates to farmers regarding the status of their deliveries. This not only ensures prompt payments but also diminishes the potential for fraudulent activities.

3. ***Supply Chain Optimization***

GPS technology plays a crucial role in enhancing supply chain efficiency by facilitating improved route planning for the transportation of goods. By determining the most effective routes and monitoring vehicle movements, e-Choupal can guarantee timely delivery of products to their intended locations, minimizing delays. Furthermore, GPS aids e-Choupal in the coordination of transportation networks, thereby increasing operational efficiency and lowering fuel expenditures.

4. ***Market Access and Price Discovery***

e-Choupal leverages location-specific GPS data to furnish farmers with

immediate market price updates. This access empowers farmers to identify optimal selling locations for their products, thereby maximizing their potential earnings and minimizing reliance on local intermediaries. The incorporation of GPS technology facilitates farmers' awareness of pricing in nearby markets, allowing them to make more strategic choices regarding the sale of their commodities.

5. Disaster Management and Weather Alert

The integration of GPS data with meteorological forecasting systems enables the provision of localized weather alerts to farmers, informing them of potential adverse conditions such as storms, droughts, or floods that could significantly affect their crops. Utilizing GPS- derived weather insights allows farmers to implement proactive measures, such as preemptively irrigating their fields or safeguarding their crops against severe weather phenomena, thus mitigating risks associated with agricultural production.

6. Data-Driven Decision Making

The integration of geospatial data and GPS technology enables e-Choupal to offer farmers recommendations grounded in data for a range of agricultural practices. This encompasses identifying optimal sowing times, determining appropriate fertilizer quantities, and enhancing pest management strategies. When these insights are merged with localized data, they empower farmers to boost crop yields and make informed decisions tailored to their unique geographical and environmental contexts.

7. Monitoring and Assessing Land Use

The implementation of GPS technology allows e-Choupal to track land utilization trends, evaluate soil conditions, and identify various crop types across distinct regions. By analyzing land use data over time, e-Choupal is positioned to provide recommendations regarding crop rotation strategies, soil preservation techniques, and the application of organic or chemical inputs grounded in accurate information. Furthermore, GPS facilitates the evaluation of soil fertility across different locations, thereby optimizing the application of

resources such as fertilizers and water for enhanced efficiency.

8. Farmer Outreach and Training

e-Choupal offers training and educational resources to farmers, utilizing GPS data to pinpoint those situated in areas that would gain the most from targeted interventions. This geographic focus enables e-Choupal to deliver pertinent and customized assistance that addresses the unique needs of each location. Furthermore, it allows e-Choupal to evaluate regions with a higher incidence of crop diseases or suboptimal yields, facilitating concentrated outreach and educational efforts in these specific areas.

Benefits of Using GPS in e-Choupal for Farmers

1. ***Improved Efficiency in Crop Management***

Through the implementation of GPS-based precision agriculture methods, farmers are able to enhance the efficiency of water utilization, fertilization practices, and pest management, resulting in lower expenses and increased productivity.

2. Reduced Post-Harvest Losses

The utilization of GPS tracking for transportation vehicles guarantees the timely arrival of agricultural products to markets, thereby reducing the risk of spoilage or damage during transportation.

3. Better Price Discovery

Farmers have the ability to obtain immediate data regarding market prices across various regions, which aids them in making informed choices about the optimal timing and locations for selling their produce to enhance profitability.

4. ***Enhanced Weather Predictions and Risk Management***

Farmers can reduce the risks associated with unfavorable weather conditions and safeguard their crops from potential harm through the

utilization of real-time weather alerts that rely on GPS data.

5. *Targeted Support and Resources*

The implementation of GPS technology enables e-Choupal to provide tailored support, educational resources, and information that are specific to a farmer's geographical location. This localized approach facilitates the enhanced adoption of optimal practices and agricultural innovations.

6. ***Cost Reduction in Logistics***

The execution of GPS technology in logistics contributes to the reduction of transportation expenses by enhancing route efficiency and decreasing delays. This optimization not only leads to lower fuel usage but also diminishes the carbon emissions associated with agricultural operations.

7. ***Sustainable Farming Practices***

The integration of GPS technology and precision agriculture enables farmers to implement more sustainable practices, including the reduction of pesticide application and the optimization of irrigation. These advancements contribute to the cultivation of healthier crops and promote improved environmental results.

The incorporation of GPS technology into the e-Choupal platform has markedly improved its capacity to assist farmers in a more precise and effective manner. By offering essential information regarding crop management, market pricing, logistics, and weather predictions, GPS facilitates enhanced decision-making, resulting in increased yields, minimized losses, and greater profitability. As agriculture increasingly relies on data, the significance of technologies such as GPS will continue to develop, fostering more sustainable and productive agricultural practices. Initiatives like e-Choupal exemplify how technology is pivotal in reshaping the agricultural sector in India, enabling farmers to succeed in a swiftly evolving landscape.

UNIT – V

GLOBALISATION AND IMPACT ON AGRICULTURE

Introduction

The process of growing interconnection and integration between the economies, markets, societies, and cultures of many nations around the world is known as globalization. The expansion of transportation, the liberalization of money flows, the growth of information and communication technology, and the removal of trade obstacles all contribute to this. First used in the early 1900s to refer to the extraordinary international connectedness of the post-Cold War world, the term "globalization" developed its current meaning sometime in the second half of the century and gained popularity in the 1990s. It was originally derived from the French word "globalisation." The 18th and 19th centuries saw the beginnings of globalization, which was fueled by developments in communication and transportation technologies. Global relationships increased as a result of these advances, which promoted the expansion of international trade as well as the sharing of cultures, ideas, and beliefs. Globalization is tightly related to social and cultural dynamics, even though its main function is economic interaction and integration. International diplomacy and disputes have also been important in the development and history of globalization, continuing to influence its current form.

Multinational Corporations (MNCs)

A multinational corporation (MNC) is a large company that operates in multiple countries. MNCs are often involved in manufacturing, consulting, and technology.

Role of MNCs

Multinational Corporations (MNCs) in the agricultural sector significantly influence the dynamics of global food systems, agricultural methodologies,

and supply chain management. Functioning across international boundaries, these entities affect numerous facets of agriculture, encompassing production, processing, distribution, and retail operations. Their participation can yield both beneficial and detrimental outcomes for local economies, farmers, and ecological systems. The following discussion provides an analysis of the role of MNCs in agriculture, highlighting their contributions, the challenges they face, and the implications of their activities on both global and local agricultural frameworks.

Introduction of Modern Agricultural Technologies

Multinational corporations (MNCs) play a crucial role in the integration of contemporary agricultural technologies that significantly improve productivity, efficiency, and the quality of crops.

Genetically Modified (GM) Crops: Corporations such as Monsanto (now integrated into Bayer), DuPont, and Syngenta have been instrumental in the innovation and commercialization of genetically modified seeds. These seeds are specifically designed to resist pests, diseases, and herbicides, as well as to endure challenging environmental conditions. This advancement has resulted in higher yields for various crops, including cotton, maize, and soybeans.

Precision Agriculture: MNCs are at the forefront of creating sophisticated agricultural equipment and technologies, such as GPS-guided tractors, drones, and automated irrigation systems. These innovations enable farmers to optimize their resource utilization, minimize expenses, and enhance crop output.

Pesticides and Fertilizers: Firms like BASF, Syngenta, and Bayer are key players in the agrochemical sector, supplying vital resources for pest management and soil fertility enhancement. Although these products contribute to increased agricultural yields, they also

raise significant concerns regarding their environmental effects, including soil degradation and the emergence of pesticide resistance.

Supply Chain Integration and Global Food Systems

Multinational corporations (MNCs) in the agricultural sector significantly contribute to the global supply chain by linking farmers to international markets.

***Export and Import**:* Prominent multinational entities such as Cargill, Archer Daniels Midland (ADM), and Olam International play a crucial role in the exportation of agricultural products across various regions. These companies engage in the trading, processing, and distribution of grains, oils, and other primary agricultural commodities, thereby enhancing global food security.

Value Addition: MNCs involved in food processing, including Nestlé, Coca-Cola, and PepsiCo, typically source raw materials from local agricultural producers, transform them into finished products, and subsequently distribute these goods on a global scale. This process not only adds value to fundamental agricultural items but also facilitates their availability in international markets.

Cold Storage and Logistics: MNCs allocate resources towards developing cold storage and transportation infrastructures to effectively manage perishable agricultural products such as fruits, vegetables, and dairy. This investment is instrumental in minimizing food waste and enhancing market access for farmers, particularly in developing nations.

Providing Access to Capital and Inputs

Multinational corporations (MNCs) play a crucial role in supplying vital resources, financial capital, and funding alternatives that empower farmers to enhance their production capabilities.

Financial Support: Firms such as John Deere and AGCO offer financial

assistance to farmers for the acquisition of sophisticated machinery, which is frequently beyond the financial reach of smallholder farmers lacking credit options. This availability of capital significantly boosts productivity and promotes the adoption of mechanization.

Distribution of Seeds and Fertilizers: MNCs provide farmers with premium seeds and fertilizers, often facilitated through exclusive contracts or partnerships with major agricultural producers. While these inputs lead to increased crop yields, they may also create a long-term reliance on corporate suppliers.

Employment and Rural Development

Multinational corporations (MNCs) significantly influence rural economies by serving as key employers and by contributing to infrastructure and development initiatives.

Employment Opportunities: Major agribusiness firms create jobs in rural regions, both directly through their operations (such as factories, supply chains, and distribution channels) and indirectly by fostering local suppliers and supporting smallholder agriculture.

Infrastructure Investment: MNCs allocate resources towards enhancing rural infrastructure, including the construction of roads, warehouses, and irrigation systems, which collectively improve the agricultural environment and boost the efficiency of local farming operations.

Education and Skill Development: Numerous MNCs are committed to enhancing farmer knowledge and skills through educational programs and extension services. They offer training in advanced agricultural practices, crop management, and business acumen. For example, companies like Cargill and Monsanto have initiated programs aimed at educating farmers on sustainable farming methods and the responsible use of pesticides.

Promoting Sustainable Agriculture

Numerous multinational corporations (MNCs) have implemented sustainability initiatives in response to the pressing issues of environmental degradation and climate change.

Sustainable Agricultural Practices: A significant number of large agribusiness firms are now endorsing sustainable agricultural methods, including conservation tillage, crop rotation, and agroforestry. These companies collaborate with farmers to minimize the reliance on chemical inputs and to transition towards more environmentally friendly alternatives.

Certification and Standards: Corporations such as Nestlé and Unilever advocate for sustainable sourcing by promoting certification programs like Fair Trade and Rainforest Alliance. These initiatives facilitate farmers' access to improved market opportunities while ensuring adherence to more responsible agricultural practices.

Climate Change Mitigation: There is a growing emphasis among MNCs on climate-smart agricultural practices, alongside the promotion of innovations aimed at alleviating the effects of climate change. This includes the development of drought-resistant crops and the implementation of water-efficient farming technologies.

Market Access and Consumer Awareness

Multinational corporations (MNCs) operating within the agricultural sector significantly affect consumer behavior and food markets through their strategies in marketing, branding, and innovation.

Consumer Products: By transforming and promoting agricultural goods under well-known global brands, MNCs play a crucial role in shaping consumer preferences and influencing demand. The products offered by companies such as PepsiCo and Nestlé substantially affect global food consumption trends.

Traceability and Transparency: A growing number of MNCs, particularly in the food and beverage industry, are prioritizing transparency within their supply chains. They are committed to providing consumers with detailed information regarding the origins and production processes of their food products.

Challenges and Criticism

Multinational corporations (MNCs) significantly influence the modernization of agriculture; however, their involvement is accompanied by various controversies. The following points outline some of the challenges and criticisms associated with their operations:

Market Control and Monopolistic Behavior

MNCs engaged in agricultural sectors, particularly in seed production (such as Monsanto/Bayer), agrochemicals, and food processing, wield considerable market influence. This dominance can result in monopolistic behaviors, leading to increased costs for farmers and potentially hindering the competitiveness of smallholder farmers.

Reliance on Corporate Resources

In numerous regions, farmers find themselves increasingly reliant on MNCs for essential inputs such as seeds, fertilizers, and pesticides. This dependency can create a cycle that undermines their long-term economic autonomy.

Environmental Consequences

The extensive application of chemical fertilizers, pesticides, and genetically modified organisms has sparked concerns regarding soil degradation, water contamination, and biodiversity loss. Certain MNCs have faced criticism for their contributions to these environmental issues.

Social and Ethical Issues

The impact of MNCs on local agricultural communities raises significant social concerns, particularly regarding land acquisition practices, labor conditions, and the erosion of traditional farming techniques.

Global Food Insecurity

Although MNCs play a role in the global food supply chain, their emphasis on export-oriented crops and high-value products can inadvertently exacerbate food insecurity in developing nations. The prioritization of cash crops such as coffee, cotton, and tobacco may limit the land available for essential staple crops, thereby intensifying issues of hunger and malnutrition.

Multinational corporations (MNCs) play a complex and significant role within the global agricultural sector. Their involvement enhances agricultural productivity, fosters technological innovation, facilitates access to international markets, and contributes to the evolution of global food systems. Nonetheless, the substantial power and influence wielded by MNCs also pose various challenges, including environmental degradation, monopolistic market behaviors, and the erosion of traditional farming methods. The increasing emphasis on sustainability and corporate social responsibility has led numerous MNCs to implement more ethical practices; however, the overall ramifications of their presence in agriculture continue to be a contentious issue.

Looking ahead, it will be crucial to strike a balance between the advantages offered by MNC participation and the requirements of local farmers, environmental integrity, and food security. Protecting the interests of smallholder farmers and rural communities while leveraging the technological innovations and market opportunities provided by MNCs will be essential for fostering a more just and sustainable agricultural framework.

Globalization of Indian Economy: Problems and Prospects of Indian Agriculture

Globalization denotes the phenomenon of heightened interconnectedness and mutual reliance among nations, economies, and cultural frameworks. The integration of the Indian economy into the global landscape, especially since the early 1990s, has resulted in considerable transformations across multiple sectors, notably agriculture. This evolution, propelled by policies of liberalization, privatization, and global integration, has woven India more tightly into the fabric of the global economic system. Although globalization has created new avenues for growth within Indian agriculture, it has simultaneously introduced considerable challenges.

Opportunities and Prospects for Indian Agriculture

Access to International Markets

One of the primary advantages of globalization for Indian agriculture is the enhanced access to global markets. Indian farmers are now able to export a diverse range of agricultural goods, including rice, tea, spices, cotton, and various horticultural items. The rising global demand for organic and specialized products has opened new avenues for the export of Indian agricultural commodities. As a significant producer of organic food, India is well-positioned to capitalize on this expanding market trend.

Increased Foreign Direct Investment (FDI)

The influx of foreign direct investment (FDI) into the agricultural sector has facilitated significant improvements in technology, infrastructure, and supply chain management. Notably, multinational corporations such as Cargill, Nestlé, and PepsiCo have made substantial investments in the Indian agricultural landscape, providing farmers with enhanced seeds, fertilizers, and superior post-harvest management strategies. Furthermore, globalization has ushered in a range of technological innovations in agriculture, including

precision farming, drip irrigation systems, and genetically modified organisms (GMOs), all of which contribute to increased productivity and sustainability in agricultural practices.

Improvement in Agricultural Infrastructure

The process of globalization has led to an increased focus on enhancing agricultural infrastructure in India. The advancement of logistics, the establishment of cold storage systems, and the modernization of supply chains have contributed to a decrease in post-harvest losses and an improvement in operational efficiency. Furthermore, initiatives such as e-Choupal, backed by international corporations like ITC, have facilitated the integration of rural farmers into the digital economy, enabling them to connect with global markets and gain access to timely information regarding market prices, weather conditions, and agricultural practices.

Market-oriented Agriculture

Globalization has prompted a transition among farmers towards market-oriented agricultural practices. This transition entails the cultivation of crops that align with market demand, moving away from an exclusive focus on subsistence farming. As a result, farmers can achieve increased income by tapping into a variety of market opportunities. Additionally, the emergence of contract farming facilitated by multinational corporations offers farmers improved pricing structures, access to quality inputs, and enhanced market connectivity.

Enhanced Export Potential

Globalization has facilitated a notable rise in Indian agricultural exports, especially concerning commodities such as rice, cotton, tea, coffee, and various fruits. The liberalization of trade has diminished obstacles to both export and import processes, thereby enabling Indian farmers to engage more effectively with the expanding global food market. Furthermore, through the establishment of free trade agreements (FTAs) and the adoption of advantageous trade policies, India is positioned to explore new markets and substantially enhance its agricultural export capacity.

Problems and Challenges for Indian Agriculture Due to Globalization

Increased Market Volatility

Globalization subjects' Indian agriculture to the variability of global commodity prices. Agricultural markets frequently experience instability as a result of erratic weather conditions, alterations in international policies, and changing consumer demand. Indian farmers, in particular, face heightened susceptibility to price declines for crops such as cotton, sugar, and pulses, largely due to the pressures of international competition. This market volatility can result in financial insecurity for farmers, particularly for small and marginal producers who possess limited capacity to withstand economic shocks.

Overdependence on Global Markets

The heightened engagement with global markets may lead to an excessive reliance on international trade. Variations in global supply and demand, geopolitical conflicts, or the imposition of trade barriers such as tariffs can adversely impact India's agricultural exports, thereby influencing the income of farmers. Furthermore, the agricultural sector in India faces potential threats if foreign entities or nations gain control over specific markets, which could render Indian farmers susceptible to price manipulation and exploitation.

Rural Displacement and Unequal Distribution of Benefits

Globalization has not provided uniform advantages to all farmers. Larger, more affluent farmers who have access to advanced resources and financial capital are able to capitalize on the global market, whereas small-scale farmers often find it challenging to compete against the technologically superior agricultural methods employed by multinational corporations. The emergence of corporate farming and extensive agribusinesses can result in the marginalization of smaller farmers, exacerbating issues of rural unemployment and income disparity. Furthermore, the arrival of foreign enterprises may displace traditional agricultural practices, effectively side-

lining small farmers in the marketplace.

Environmental Degradation

The focus on cultivating high-yield crops and adopting industrial farming techniques frequently results in the excessive application of chemicals, pesticides, and fertilizers. This practice contributes to soil degradation, water contamination, and a decline in biodiversity. Additionally, the transition towards cash crops such as cotton and soybean, which depend significantly on chemical inputs, may result in soil erosion and promote unsustainable agricultural practices over time.

Threat to Food Security

The escalating emphasis on cash crops intended for export can occasionally jeopardize food security in India. When agricultural land is redirected from the cultivation of staple crops such as wheat and rice to cash crops aimed at international markets, it may result in a deficiency of vital food products domestically. Furthermore, the growing influence of multinational corporations in agricultural production often prioritizes profit generation over the implementation of sustainable food security measures, thereby exacerbating long-term challenges related to food security.

Cultural and Social Impact

The adoption of foreign agricultural technologies and genetically modified seeds has generated significant apprehension among Indian farmers and environmental advocates. Although these innovations offer the potential for increased crop yields, they pose a risk of undermining traditional agricultural knowledge and practices, which may be supplanted by corporate-driven, commercial methodologies. Furthermore, the consolidation of land by large multinational corporations or agribusinesses threatens the livelihoods of smallholder farmers, potentially destabilizing local agricultural communities.

Risk of Corporate Control

The growing involvement of multinational corporations in the agricultural value chain has sparked apprehensions regarding market monopolization.

Companies such as Bayer, Monsanto, and Cargill exert significant influence over the seed, pesticide, and agrochemical sectors, which may result in increased prices and restricted availability of affordable agricultural inputs for farmers. Additionally, the risk of land acquisitions and corporate dominance over agricultural resources poses a significant challenge in the era of globalization, particularly as these corporations amass land for extensive agricultural operations.

Prospects for Indian Agriculture in the Era of Globalisation

Technological Advancements

India has the potential to leverage the advantages of globalization by embracing and modifying advanced agricultural technologies. For instance, innovations such as precision agriculture, drip irrigation systems, and the use of drones can enable smallholder farmers to enhance their crop yields while simultaneously conserving water resources and minimizing input costs. The accessibility of these technologies is on the rise, facilitated by the participation of multinational corporations and foreign investment.

Sustainable Agricultural Practices

Globalization presents India with the potential to embrace sustainable agricultural practices through the incorporation of global insights into agroecology, organic farming, and climate-resilient agriculture. As international trade agreements increasingly prioritize sustainability, India has the opportunity to utilize this trend to advance environmentally friendly farming techniques and gain access to markets for sustainable agricultural products.

Diversification of Agricultural Exports

Through the diversification of agricultural exports into premium products, including organically cultivated vegetables, herbs, floriculture, and processed foods, India has the potential to capitalize on the increasing global consumer demand for healthier and environmentally sustainable options. This strategy

would not only boost export revenues but also create improved opportunities for farmers.

Reform of Agricultural Policies

India has the potential to maximize the benefits of globalization by reforming its agricultural policies to enhance integration with international markets while safeguarding local interests. The reforms introduced by the Farm Laws of 2020, despite being contentious, are designed to modernize the agricultural sector and bolster the involvement of private investment, facilitate contract farming, and improve market accessibility.

Increased Rural Empowerment

Globalization has the potential to serve as a catalyst for rural empowerment, provided that appropriate policies and infrastructure are established. By integrating small and medium-sized farmers into global supply chains, these individuals may experience enhanced income levels, improved quality of life, and greater opportunities for education and training initiatives.

Public-Private Partnerships (PPP)

The government has the potential to engage in public-private partnerships (PPP) with multinational corporations to advance rural infrastructure, facilitate access to contemporary agricultural techniques, and bolster the competitiveness of the agricultural sector. Such collaboration may serve as a strategy to assist Indian farmers in maintaining their competitiveness within the global marketplace.

The global integration of Indian agriculture offers significant prospects as well as formidable challenges. It has facilitated new avenues for exports, enhanced access to advanced technologies, and spurred infrastructure improvements. However, it also introduces risks including market instability, environmental harm, and social disparities. To effectively leverage the benefits of globalisation, India must find a harmonious balance between embracing modern technologies and practices while safeguarding the interests of small farmers, fostering sustainability, and ensuring food security.

Implementing appropriate policy reforms, empowering rural communities, and prioritizing sustainable agricultural practices will be vital in addressing the intricacies of globalisation and securing the future of Indian agriculture.

Impact of WTO on Indian Agriculture: Agreement on Agriculture (AoA)

The World Trade Organization (WTO), founded in 1995, serves as a global institution overseeing international trade regulations. A pivotal component of its framework is the Agreement on Agriculture (AoA), which seeks to reform agricultural trade on a global scale, promoting fairness and a market-driven approach. This agreement has profound consequences for nations such as India, where agriculture is integral to the economy and the livelihoods of millions of farmers.

The AoA establishes trade regulations concerning agricultural commodities, encompassing obligations related to market access, domestic support, and export subsidies. The effects of this agreement on Indian agriculture are multifaceted, presenting both advantages and challenges. The following analysis provides an in-depth examination of the WTO's influence on Indian agriculture, emphasizing the implications of the Agreement on Agriculture (AoA).

WTO Agreement on Agriculture (AoA)

The Agreement on Agriculture (AoA) seeks to diminish trade obstacles in the agricultural sector by fostering a more market-driven framework. This agreement is organized into three principal components:

1. *Market Access*

The AoA's objective is to lower tariffs and eradicate non-tariff barriers affecting agricultural trade. Participating nations have committed to liberalizing their agricultural markets by decreasing tariffs and quotas on imports of agricultural products.

2. *Domestic Support*

The agreement classifies domestic subsidies into various categories and aims to curtail those that distort trade. Subsidies classified under the green box (non-distorting) are permitted, while those in the amber box (trade-distorting) are subject to reduction measures.

3. *Export Competition*

The AoA imposes limitations on export subsidies, which are perceived as disruptive to global agricultural markets. Specifically, developed nations are obligated to reduce their subsidies related to agricultural exports.

Impact of WTO on Indian Agriculture

Market Access and Tariffs

Reduction in Tariffs: The Agreement on Agriculture (AoA) requires the reduction of tariffs on agricultural commodities. For India, this has resulted in increased competition from imported agricultural products. Consequently, India was obligated to lower tariffs on items such as wheat, rice, and sugar, facilitating the entry of foreign agricultural goods into the Indian marketplace. This situation has adversely affected Indian farmers, particularly in areas where domestic production lacks competitiveness or where imported products are more affordable. For instance, the influx of less expensive imports of pulses or vegetable oils poses a threat to local producers.

Increased Export Opportunities: The reduction of trade barriers has positively impacted Indian agricultural exports, facilitating the international trade of products such as spices, rice, tea, and fruits. The Agreement on Agriculture (AoA) has enabled India to enhance its agricultural export capabilities by providing improved access to global markets. Nevertheless, Indian agriculture encounters significant challenges in adhering to the rigorous international quality standards necessary for exports, which constrains its overall potential.

Domestic Support and Subsidies

Reduction in Trade-Distorting Subsidies: A significant aspect of the Agreement on Agriculture (AoA) was the mandate to decrease domestic subsidies for agricultural production, with a particular focus on amber box subsidies, which encompass price supports and subsidies for essential inputs such as fertilizers and seeds. Consequently, India was required to diminish or streamline its financial assistance to farmers, particularly concerning subsidies associated with food grain procurement and price support initiatives. This requirement has raised apprehensions, as a substantial number of Indian farmers rely on government subsidies for their livelihoods and to maintain their competitive edge.

Green Box Subsidies: The Agreement on Agriculture (AoA) permits nations to offer non-distorting subsidies categorized under the green box, which includes investments in rural development, agricultural research, and infrastructure. Consequently, India retains the ability to provide specific forms of assistance without contravening World Trade Organization (WTO) regulations, such as support for food security initiatives like the Public Distribution System (PDS).

Despite this provision allowing for some degree of flexibility, the scope of support permitted under the green box remains constrained. There are apprehensions that Indian farmers may not derive the same level of benefit as their counterparts in developed countries, who are capable of implementing more substantial subsidy programs.

Export Subsidies and Export Competition

Reduction of Export Subsidies: The Agreement on Agriculture (AoA) stipulates a decrease in export subsidies, which have historically been employed by nations such as the European Union and the United States to enhance the exportation of agricultural goods, including wheat, cotton, and dairy. For India, this development may result in foreign exports becoming less artificially priced, thereby establishing a more equitable competitive environment for Indian agricultural products in the global marketplace. Nevertheless, the

constraints on India's capacity to offer its own export subsidies may hinder the competitiveness of its agricultural exports. Although India's application of export subsidies has been relatively modest, the reduction of such subsidies in developed nations could pose challenges for India in competing against subsidized agricultural products from these countries in the international arena.

Food Security Concerns

WTO and India's Food Security: One of the foremost issues regarding the Agreement on Agriculture (AoA) pertains to its potential ramifications for food security in India. A significant portion of India's population relies on subsidized food, particularly in rural regions. The AoA's constraints on trade- distorting subsidies have raised apprehensions that India may struggle to maintain the Minimum Support Price (MSP) for agricultural products or sustain its food security initiatives due to limitations on domestic support. However, India successfully secured waivers for food security at the World Trade Organization (WTO), allowing it to uphold its Public Distribution System (PDS) and public stockholding programs for food grains in compliance with AoA regulations. While this achievement has alleviated some concerns, the long-term viability of these programs continues to pose challenges.

Impact on Small and Marginal Farmers

Vulnerability of Small Farmers: Small and marginal farmers in India frequently represent the demographic most susceptible to the repercussions of globalization and the policies set forth by the World Trade Organization (WTO). The decrease in tariffs and subsidies renders them vulnerable to the unpredictable and often volatile nature of international market prices. As agricultural markets evolve into more competitive arenas, small-scale farmers, who typically have restricted access to advanced technology and essential inputs, may struggle to compete with larger, capital-intensive agricultural enterprises, both within the domestic sphere and on the global stage.

Access to Technology and Innovation: The Agreement on Agriculture (AoA) has facilitated trade in agricultural products, simultaneously paving the way for the adoption of innovative technologies, superior seed varieties, and enhanced agricultural practices sourced from global markets. Nevertheless, the acquisition of these technologies frequently necessitates financial investment, which may be beyond the reach of smallholder farmers. Furthermore, the dominance of foreign entities in the supply chain can exacerbate the marginalization of small farmers, constraining their market access and diminishing their capacity to influence pricing.

Environmental Impact

Pressure to Intensify Production: The Agreement on Agriculture (AoA) has facilitated market access, potentially compelling Indian farmers to enhance their production levels to satisfy the global demand for specific crops. This situation may result in the adoption of more intensive agricultural practices, which could adversely affect the environment through soil degradation, depletion of water resources, and a decline in biodiversity. Furthermore, the World Trade Organization's (WTO) focus on market efficiency may promote monoculture farming, leading to a heightened reliance on chemical fertilizers and pesticides, thereby posing risks to ecological systems.

The World Trade Organization's Agreement on Agriculture (AoA) has produced a complex array of effects on Indian agriculture. On one hand, it has facilitated access to international markets and stimulated reforms aimed at market orientation; on the other hand, it has subjected Indian farmers to heightened global competition, led to a decrease in subsidies, and posed significant challenges to food security.

For India, the AoA presents a dual-edged sword, offering avenues for growth while simultaneously posing threats to smallholder farmers, particularly concerning environmental sustainability and equitable pricing. The nation's capacity to navigate the demands of WTO compliance while

protecting the livelihoods of its farmers, especially those who are impoverished and marginalized, will be essential for the enduring viability of its agricultural sector. Ongoing policy reforms, robust government support, and an emphasis on sustainable agricultural practices are crucial for alleviating the adverse effects of globalization while capitalizing on its potential advantages for Indian farmers and the broader economy.

WTO Agriculture Subsidies Boxes and Criticisms

The World Trade Organization (WTO) formulated a framework of regulations through the Agreement on Agriculture (AoA) aimed at overseeing agricultural subsidies and mitigating trade distortions. This framework classifies agricultural subsidies into three specific categories—Amber Box, Blue Box, and Green Box—according to their potential to distort trade. Each category carries distinct consequences for the nations that implement them.

Although the intention behind these classifications is to foster a more equitable and market- driven agricultural trade environment, there are detractors who contend that the existing system is flawed, disproportionately favoring affluent countries while placing developing nations, such as India, at a disadvantage. An in-depth examination of the WTO's Agricultural Subsidy Boxes and the associated criticisms follows.

Amber Box (Trade-Distorting Subsidies)

Description of Amber Box

Amber Box subsidies are classified as the most trade-distorting forms of support, as they have a direct impact on both production and trade. These subsidies are generally allocated to producers in the form of price supports, such as minimum price guarantees for agricultural goods, or as input subsidies, which include financial assistance for fertilizers, seeds, and water resources. Nations that implement amber box subsidies are obligated to decrease these subsidies in accordance with established limits. For

developed nations, this limit is determined as a percentage of their overall agricultural production value. Conversely, developing nations are afforded a higher ceiling to facilitate their growth and development.

Criticisms of Amber Box

Distortion of Global Markets: Amber box subsidies contribute to excessive production in affluent nations, leading to the dumping of agricultural goods in international markets. This practice adversely affects producers in developing countries, who struggle to compete with these artificially low-priced imports.

Bias towards Developed Countries: Wealthy nations, such as the European Union and the United States, allocate substantial amber box subsidies, especially for crops like cotton, corn, and sugar, thereby providing their farmers with a considerable competitive edge over those in less affluent countries.

Inefficiency and Sustainability: These subsidies promote unsustainable agricultural methods, as they often result in a heavy dependence on synthetic inputs, such as fertilizers and water, which in turn exacerbates environmental degradation.

Blue Box (Production-Limiting Subsidies)

Description of Blue Box

Blue Box subsidies represent a distinct category of financial support aimed at curbing production levels or mitigating the trade-distorting impacts associated with amber box subsidies. Typically, these subsidies manifest as direct payments to agricultural producers; however, the disbursements are contingent upon adherence to predetermined production limits or other regulatory constraints intended to decrease total agricultural output. An illustrative example of this can be found in the payments allocated to farmers through particular initiatives such as the US Farm Bill, which ties subsidy amounts to designated acreage or specific production objectives.

Criticisms of Blue Box

1. *Insufficient Actual Decrease in Production:* Although blue box subsidies are intended to regulate agricultural output, they frequently fail to achieve genuine reductions in production levels. Farmers may continue to cultivate surplus crops, albeit under altered conditions.
2. *Uncertainty and Absence of Defined Boundaries:* The blue box is occasionally perceived as a regulatory gap. Subsidies categorized as blue box are not consistently subjected to stringent evaluation or enforcement, resulting in ambiguity regarding which subsidies are permissible and which should face limitations.
3. *Potential Exploitation by Developed Nations:* Similar to amber box subsidies, blue box subsidies tend to be more readily available to developed countries, which possess the necessary resources and infrastructure to implement such financial support, thereby placing developing nations at a disadvantage.

Green Box (Non-Distorting Subsidies)

Description of Green Box

Green Box subsidies refer to financial supports that are classified as non-distortive to trade or production. Under the Agreement on Agriculture (AoA), these subsidies are permitted due to their perceived minimal effect on global trade dynamics. Their primary focus is on initiatives that promote rural development, agricultural innovation, environmental sustainability, and food security. Instances of Green Box subsidies encompass government funding directed towards agricultural research and development (R&D), environmental initiatives, food assistance programs, and the enhancement of rural infrastructure.

Criticisms of Green Box

1. Insufficient Monitoring Mechanisms: Although green box subsidies are

classified as non- distorting, there exists a notable absence of robust monitoring and enforcement systems to guarantee that these subsidies do not inadvertently result in trade distortions or inefficiencies. Critics contend that even green box subsidies can indirectly modify production patterns by changing the incentives faced by farmers.

2. *Disparities in Access:* Developed nations possess more substantial resources to allocate towards green box subsidies, including investments in research and infrastructure, which disproportionately advantages their agricultural sectors. This situation creates a disparity between developed and developing countries, as the latter often lack the financial means to effectively implement similar programs.

3. *Green Box as a Veil for Protectionist Policies:* Some critics assert that affluent countries may categorize their subsidies as green box to circumvent reductions, even when these subsidies are primarily intended to shield domestic agriculture or are inherently inefficient. Consequently, such subsidies may still contribute to inequities in the realm of international trade.

Special and Differential Treatment (SDT) for Developing Countries

The Special and Differential Treatment (SDT) provision permits developing nations to implement higher subsidy levels and enjoy greater leeway in subsidy reduction compared to their developed counterparts. This flexibility aims to support the growth of agricultural sectors in developing countries and to promote food security.

Nonetheless, this provision has faced criticism regarding its practical effectiveness:

Limited Practical Benefit: In reality, countries such as India encounter significant obstacles in utilizing these flexibilities, and the SDT provisions frequently fall short in addressing critical issues such as market access and export competition. Overuse of Subsidies: Critics contend that developing nations may exploit SDT provisions to protect inefficient agricultural sectors,

potentially impeding long-term growth and modernization within the agricultural industry.

Criticism of the WTO Agriculture Subsidy System as a Whole

Developed vs. Developing Countries: The primary criticism of the World Trade Organization's regulations regarding agricultural subsidies centers on the disparity between developed and developing nations. Wealthy countries typically provide significantly greater support to their agricultural industries, particularly through amber and blue box subsidies. This situation creates an uneven playing field in the international agricultural market, hindering the ability of developing nations to compete effectively. Furthermore, smallholder and impoverished farmers in these developing countries frequently lack access to the subsidies permitted by the WTO framework, which further complicates their participation in global markets.

Ineffective Reduction of Trade Distortions: Critics contend that, notwithstanding the presence of these subsidy categories, the World Trade Organization's Agreement on Agriculture (AoA) has not effectively diminished trade-distorting subsidies, particularly among developed nations. Countries such as the United States and the European Union persist in offering considerable assistance to their agricultural industries, which adversely impacts global agricultural markets and obstructs equitable competition.

Environmental Sustainability: Subsidies, especially those categorized within the amber box, frequently encourage agricultural practices that are not sustainable, including excessive reliance on water, fertilizers, and pesticides. Such subsidies promote high-input farming methods, which lead to various forms of environmental harm, such as soil erosion, water pollution, and a decline in biodiversity. Although green box subsidies are designed to foster environmentally sustainable practices, the existing framework generally falls short of sufficiently promoting sustainable agricultural practices on a global scale.

Market Access Barriers: Many developing nations continue to encounter significant obstacles in exporting their agricultural goods, despite the market access provisions outlined in the Agreement on Agriculture (AoA). High tariffs and subsidized competition from developed countries hinder these nations' ability to penetrate profitable global agricultural markets, thereby complicating the economic prospects for smaller economies.

Non-Agricultural Subsidy Issues: The Agreement on Agriculture (AoA) predominantly emphasizes agricultural subsidies; however, it insufficiently addresses the trade-distorting effects of subsidies in other sectors, such as manufacturing, which can have repercussions on agricultural trade. The implications of these cross-sector subsidies are frequently overlooked or inadequately examined in discussions within the World Trade Organization (WTO).

The Agriculture Subsidy Boxes established by the World Trade Organization (WTO) were intended to regulate agricultural subsidies and foster equitable trade practices. Nonetheless, their execution has faced criticism for perpetuating disparities between developed and developing nations, particularly regarding the substantial subsidies that affluent countries can provide. Although green box subsidies are classified as non-distorting, they still pose challenges related to accessibility and oversight. The overall framework is perceived as favoring the interests of developed countries, with detractors contending that it falls short in advancing sustainable agricultural practices, facilitating market access for developing nations, and addressing environmental issues.

To fulfill its objectives of promoting fairer global agricultural trade, the WTO must undertake reforms of the subsidy system to ensure a more balanced and equitable framework that considers the requirements of developing countries and smallholder farmers.