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AGRICULTURE IN INDIA

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ABSTRACT

India is a global agricultural powerhouse. It is the world's largest producer of milk, pulses, and spices, and has the world's largest cattle herd, as well as the largest area under wheat, rice, and cotton. India's farmers have been putting food on the table for India and the world for decades. Agriculture has been most enduring foundation for Indian economy. It constitutes the most significant part of Indian economy and it will continue to remain so for a long time. It still provides livelihood to the people in the country. It fulfills the basic need of human beings and animals. India ranks among the leading nations in the world that produce commodities like rice, wheat, cotton. sugar, milk, and horticulture. However, Indian agriculture is lagging in growth compared with the rest of the economy for decades. This paper examines the practice of agriculture in India.

Key Words: Agriculture, Farming, India, Indian Agriculture, Rural Communities, Traditional Agriculture.

1. INTRODUCTION

India occupies the greater part of the South Asian subcontinent. Figure 1 shows the map of India [1]. India's large population is expected to become the world's largest in the next 20 years, while its economy will soon become the world's third largest. Agriculture remains the back-bone and support system of the almost all of the developing nations including India. With a population of 1.27 billion, India is the world's second most populous country. It is the world's third largest economy after the US and China. It has a unique culture and is one of the oldest and greatest civilizations of the world. It is a diverse country where over 22 major languages and 415 dialects are spoken. Human ability to do farming and agriculture is the basis of Indian civilization. The agricultural industry is a central pillar of the Indian economy, employing a large portion of the nation's workforce. It is the only industry which employs more than two-thirds of the population. Agriculture is the largest source of livelihoods in India. 70 percent of its rural households still depend primarily on agriculture for their livelihood [2]. India is a country with an agrarian economy, with over 54% of the country's land classified as arable. Farmers in India are as diverse as the country itself. India does not have anything much, but they have people. Their only true resource is human resource.

Farming is one of the oldest economic activities in India. Indian agriculture is characterized by agro-ecological diversities in soil, rainfall, temperature, and cropping system. Agricultural commodities produced have to undergo a series of operations such as harvesting, threshing, winnowing, bagging, transportation, storage, processing and exchange before they reach the market. India's production of food grains has been increasing every year, and India is

among the top producers of several crops such as wheat, rice, pulses, sugarcane and cotton. It is the highest producer of milk and second highest producer of fruits and vegetables.

2. TYPES OF AGRICULTURE

Since ancient times, Indian farmers have been engaged in various agricultural practices. Farming methods prevalent in India can be classified as follows [3,4].

1. Subsistence Farming: A family of farmers are usually engaged in this farming method and use the output for their own consumption. This is a primitive farming method and farmers still practice it in some parts of the country. Subsistence farming is typically done on small farmland and also uses indigenous tools like a hoe, Dao, digging sticks, etc.

2. Intensive Farming: This is another form of subsistence farming. This farming practice can be seen in densely populated areas in India. It requires a huge amount of capital in addition to a great deal of human labor, but more than one crop can be raised per year. Also, to get a high quantity of produce chemical fertilizers and different irrigation methods are used.

3. Extensive Farming: This is the modern type of farming that can be seen largely in the developed world and in some parts of India. It relies largely on machinery as opposed to a human labor force.

4. Plantation Farming: This type of agriculture was introduced by the Europeans in the tropical and the subtropical regions. It is often used for crops which require a lot of space and a long growing period, such as rubber, tea, coconut, coffee, cocoa, spices, and fruits. Plantations are only capable of producing a single crop.

5. Dry land farming: This kind of farming is practiced in the more arid and desert-like areas of the country, including northwest and central India.

6. Wet Land Farming: Many areas of India are affected by heavy monsoon rains and subsequent flooding. Well-irrigated areas, such as those in the northeast India and the Western Ghats, are suitable for farming rice, jute, and sugarcane.

7. Shifting Farming: The cleared land is cultivated for two or three years with primitive tools. When the land is no longer fertile, another area of land is cleared and the crops are shifted there. Shifting cultivation is still practiced on a small scale in the forested areas of northeastern states of India.

8. Commercial Farming: This type of farming produces huge volumes of yield and contributes to the country's economy. The goal of commercial agriculture is a high yield, so that produce can be exported to other nations for profit. In this farming method, the Indian farmer depends on a high amount of fertilizers, pesticides, and insecticides to enhance and maintain the growth of the crops. India's main problem with agriculture began when they started moving from subsistence farming to cash farming or commercial farming approximately 50 years ago. The rural population has shrunk simply because of this move from subsistence farming to cash farming.

9. Mixed Farming: This is a situation in which both raising crops and rearing animals are carried on simultaneously. Cattle rearing and rotation of crops are important. It is practiced in highly populated areas. The yields are generally high. Farmers engaged in mixed farming are economically better off than others.

10. Dairy Farming: This type of farming has been developed to meet the needs of the industrial cities. Milk cattle are reared near big cities to provide dairy products for the people living and working in the urban areas.

3. BRIEF HISTORY OF INDIAN AGRICULTURE

India is one of the oldest civilizations in the world. The history of agricultural is closely interwoven with the progress of culture. Indian agriculture has long history which dates back to the Indus Valley civilization era. Agriculture was a way of life even before the Indus Valley civilization. Wheat and barley were grown during the Neolithic revolution and irrigation came about in full swing during the Indus Valley Civilization. Indian farmers had discovered and begun farming many spices and sugarcane more than 2500 years ago. Three hundred years ago, India was probably the most industrialized country in the world. India before British colonization had one of the highest per capita agricultural output and food prices were low. Under the British cash crops such cotton, opium, indigo, rice, and wheat were regularly exported.

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India has gone through changes in agriculture from ancient times through invasions and occupations, the repercussions from which today's farmers still suffer. Agricultural intensification in the 1970s to 1980s saw an increased demand for rural labor that raised rural wages. The sharp rise in food-grain production during India's Green Revolution of the 1970s enabled the country to achieve self-sufficiency in food-grains and avoided the threat of famine. Till the early 1960's, the predominant mode of cultivation was what is now called "organic farming", with no synthetic fertilizers or pesticides. Since the use of urea from the beginning of the 1960s, nitrogen, phosphorus and potassium-based fertilizers became available after the establishment of industrial plants. Due to drought from 1964-70, India had to import food and became heavily dependent on the United States for wheat supplies. Ultimately, the Green Revolution was initiated. The theme of the initiative was to boost food grains production of rice and wheat using any method and at any cost [5]. When India became an independent nation, agriculture was the driver of the economy, contributing more than half of the nation's GDP. The main aim of the government after independence was to ensure food supplies to the growing population. Today, India is still one of the world's largest producers of agricultural products.

4. TRADITIONAL INDIAN AGRICULTURE

Agriculture in India has two faces: modern and traditional. Mostly, traditional forms of agriculture prevailed in India. Farmers then practiced sustainable agriculture for their subsistence. They used wide a variety of organic techniques including recycling all organic materials, the use of indigenous strains, crop rotations and intercropping, incorporating legumes and biological pest control. Livestock rearing was an integral part of farming. An example of traditional farming is shown in Figure 2 [3]. Agriculture in India, though dominated by men, has some small sections where women are engaged in cultivating and harvesting. The major traditional agricultural inputs in India include millet, rice, wheat, tea, rubber, cabbages, vegetables, fruit trees, tobacco, leather, beef, poultry, goats, hunting, gecko fruits, honey, bird skins, and ornamental birds. The transition from traditional agriculture to modern agriculture shifted the objective of farming. The need to change the methods of farming to meet the demands of the growing population was inevitable. Agriculture in India has been facilitated by modern technologies, which has made it feasible, efficient, and profitable for the farmers.

5. MODERN AGRICULTURE

India is regarded a global agricultural powerhouse. Agriculture is the primary source of income for half of the population. 59% of the workforce makes a living from agriculture. India is ranked first in the production of milk, second in dry fruits, third in fish production, fourth in egg, and fifth in poultry production worldwide. Indian is the largest producer of most of the fruits in the world that includes bananas, guava, mango, lemon, papaya, and vegetables. India also produces spices that include ginger, pepper, and chili. India is also the world's largest wheat-producing nation. Farmers in India are happy to be able to feed their family and give education to their children. Raising productivity per unit of land will need to be the main engine of agricultural growth as virtually all cultivable land is farmed. Rural development may benefit the poor, landless, women, scheduled castes, and tribes. Major reform and strengthening of India's agricultural research and extension systems is one of the most important needs for agricultural growth. Since agriculture is India's largest user of water, increasing competition for water between industry, domestic use, and agriculture has highlighted the need to plan and manage water on a river basin and multi-sectoral basis [6]. The Indian government established a Sub-Mission on Agricultural Mechanization (SMAM). Its objective is to boost productivity on limited land in order to fulfil increased demand due to population expansion and higher wealth. A typical mechanized farming is shown in Figure 3 [7].

Today, the staple diet in southern India has become rice, tamarind, onion, and chili. India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. The major crop types in India are [8]:

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Food Crops	Rice	Wheat	Maize	Millets	Pulses
Cash Crops	Sugarcane	Tobacco	Cotton	Jute	
Plantation Crops	Coffee	Coconut	Arecanut	Tea	Rubber
Horticulture	Fruits and vegetables				

India is a net importer of cotton, but is a net exporter of wool and of hides and skins. For about 90% Indians, rice or wheat are almost exclusively the staple food. The staple food for cattle is rice straw.

India's government has also taken several policy steps and conducted pilots to foster technology and innovation in the agricultural sector. These polices and initiatives are supporting farmers in areas where they need the most help. Investment in India has centered on the basics: financing and technology to improve agriculture and farm practices and to avoid climate risks. Technology is helping farmers grow purposefully and more profitably. Digital technologies could enhance production at every step, from high-quality agriculture inputs to world-class agriculture outputs. For the adoption of agtechs to be successful, farmers will need stable sources of funding [9].

5.1 BENEFITS

Agriculture is the heart of India. It has moved beyond being mere means to livelihood. It has became the essence of cultural existence. India continues to be a leading producer in various agricultural outputs, such as coconut, ginger, banana, turmeric, wheat, groundnut, fruits, vegetable, etc. Trends indicate an increase in on-the-go eating, snacking in between meals, switching to healthier eating alternatives, pre-cooked ready-to-eat meals, and increasing consumption of organic foods. With the increase in urbanization, rising income, and change in consumption habits, the demand for different types of fresh and processed products is rising. Organic farming is native to India and is beneficial for all—the farmers, the consumers, and the environment. The demand for organic products in the Indian market is growing and is anticipated to rise.in the Indian market is growing.

5.2 CHALLENGES

There is an increasing lack of interest in farming among the educated youths. Agriculture sector challenges will be important to India's overall development and the improved welfare of its rural poor. There can be no one-size-fits-all approach to address these challenges. The challenges include the following [10,11].

1. Raising Productivity: Agricultural productivity remains a challenge. Raising productivity per unit of land will need to be the main engine of agricultural growth as virtually all cultivable land is farmed. All measures to increase productivity will need increasing yields, diversification to higher value crops, and developing value chains to reduce marketing costs. Limited access to education and basic crop information keep many farmers locked in a cycle of low productivity and poverty. Labor productivity in agriculture can either be increased by higher land productivity or higher land availability per farmer and mechanization. However, the dramatic increase in land productivity through industrial farming has caused severe environmental damage and did not boost agricultural labor productivity. India needs a serious boost to improve productivity and nanotechnology comes in rescue and helps in improving the productivity.

2. Reducing Poverty: Although India has achieved food sufficiency in production, it still accounts for a quarter of the world's hungry people and home to over 190 million undernourished people. The majority of India's poor (about 70 percent) are found in rural areas. Rural development must also benefit the poor, landless, women, scheduled castes and tribes. Poverty alleviation is a central pillar of the rural development efforts of the government and the World Bank. Although agricultural growth will provide the base for increasing incomes for the rural farmers that are below the poverty line, additional measures are required to make this growth inclusive. Class and caste have played a role in the financial dynamics of the sector too and hence the gap between rich and poor peasants has been stark for long.

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3. Food Security: The sharp rise in food-grain production during India's Green Revolution of the 1970s enabled the country to achieve self-sufficiency in food-grains and avoided the threat of famine. India's food security depends on producing cereal crops.

4. Climate Change: This is having an adverse effect on the people of India and its economy.
Agriculture in India is subject to fluctuations in temperature, excessive and untimely rains, floods, droughts, pests, diseases, and other environmental concerns. At the forefront of these risks are farmers, especially in Northen India. Droughts, floods, and erratic rains have greatest impact in rain-fed areas. India's climate varies from humid and dry tropical in the south to temperate alpine in the north. Agriculture needs to be made resilient in the face of the grave impact of climate change. The Indian Council of Agricultural Research (ICAR) is supposed to release climate-resilient varieties of crops to aid farmers and encourage them to shift towards sustainable agriculture.

5. Reform: In recent decades, the Government has made a concerted effort to initiate changes in the farm economy that would stimulate production, raise living levels, and reduce economic and social inequalities in the countryside. Major reform and strengthening of India's agricultural research and extension systems is one of the most important needs for agricultural growth. The latest reforms appear to be fueled by a concerted focus to transform India into a key production hub in the coming years. With the latest reform, farmers will now be provided with greater freedom to sell their produce directly to wholesalers and other buyers. Under the new framework, farmers will be able to agree fixed prices with wholesalers, processors, retailers, aggregators, and exporters at the time of sowing.

6. Water Resources: Agriculture is India's largest user of water. However, increasing competition for water between industry, domestic use, and agriculture has highlighted the need to plan and manage water on a river basin. As urban and other demands multiply, less water is likely to be available for irrigation. Ways to radically enhance the productivity of irrigation need to be found. In order to make water available for irrigation, huge investments are made towards building dams and canals.

7. Diversification: Encouraging farmers to diversify to higher value commodities will be a significant factor for higher agricultural growth. While diversification initiatives should be left to farmers, the government can liberalize constraints to marketing, transport, and export.

8. Feminization: Feminization of agriculture is mainly due to increasing rural-urban migration by men, rise of women-headed households, and growth in the production of cash crops which are labor intensive. Rural Indian women are extensively involved in agricultural activities. Women in rural areas, who do not own land, usually engage in agricultural labor activities. Figure 4 shows some women farmers in India [12]. Women farmers in the Indian have realized benefits of using modern technology and techniques in agricultural activities such as spraying herbicide, irrigation, fertilizers, seed treatment, etc. Mechanization of agriculture has resulted in confinement of women to traditional roles such as winnowing, harvesting, sowing seeds, and rearing livestock, which are low paying.

9. Protests: Today of, Indian farmers are fighting for their rights. The nation has witnessed farmers who have taken to the streets in a peaceful way to protest against these agricultural laws. India is witnessing a historic mass mobilization of farmers against three new farm laws, primarily on prices of agricultural produce, marketing channels, and the role of middlemen. Many farmers are concerned that the new laws will leave them vulnerable to exploitation by corporate agribusiness and at risk of losing their land. Figure 5 shows protesting Indian farmers [13].

10. Suicides: Farmer suicides grabbed headlines and largely remained so. And hence the Indian farmer who has long been the pillar and support of this nation, unfortunately found his social status never exalted to a stage that merited respect and dignity.

11. Sustainability*:* There is the challenge of sustainability of the natural resources—land, water, forests and so on. For example, technology can be used to increase water use efficiency. Sustainability of plants, fishes, forests, and livestock and their natural interdependence with the well-being of people should be given due attention.

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12. Food Loss: This takes place from the farm up to the retail level. Much of India's agricultural production is lost to waste due to a lack of appropriate infrastructure. There are losses in the food supply chain as well as losses in government warehouses storing wheat and rice. Figure 6 shows an example of food loss or food wastage [14].

6. CONCLUSION

India is predominantly agrarian; 80% of the population is directly or indirectly dependent on agriculture. It has achieved all-round socio-economic progress since its independence. However, agriculture continued to face serious challenges including uneven regional growth, rising fiscal constraints, mounting subsidies, failing institutions that manage public canals, increasing fragmentation of holdings, labor-intensive farming, and depleting groundwater and solid nutrients. One of the most important things needed right now is to organize agriculture, to bring in technology and, above all, the economy of scale is needed. To meet the food demands of a growing population with rising incomes, a productive, competitive, diversified, and sustainable agricultural sector will need to emerge at an accelerated pace. The agriculture industry must generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing, and cold storage. India must respond to the agricultural crisis by moving towards a more inclusive, equitable and sustainable system. As typically shown in Figure 7, the future of Indian agriculture lies on tech-driven farming practices [15]. More information about agriculture in India can be found in the book in [16-33].

REFERENCES

[1] Show map of India in 1947 and compare it with Indian political map accessed on Jan-2024

[2] "India at a glance,"https://www.fao.org/india/fao-in-india/india-at-a-glance/en/

[3] "Farming in India: Story of the Indian farmer, types of farming, examples," July 2021, https://guides.byjusweb.com "guides/geography/agriculture/farming-in-india/

[4] "9 Types of agriculture in India"https://aquaponicsinindia.com/types-of-agriculture-in-india/

[5] S. Pachauri, "Defeminisation of Indian agriculture," March 2018,

https://www.downtoearth.org.in/news/agriculture/defeminisation-of-indian-agriculture-59834

[6] "India: Issues and priorities for agriculture," May 2012,India: Issues and priorities for agriculture

[7] "Sub-Mission on Agricultural Mechanization: Mission to boost productivity," May 2022,

https://www.theindianiris.com/sub-mission-on-agricultural-mechanization-mission-to-boost-productivity/

[8] "Agriculture in India," https://examsdaily.in/agriculture-in-india-pdf-upsc-ssc

[9] "How agritech is poised to transform India into a farming powerhouse," May 2023, https://www.mckinsey.com/industries/agriculture/our-insights/how-agtech-is-poised-to-transform-india-into-a-farming-powerhouse

[10] "India: Issues and priorities for agriculture," May 2012,

https://cropsafepesticides.com/india-issues-and-priorities-for-griculture/#:~:text=India%3A%20Issues%20and%20Priorities%20for%20Agriculture%201%201.,Poverty%20alleviation%20and%20community%20actions%20...%20More%20items

[11] "Farmers finally freed from backward Mandi system – 'One India, One Market' can transform Indian agriculture," June 2020,

https://www.timesnownews.com/business-economy/economy/article/farmers-finally-freed-from-backward-mandi-system-one-india-one-market-can-transform-indian-agriculture/601472

[12] D. Tali, "In India, mobile apps are transforming agriculture," January 2016,

DOI: 10.31695/IJASRE.2024.2.1

https://modernfarmer.com/2016/01/agriculture-apps-india/

[13] S. Bhogal and S. Sinha, "India protests: Farmers could switch to more climate-resilient crops – but they have been given no incentive," February 2021,

https://theconversation.com/india-protests-farmers-could-switch-to-more-climate-resilient-crops-but-they-have-been-given-no-incentive-154700

[14] "How much of india's agricultural produce is wasted annually?" January 2021,

https://thewire.in/agriculture/india-agricultural-produce-wasted

[15] Agriculture Post, "Future of Indian agriculture lies on tech-driven farming practices: Vice President," January 2021,

https://agriculturepost.com/agritech/future-of-indian-agriculture-lies-on-tech-driven-farming-practices-vice-president/

[16] N. Gupta et al., *Sustainable Agriculture in India 2021*. CEEW Report, 2021.

[17] V. C. Srivastava, *History of Agriculture in India, Up to c. 1200 AD*. Concept Publishing Company, 2008.

[18] V. P. Sharma and D. Jain, *High-value Agriculture in India: Past Trends and Future Prospects*. Ahmadabad: Indian Institute of Management, 2011.

[19] S. Mittal, *Modern ICT for Agricultural Development and Risk Management in Smallholder Agriculture in India*. CIMMYT, 2012.

[20] G. S. L. H. V. Prasada, V. U. M. Rao, and G. G. S. N. Rao. *Climate Change and Agriculture Over India*. PHI Learning Pvt. Ltd., 2010.

[21] M. D. Kumar, *Food Security and Sustainable Agriculture in India: The water management challenge*. IWMI, 2003.

[22] I. Scoones, *Science, Agriculture and The Politics of Policy: The Case of Biotechnology in India*. Orient blackswan, 2006.

[23] T. Brown, *Farmers, Subalterns, and Activists: Social Politics of Sustainable Agriculture in India*. Cambridge University Press, 2018.

[24] A. Gupta, *Postcolonial Developments: Agriculture in the Making of Modern India*. Duke University Press, 1998.

[25] P. S. Ramakrishnan, *Shifting Agriculture and Sustainable Development: An Interdisciplinary Study From North-Eastern India*. Parthenon Publishing Group, 1992.

[26] S. Dasgupta, *Diffusion of Agricultural Innovations in Village India*. Wiley Eastern, 1989.

[27] J. A. Voelcker, *Report on the Improvement of Indian agriculture*. Eyre and Spottiswoode, 1893.

[28] R. Chand, *Effects of Trade Liberalization on Agriculture in India: Commodity aspects*. CGPRT Centre, 1999.

[29] T. Haque, *Sustainability of Small Holder Agriculture in India*. Concept Publishing Company, 1996.

[30] A. Dinar (ed.), *Measuring the Impact of Climate Change on Indian agriculture*. World Bank Publications, 1998.

[31] A. Howard and G. L. C. Howard, *The Development of Indian Agriculture*. H. Milford, Oxford University Press, 1927.

[32] K. Palanisami et al., *Climate Change and Agriculture in India: Studies From Selected River Basins*. Routledge, 2014.

[33] A. Mohammad (ed.), *Dynamics of Agricultural Development in India*. Concept Publishing Company, 1979.

DOI: 10.31695/IJASRE.2024.2.1

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Figure 1 The map of India [1].

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Figure 2 An example of traditional farming [3].

Figure 3 A typical mechanized farming [7].

Figure 4 Some women farmers in India [12].

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Figure 5 Protesting Indian farmers [13].

Figure 6 An example of food loss or food wastage [14].

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Figure 7 The future of Indian agriculture lies on tech-driven farming practices [15].

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