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Evolution and Transformation of Agricultural Practices in India from Traditional to Modern Era

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ABSTRACT

The agricultural industry in India is vital to the national economy. Over 58% of India's population depends on agriculture for their livelihood. The fact that 57% of India's land is set aside for crop production, as opposed to the worldwide average of about 12%, is indicative of the significance of the agricultural industry in the country. After the Green Revolution, traditional subsistence farming gave way to more modern, technology-driven, and market-oriented production methods in India's agricultural sector. In spite of its shrinking percentage of GDP, India's agricultural sector is vital to the country's industrialisation, commerce, and general economic stability, and it provides food and income for a large number of the people. This research sheds insight on the evolution, economic importance, and current limitations of Indian agriculture, all the while highlighting possible solutions forward for resilient, inclusive, and environmentally friendly agricultural growth.

Keywords: *Indian Agriculture, Economic, Climate, Technology, Crop.*

I. INTRODUCTION

As a whole, agriculture is crucial to economic and social progress. About 70% of rural families in India rely only on agriculture for their livelihood, while 58% of the population relies on agriculture as a major source of income. About 20% of India's GDP comes from the agricultural sector, making it a very important economic driver. About 62% of the people in India depend on it for their daily sustenance. With an estimated 20.19 percent of GDP, agriculture plays a crucial role in India's economy. While early farmers primarily farmed for subsistence, innovations in farming techniques allowed them to increase crop yields and diversify their income streams. However, environmental dangers aren't the only problems that have surfaced; a number of social issues have as well.

A sustainable food system relies heavily on agricultural technology. One example of how technology that is independent of scale altered agricultural output is the Green Revolution (GR). Among the many positive outcomes of the GR have been improved crop yields, decreased poverty, expanded access to nutritious food, and decreased food prices. Importantly, it helped allay fears that we had crossed the threshold of food surplus capacity, the point at which population growth outpaces agricultural output—a problem that plagues nations like India. India is second in agricultural production globally, despite having just a small proportion of the world's agricultural territory. The fact that green revolution techniques can only be applied to a limited range of crops is their biggest drawback. With a growing global population and more people worried about the environment, the need of achieving sustainable development via mitigating negative impacts is growing.



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Modern agricultural practices and state-of-the-art technologies are severely lacking in India. Across the world, farmers are using cutting-edge practices and applying AI through the use of sensors and other scientific instruments. Aside from improving quality and output, it also helps save money and lessens the impact on the environment. Similarly, the expansion of new markets might increase the demand for food and other agricultural products. Consequently, stronger ties between the agricultural and non-agricultural sectors may emerge as a consequence of an increase in accessible resources, expansion of businesses, or the redistribution of non-farm profits into the agricultural sector. One important aspect of developing rural economies is removing financial and market barriers. The urban population in India was 30% in 2010, but it is projected to reach 40% in 2030 and more than 50% by 2045, according to a UNDP study. By 2050, the projected urban population in India would have surpassed 6 billion, up from an estimated 3.5 billion in the current year. *The annual growth rate of cultivated areas is a meagre 2%.

II. REVIEW OF LITERATURE

Gupta, Jimmy. (2024) The agricultural sector has played a significant role in the nation's economic growth and development by ensuring the nation's food supply, employing people, supplying other sectors with raw materials, and earning foreign currency. The agricultural industry in India has expanded at a pace of 4.6% per year on average during the last six years. Annual grain output has been on the rise. In the fiscal year 2020–21, global food grain output reached 315.7 million metric tonnes. In a short amount of time, India became a leading exporter of agricultural goods. From 2019 to 2020, India's exports of food and related items jumped 18%, according to the Economic Survey (2022–2023). Improvements in agricultural infrastructure, technology, and policymaking have also been a priority for the Indian government.

Singh, Mahender. (2023) By utilising ploughs and wheeled carts, the Indus Valley Civilisation was able to boost the yield of several crops, including wheat, barley, rice, maize, millets, cotton, and many more. In and around big cities, horticulture attracted the vast majority of people who did not work in agriculture. Many people believe that the Harappan civilisation, which existed from 3500 to 1500 B.C., was the pinnacle of irrigation technique. Crop rotation, seed treatment and selection, planting and harvesting seasons, manuring to increase crop yields, and related knowledge seem to have been well-understood by farmers of the Vedic period, according to Vedic literature. The Jaitiriva Samhita suggests growing rice and legumes on the same plot of land throughout the summer and winter, respectively. A common theme among Tamil Nadu poets is the Cauvery's positive effect on the state's verdant landscape. Water storage, land enrichment, and people welfare were among the topics that poets counselled monarchs on throughout the sangam period. Respect for employees' inherent worth was key to their efforts.

Saini, Pankaj et al., (2022). Number of employment created and agricultural sector's contribution to GDP are the most crucial metrics for India's agricultural position. Although agriculture and related industries provide jobs for most Indians, they account for a smaller percentage of India's GDP than the services and manufacturing sectors. An attempt has been made to examine basic agricultural statistics and to determine the most critical issues confronting the Indian agricultural sector. Research Methodology—This work is a scientific literature review. We used a descriptive research strategy to identify our objectives, and we based our presentation of data and statistics on secondary sources, as well as our assessment of the



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literature, on these same sources. Results -The aspects described below have provided an explanation of the concerns, challenges, and future of the Indian agricultural industry, which is the major sector of the economy. for instance, supply chain management that is inefficient, Effects of subprime lenders, Ineffective governmental price restrictions Putting unused farmland to alternative uses, The biotech industry, global commerce, the food processing industry, agricultural losses due to feral animals, and catastrophic events The government of India should keep these things in mind when they make policies for the agriculture sector. Important caveats—The results were based on recent novel observations and a review of the related literature. The agriculture sector in Northern India will be the primary focus of the study. Horticulture and floriculture have not been the subjects of any studies.

Hinz, Roman et al., (2020) India is home to the second-largest population in the world with a vast array of flora, wildlife, land usage, socioeconomic status, and climate types. To be relevant in the future of food security, agricultural systems will have to adjust to global change agents such changing dietary habits, changing weather patterns, and increasing human populations. However, other SDGs, including protecting natural habitats and mitigating climate change, may conflict with potential shifts in food production practices in the future. Policymakers should be cognisant of the potential trade-offs between human demands and environmental consequences in order to achieve a balance between the two. This study looks at the impacts on carbon storage and terrestrial biodiversity in India up to 2030 and the ways in which land use, land cover, and agricultural output will change along those lines. According to the results, in order to meet the anticipated need for food production in the future, existing farmlands will need to be improved and new agricultural areas will need to be established.

J., Surendra. (2020) In developing nations like India, agriculture is crucial to the expansion of the economy. Acquiring labour, storing it, adding to the market for industrial goods, and earning foreign currencies are all functions of agriculture that go beyond just feeding the population. The purpose of this research was to look at how well India's agricultural sector did after the green revolution and throughout the economic reforms that followed. The primary food and non-food crops' compound yearly growth rate was calculated using a semi-log model. The shift in land use and cropping patterns was investigated using descriptive statistics. The calculation of the fertiliser usage ratio allowed for an examination of the prudent application of chemical fertilisers. While the green revolution helped alleviate the food shortage that hit the United States in the 1960s, research shows that it also exacerbated existing inequalities in resource utilisation, crop yields, and farming practices among regions. Many cash crops become scarce as a result of promotional pricing policies for certain of them.

Babar, Someshwar. (2020). Agriculture produces more food, which changes the economy and society. Gains in income, quality of life, health, and capacity to reinvest in farms would be multiplied by an increase in agricultural output. Agricultural output rises in tandem with economic expansion. While jute and mesta, coffee, and tea had the lowest average gross cultivated area and output throughout the study period, cereals, rice, wheat, pulses, and oilseeds had the highest. According to the research period, the planted area and production of pulses, potatoes, maize, gram, rice, foodgrains, and cereals all had compound growth rates that were higher than the others. Conversely, the rate of increase was lowest for cotton, bajra, jowar, and groundnut. In the time frame of the study, the average net availability of food grains per capita per day increased.



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Nayak, Akshata & Huchaiah, Lokesha (2019) There has been a remarkable change in the environment of agricultural research and development in India since the beginning of the Green Revolution. The scope, depth, and inclusivity of agricultural research has grown substantially, and it has also grown more multidisciplinary. The low productivity in India is a result of the country's pitiful investment in agricultural research. The economic analysis found that innovation in agriculture is mostly driven by research and development (R&D), which is crucial for the sustainable growth of agricultural production. The survey details the expenditure of 6,800 crore rupees by the Department of Agricultural Research and Education/Indian Council of Agricultural Research (ICAR) between 2010-11 and 2017-18. Spending has increased at a CAGR of 4.2% over the years, although in some years it has been somewhat higher. For the 2018–19 fiscal year, the ICAR has a budget of Rs 4,599 crore. This is an increase of 0.6% from the revised forecast for 2017–18. The ICAR allocation increased in 2017–18, after a jump from the actual expenditure of Rs 319 crore in 2016–17.

III. HISTORY OF INDIAN AGRICULTURE

There have been four main epochs in the development of Indian agriculture since independence. Between 1900 and 1947, food output increased at a pace of only 0.1%. The suggestions of famine commissions were the source of most of the significant institutional changes in agriculture. Indian independence was set against the backdrop of the Great Bengal Famine that occurred between 1942 and 1943.

The First Stage 1947-64

During Jawaharlal Nehru's tenure, scientific agriculture's underlying infrastructure was a top priority. It all started with the founding of agricultural universities like Pant Nagar University in 1958 and continued with the establishment of research institutes like the Central Potato Research Institute in Shimla and the Central Rice Research Institute in Cuttack. Large multi-purpose irrigation-cum-power projects were also built. Community development and national extension programs were also instituted.

Improvements in both preventative and curative medicine, together with measures to bolster public health care systems, contributed to a three percent annual increase in the population throughout this time. Food imports were necessary since the increase in food production was not enough to satisfy the rising demand from the population. In 1966, the United States' PL-480 program contributed significantly to the spike in food imports, which reached a peak of 10 million tonnes.

The Second Stage 1965-1985

Prime Ministers Morarji Desai and Charan Singh held office from 1977 to 1979, which occurs during the same time as Lal Bahadur Shastri and Indira Gandhi's leadership. Irrigation and technology transfer were two areas where the focus was on making the most of the infrastructure that was built in step-I. For instance, the introduction of semi-dwarf high-yielding wheat and rice varieties that could use water, sunlight, and nutrients more efficiently and yield twice as much as the strains included in the Intensive Agriculture District Programme (IADP) of the early 1960s was one way significant gaps in the strategies used in step-I were filled. Institutions were established during this time to guarantee farmers access to markets and fair prices for their goods, and agricultural research, education, and extension were



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restructured and strengthened. Agricultural and Rural Development Bank of India (NABARD) was established. The culmination of all these measures was the Green Revolution, which occurred in 1968 and was characterised by a dramatic increase in the yield of staple crops like wheat and rice. The essential direction and backing for public policy came from C. Subramaniam (1964–1967) and Jagjivan Ram.

A sense of assurance in our agricultural capacity was fostered by the Green Revolution. Agricultural growth finally surpassed the general economic growth rate during the Sixth Five Year Plan (1980–1985), solidifying the advantages. Food production was also increasing at a faster rate than the population. The success of the Sixth Plan shows how investment objectives and the overall plan for agricultural output may help farmers.

The Third Stage: 1985-2000

Several other prime ministers served for brief terms during this time, but Rajiv Gandhi, P.V. Narasimha Rao, and Atal Bihari Vajpayee were the most prominent. During this time, dairy, vegetables, fruits, and legumes and oilseeds were the mainstays of the food supply. The introduction of technological missions and other organisational improvements by Rajiv Gandhi led to a dramatic increase in oilseed output. Prioritising preservation, production, consumption, and trade all occur in tandem in the Mission method. A Wasteland Development Board was established, and rain-fed regions and wastelands were given more attention. Consistent and, in some cases, remarkable improvement occurred whenever a comprehensive strategy was implemented that addressed every stage of the production-consumption cycle, such as in the production of milk and eggs. At the conclusion of this era, the government had substantial grain stores, and the media focused on the fact that there were "Grain Mountains and hungry millions." During this time, the cooperative credit system began to crumble, and public investment in irrigation and other infrastructure vital to agricultural advancement began to dwindle.

The Fourth Stage: 2001 to The Present Day

Atal Bihari Vajpayee and Manmohan Singh, the prime ministers of India, have been unsuccessful thus far in enacting their policies, which has led to a lack of enthusiasm for both technology expansion and manufacturing. Nobody should be surprised that farmers, who sustain so many lives, are increasingly turning to suicide; nevertheless, 40% of farmers express a desire to leave farming altogether if given the chance.

Coincident with the agricultural downturn, the global price of key foodgrains is skyrocketing, in part because of the increased demand for grain in the manufacturing of ethanol. A big problem is emerging: land for food and fuel. The price of wheat, for export, increased from \$197/tonne in 2005 to \$263/tonne in 2007. Since 2005, when it was selling for around \$100/tonne, the price of maize has risen to \$166/tonne. The unfettered but unfair flow of international trade is another development. A worsening of these issues may occur if global warming causes unfavourable shifts in precipitation, temperature, and sea level. Extreme floods in northern India will be caused by the melting of glaciers and ice in the Himalayas. It is quite probable that we will revert to the pre-Independence era of frequent famines if agricultural output does not keep up with the rate of population increase and the public distribution system runs out of grain. We are now living in an era of dwindling food stocks, skyrocketing prices, and pervasive undernourishment; the Grain Mountains have vanished.



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IV. AGRICULTURE IN THE INDIAN ECONOMY

The Significant Wellspring of Job

Agriculture is one of the main sources of employment. Horticultural activities are important to the livelihood of more than 70% of the country's Indian population. In one way or another, people make a living through horticulture activities. Farming employs a far smaller percentage of the population in developed countries like the United States, Japan, and Germany than it does in India.

Increase in Unfamiliar Exchange

When it comes to improving foreign trade, India's agricultural sector plays a major role. India is a major trader of oil cakes, tea, organic foods, cotton, flavours, sugar, tobacco, vegetable oils, crude fleece, and blooms. A notable portion of Indian fares is contributed by the agricultural sector. Shipments have also grown in the last several years, thanks to the development of organic agricultural practices.

Creates Business Openings

A considerable portion of the provincial population in India finds gainful employment in agriculture. Development and related agro-industries provide employment for about 70% of the population in rural and regressive areas. In the same way that it helps with industrial development and extension, which leads to more business, agriculture also helps with expanding job opportunities.

More Capital Investment

Modern agricultural machinery takes a colossal financial toll on things like development, water systems, land planning, bands, harvesting, furrows, and much more. We save more of our income, and we invest more of our savings. There will be cost savings from the plant growth specialist and it will drive capital arrangement because agriculture provides practically 16% to the public income of the economy. Livestock also includes domesticated animals such as steers, oxen, sheep, goats, ponies, horses, and so on.

V. MAJOR CHALLENGES FACED BY INDIAN AGRICULTURE

Difficulties encountered by the Indian agricultural sector may be categorized into two main groups. There is a group of issues that have been around for a while. The second group of issues is more recent and has been developing as a result of the current agricultural system, changing weather patterns, and economic conditions. Here are the main obstacles:

Stagnation in Production of Major Crops

Major staple crop production, including wheat and rice, has been flat for some time. Concerned about this scenario are our agricultural experts, planners, and policymakers. There will be a massive disparity between the supply and demand caused by the ever-increasing population if this trend persists. No one in India wants things to return to how they were before the Green Revolution. Determine the state of affairs prior to the Green Revolution.



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High cost of Farm Inputs

The rates of agricultural inputs have grown substantially throughout the years. Some examples of farm inputs are HYV seeds, fertiliser, pesticides, insecticides, and the cost of farm manpower. Low and medium land holding farmers are disadvantaged by this growth.

Soil Exhaustion

A good outcome of the green revolution has been the alleviation of hunger in India. However, there have been some unintended negative outcomes as a result. One of these is soil depletion. Replanting the same crop year after year depletes soil nutrients, a phenomenon known as soil depletion. This is a common occurrence in tropical forests.

Depletion of Fresh Ground Water

The second big problem with the green revolution is that fresh ground water is getting dwindling. If you recall, the use of chemical fertilisers and irrigation was the reason the green revolution was effective in some regions. Groundwater was used excessively for irrigation in arid regions of Punjab, Haryana, and Western Uttar Pradesh. The current status of fresh groundwater in these states is somewhat concerning. These states will experience water scarcity in the near future if current agricultural practices persist.

Adverse Impact of Global Climatic Change

One of the more recent problems is global warming. Its alleged enormous effect on farming has not been confirmed. The repercussions are obvious given that 70% of the Indian population works in agriculture. Temperatures are projected to rise by 2 to 3 degrees Celsius as a result of climate change. Other expected changes include higher sea levels, more powerful cyclones, unpredictable rainfall, and more frequent and violent storms. The output of wheat and rice would be negatively impacted by these modifications. Increases in wintertime temperatures would have a particular impact on wheat harvests in northern India. The infiltration of salt water and the intensification of cyclones would have an impact on rice production in coastal regions of India.

Impact of Globalization

Globalisation has had its mark on India's agricultural industry. It has had an impact on all emerging nations. The most noticeable impact is the decline in farmer income and the danger to India's agricultural sustainability. The reason for this is the decline in product prices and the increase in input costs. The mix of less subsidies and protection for farmers is reflected in this. As a result of trade liberalisation, these farmers will face competition from industrialised nations' heavily subsidised products.

Providing Food Security

We were unable to meet our own food grain needs prior to the arrival of the green revolution in India. Pakistan was once known as West Pakistan and benefited from India's canal irrigation system, cotton belt, and wheat bowl after the 1947 split. Similarly, East Pakistan—now known as Bangladesh—was bestowed the jute belt and rice bowl. The green revolution led to a dramatic rise in grain output, which allowed India to achieve food self-sufficiency. The overall output, however, has remained basically unchanged over the



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past decade. Conversely, over this time, we have gained an additional 16–18 million people to our population. India has achieved food self-sufficiency in terms of goods, but not in terms of food security, which is based on the availability, cost, and nutritional content of food. Ensuring food security for the people of India is one of the country's most pressing problems.

Farmers Suicide

A multitude of factors contribute to every suicide. It makes reasonable to look for broad shared variables within a group when there are approximately 200,000 of them. It would appear that the suicides are concentrated in areas where agricultural commercialisation is rampant and peasant debt is quite high. Suicide seems to be a considerably more common occurrence among farmers who grew cash crops as opposed to food crops. However, nothing changed with regard to the fundamental reasons behind the crisis. The decline started with the commercialisation of the countryside and the significant decrease in investment in agriculture. Problems were made worse by the fact that bank credit was pulled during a period when input costs were skyrocketing and agricultural revenues were plummeting. Transplanting millions of people from growing food crops to cash crops posed its own set of challenges. A number of resources have been privatised, which has only made matters worse. The five largest states in India—Maharashtra, Andhra Pradesh, Karnataka, Madhya Pradesh, and Chhattisgarh—are where the destruction is most severe. Between 2003 and 2008, two-thirds of all agricultural suicides occurred in these states. A decline in economic standing, crop failure, and mounting debt are three key contributors. The lives of farmers have become increasingly tough due to factors such as a decline in social status, excessive charges by local money lenders targeting poor farmers, addiction, chronic disease within the family, and so on.

VI. CHALLENGES AND OPPORTUNITIES FOR AGRICULTURAL DEVELOPMENT IN INDIA

Challenges

Several challenges are being faced by the agricultural sector in India.

- Outdated agricultural methods, poor irrigation infrastructure, and overuse of pesticides and fertilisers have contributed to low productivity in the industry, which in turn has reduced farmers' harvests and profitability.
- Climate change has caused unpredictable weather patterns, protracted droughts, and floods, which have an effect on food production and availability, which in turn affects consumer pricing. As a result, the agriculture industry is susceptible to these impacts.
- Farmers have a hard time getting their goods to markets and investors have been hesitant to put money into the industry because of the poor infrastructure in rural regions, which includes things like bad roads, insufficient storage facilities, and limited access to loans.
- Farmers' inability to embrace new agricultural techniques and increase yields is mostly attributable to their ignorance of how to make the most of current technology and best practices.
- Small and marginal farmers in India's agriculture industry have significant challenges in competing with bigger market competitors due to restricted access to inputs and resources.



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Millions of farmers in India have seen their livelihoods impacted by these obstacles, which have slowed agricultural expansion. Organic farming and the use of high-yield variety seeds are two examples of the contemporary farming practices that the government is actively encouraging via various initiatives. A number of businesses in the private sector have also been making strides to capitalize on innovative goods and technology that can boost agricultural output. To overcome these obstacles, however, India's agricultural industry still has a ways to go. There has to be a greater financial commitment to infrastructure, R&D, and the dissemination of innovative agricultural practices. To add to that, programs and regulations should be put in place to guarantee that small and marginal farmers can participate in the market by having access to the inputs and resources they require.

Opportunities

The agriculture sector has enormous untapped potential in India, which is primarily an agrarian economy. The agriculture industry has a number of opportunities that might be used to foster growth that is both sustainable and equitable.

- There is an enormous need for food and agricultural goods in India due to the country's huge and increasing population. Boosting agricultural output and enhancing the supply chain can satisfy this need.
- India's wide diversity of agro-climatic zones allows for the cultivation of a wide array of crops, providing farmers with several options to diversify their revenue streams.
- India might become a world leader in organic farming and capitalise on the increasing demand for organic products due to the rising popularity of sustainable agriculture and organic farming.
- The expanding agro-forestry and agro-tourism industries may provide farmers with additional revenue while also encouraging sustainable land use practices provided they are properly capitalised.
- The Indian government has established many programs to boost agricultural growth, including the e-NAM (National Agriculture Market) project, the Pradhan Mantri Krishi Sinchai Yojana, and the Pradhan Mantri Fasal Bima Yojana. In order to increase their revenue and production, farmers may take advantage of these programs' chances to get insurance, irrigation facilities, and market data.

The Indian government and other interested parties may improve the country's agricultural sector by giving farmers the resources they need and opening up new chances for infrastructural development. Among these are advocating for organic farming and sustainable land use methods and providing access to capital, market data, and technology. Doing so would help India's agricultural sector thrive in a way that benefits everyone and the economy as a whole.

VII. CONCLUSION

Increasing the importance of agricultural research and development and the work of agricultural scientists might help the agricultural industry become more profit-oriented. For agriculture to be sustainable in the long run, it will need a mix of traditional practices and modern technology in areas such as land usage,



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organic and biodegradable fertiliser application, vermicomposting, land reform programs, and improved irrigation infrastructure. The agricultural sector relies on natural resources to produce vital commodities. Consequently, it is essential that it be preserved, protected, and passed on to the next generation. Both the previous and new plans show that the government wants to make agriculture and allied businesses more environmentally friendly, profitable, and climate adaptable. However, there are problems with implementation and coordination between the federal government and the states in both of these plans. There are several aspects that contribute to sustainable development in agriculture, including land, water, energy, fertiliser supply, genetic diversity, pest management, systems approach, and the location of specialised research and development.

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