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Indian Knowledge Systems (IKS) and Agricultural Development in India

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Abstract

Since independence, remarkable changes have taken place in agriculture in India where food scarcity has given way to excessive production, and new technologies and policies have been incorporated. The traditional methods of soil conservation, water harvesting and crop diversification, which are part of Indian Knowledge Systems (IKS), have been a central part of sustainable farming. This paper will discuss agricultural growth since 1947, the green revolution, the diversification into horticultural and high-value crops, and the modern innovations including precision farming, biotechnology and online platforms. It incorporates secondary data on the Reserve Bank of India (RBI), Ministry of Agriculture and Farmers Welfare (MoAFW), FAO, and peer-reviewed literature to compare the long-term trends (1950 2025). Results indicate that there has been a shift in production that requires subsistence-driven production to productivity production and now sustainability production. The paper suggests that IKS combined with modern science is the way to solve the issues of climate change, soil degradation, and rural inequality, as well as to guarantee food security and inclusive growth.

Keywords: *Indian Knowledge Systems, Agricultural Development, Green Revolution, Sustainability, Rural Economy.*

Introduction

The Indian economy has traditionally been agriculture-based. When the country gained independence the sector contributed almost 55 percent of the Gross Domestic Product (GDP) and the sector employed most of the labor force (Kannan, 2011). The structural change to industry and services has resulted in agriculture contributing approximately 16 percent share in GDP by 2024 (MoAFW, 2023).

Table 2: Agriculture Share in India's GDP

Sr. No.	Year	Share of GDP (%)
1	1950	55
2	2023	16.2

Source: Ministry of agriculture and farmers welfare. (2023). Agricultural Statistics at a Glance 2023. Government of India

However, it has continued to be the livelihood of over fifty percent of Indian labor force and the key to food security, poverty reduction, and sustainability of the rural areas (World Bank, 2023). The Indian economy has traditionally been dependent on agriculture. The industry had been contributing approximately 55 percent of the Gross Domestic Product (GDP) during the independence period and it has also been supplying the majority of the working group (Kannan, 2011). In 2024, the agricultural sector added an approximate of 16 percent to GDP, an industrial and service structural adjustment (Ministry of Agriculture and Farmers Welfare [MoAFW], 2023). However, it has continued to be the livelihood of over fifty percent of Indian labor force and the key to food security, poverty reduction, and sustainability of the rural areas (World Bank, 2023).

The first years of post independence era witnessed extreme food crisis, low production and over dependence on imports of grains such as U.S. Public Law 480 (PL-480) program. This dependency was reversed with the Green Revolution of the late 1960s that introduced with it high-yielding varieties (HYVs) of both wheat and rice, alongside greater irrigation, fertilisers, pesticides, and institutional credit (Gord, 2023). Such efforts resulted in India becoming a food surplus country by 1980s.

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The beneficial effect of the Green Revolution was, however, localized and concentrated on crops Punjab, Haryana and western Uttar Pradesh reaped the actual benefits in the process but eastern and rainfed areas were subsequently left out (Kannan, 2011).

Parallel to these scientific inventions, there have been influences by the Indian Knowledge System (IKS) in the agricultural experience since the beginning of time. Hundreds of years of practice provided the strength and harmony with the environment by traditional rainfall collection, tank irrigation, mixed farming, organic fertilized soil, and soil preservation (Malik, 2024). These olden traditions were incorporated in the local agro- climatic environments that were capable of sustaining soil fertility and biodiversity as well as reducing exposure to climate changes. The revival of millets, indigenous seeds, organic agriculture in the last decades is a pointer of the revival of the significance of IKS to complement contemporary science (FAO, 2024).

The contemporary agricultural landscape however reflects new challenges to the agricultural landscape. The problem of climate change has led to the appearance of unpredictable precipitation, frequent droughts and floods that directly affect the income and productivity of farmers (IMF, 2024). Other and more self-evident threats to long-term sustainability are threats towards soil degradation, groundwater, and the loss of biodiversity (MoAFW, 2023). The socio-economic challenges arise to compound these vulnerabilities, such as an indebted state of the rural populace, low income in agriculture, and widespread inequality of smallholders (Suparna, 2023).

Such issues have highlighted the necessity to combine the ancient Indian knowledge with science. Modern technology, i.e. biotechnology, high-tech farming, artificial intelligence, and digital space can improve the efficiency and productivity. However, they can do no better than promote their long-term impact as long as they are exposed to indigenous practices that are geared towards sustainability, inclusiveness, and ecological balance. The hybridization of IKS and modern agricultural science, thus, uses one prospective route in achieving its goal of increasing productivity, preserving natural resources, and facilitating the development of Indian agriculture in a justifiable way.

Objectives of the Study

1. To trace the development of agriculture in India since independence, particularly on structural steps and breaking points.
2. To establish the contribution of the Indian Knowledge Systems (IKS) in establishing sustainable agriculture.
3. To analyze the latest farming trends, such as crop diversification, digital technologies, and agriculture resistant to climate changes, and the socio-economic outcomes of new trends.
4. To identify gaps and limitations in the process of integrating IKS in modern science with the aim of having sustainable agricultural development.
5. To provide evidence based policy suggestions on how to improve agricultural resilience and livelihood of the farmers.

Research Design / Methodology

This research design would be descriptive-analytical research design which will involve historical review, secondary data analysis and thematic synthesis. The methodology includes:

- **Data Sources:**
  - Domestic: Statistical Reports of the reserve bank of India (RBI), agricultural statistics at a glance (moafw), Niti aayog reports, census of India, NSSO surveys.
  - International: Food and Agriculture Organization (FAO), World Bank, international monetary fund (IMF), Asian Development Bank (ADB).
  - Academic Literature: Articles and working papers in the area of IKS, Green Revolution, and sustainability transitions.
- **Analytical Framework:**

1. Periodization of Agriculture: Agricultural sector is surveyed under four broad periods, which involve: (i) pre-independence food crisis, (ii) post-independence Green Revolution, (iii) economic liberalization and diversification, and (iv) contemporary digital-sustainability era.
2. Literature Thematic Coding The thematic codes were codes produced by thematic coding Literature coding: IKS, productivity growth, diversification, sustainability, and inclusion.
3. Trend Analysis: The data was taken in the form of secondary data on production, productivity, trade and tabulated and plotted to give the long term trends.

Limitations:

This is the weakness of the study because the secondary data applied is prone to reporting delays or aggregation bias. It does not have primary surveys and econometric modelling and leaves possibilities of empirical validation in future.

Discussion

1. Since Independence. Farming development.
2. Indian agricultural sector changed into perpetual food scarcity in 50s to surplus production in 80s. Foodgrain production has risen to more than 330 million tonnes in 202223 (50 million tonnes in 195051) (MoAFW, 2023).

Table 1: Growth of Foodgrain Production in India (1950–2023)

Sr. No.	Year	Foodgrain Production (Million Tonnes)
1	1950–51	50.8
2	1969–70	108.4
3	1980–81	129.6
4	2000–01	196.8
5	2010–11	244.5
6	2022–23	330.5

Source: Ministry of Agriculture and farmers Welfare. (2023). Agricultural Statistics at a Glance 2023. Government of India

The agricultural sector of India went through the oil period of constant food shortages in the 1950s and reached its surplus production level in the 1980s. The production of foodgrains increased to an excess of 330 million tonnes in 202223 against 50 million tonnes in 195051 (MoAFW, 2023). This transformation was led by the Green Revolution of the late 1960s especially in the increased productivity of wheat and rice. This growth was however unequal bypassing rain-fed areas and non-cereal crops (Kannan, 2011).

Indian Knowledge Systems (IKS) Role

The IKS include prehistoric traditions like tank irrigation, rainwater harvesting, mixed and intercropping, composting, and traditional pest control (Malik, 2024). These measures guaranteed the resilience of ecology and community. Over the last few years, the desire to revive millets, native seed banks, organic farming, and the use of organic systems has revived its attention in terms of sustainable farming models (FAO, 2024).

Diversification and Structural Shifts

Since the 1990s, the agricultural sector has stopped being predominantly agricultural, with the horticulture, dairy, and fisheries industries becoming more than a half of agricultural GDP (Suporna, 2023).

Table 5: Agricultural Output (202223).

Sr. No.	Sector	Share in Agri GDP (%)
1	Foodgrains	50
2	Horticulture	30
3	Livestock & Others	20

Source: Ministry of Agriculture and farmers welfare. (2023). Agricultural statistics at a glance 2023. Government of India.

Since the 1990s, Indian agriculture has been diversified to include horticulture, floriculture, dairy, fisheries and livestock, currently over half of the agricultural GDP (Suparna, 2023). Export create crops such as spices, fruits, and cotton have increased significantly with agri-exports amounting to $53 billion in FY2023 (World Bank, 2023).

Digital Agriculture and New Technologies

1. In the recent decades, biotechnology (e.g., Bt cotton) technology, precision farming, drones, artificial intelligence, and e-NAM platforms have been adopted (Gord, 2023). These technologies boost productivity and open the farmers to the national markets though they also cast doubts over the affordability and accessibility by smallholders.
2. Contemporary Challenges
3. In spite of a spectacular improvement, the industry has serious problems:
4. Climate change: Unpredictable monsoons, floods, and heat stress.
5. Deterioration of resources: loss of soil fertility and depletion of groundwater.
6. Inequality: the marginal farmers were not always beneficiaries of modern inputs.
7. Markets: volatility in the market in the case of perishable commodities.
8. These issues highlight the value of integrating new technology with established practices in order to be resilient and inclusive.

Findings

1. Since independence, agricultural expansion has been characterized by periods of scarcity, a boom of productivity, diversification followed by ecological stress that limits present agricultural expansion.
2. The solutions that are offered by the IKS practices are low-cost, eco-friendly and locally adapted, and these solutions are still relevant to climate resilience.
3. Horticultural and dairy diversification and export earnings redefined the rural incomes.
4. New technologies increase efficiency at the cost of increasing the divide between large and small farmers.
5. A change towards inclusive and sustainable agricultural practice is emphasized in the policy frameworks (PM-KISAN, RKVY, e-NAM, Year of Millets 2023).
6. Exports developed into importance, but unstable.

Sr. No.	Year	Export Value (USD Billion)
1	2022–23	52.5
2	2023–24	48.5
3	2024–25 (Apr–Dec)	36.95

Source: 1. Government of India., Ministry of Commerce and Industry. (2024). 202324 Annual agricultural export statistics [Press release]. Department of Commerce. Accessed on 16 September 2018, at https://www.ibef.org/exports/ agriculture-and-food-industry-india

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Conclusion and Suggestions

Conclusion

The agricultural development in India since independence can be described as an exemplary process of a country that relied on imports and grew to be food sufficient and exportable. The productivity was stimulated by the modern science, whereas the IKS traditions offered sustainability and environmental resistance. Combining these two systems is the key to the future of Indian agriculture to solve the climate challenges, degradation of resources, and inequality.

Suggestions

- Policy: Increase support to organic and millet-based agriculture, promote water conservation, and incorporate IKS into the programs of extension.
- Technology:Enhance accessibility of AI, drones, and digital platforms to smallholders at a low cost.

Institutions: Enhance the access of farmers-producer organizations (FPOs) to the market.

- Research: Fund interdisciplinary research on IKS-biotechnology and climate science.
- Capacity Building: Increase farmer literacy on digital and sustainable.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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