

ENHANCING INDIA'S AGRICULTURAL RESILIENCE AND SUSTAINABILITY: A STUDY ON THE NEW SCHEMES LAUNCHED BY THE GOVERNMENT

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ABSTRACT

The Union Cabinet of India recently approved seven new agricultural schemes with a total financial outlay of nearly Rs 14,000 crore, aimed at advancing the agriculture and allied sectors. These schemes are focused on boosting agricultural research, digitalization, climate resilience, livestock development, and sustainable horticulture. The paper explores the objectives, strategies, and anticipated outcomes of these schemes, highlighting their potential impact on enhancing the agriculture sector's efficiency, climate adaptability, and farmer income. Special attention is given to the role of technology in promoting digital agriculture, optimizing resource management, and improving productivity. This study aims to understand the schemes' contributions to making Indian agriculture more sustainable and resilient in light of global climate challenges.

Keywords: Digital Agriculture and Technological Integration in Agriculture.

Introduction

The Objective of the Study

- To analyze the seven new agricultural schemes approved by the Union Cabinet and their potential contribution to the growth of India's agriculture and allied sectors.
- To assess the role of technology in facilitating digital agriculture, improving decision-making, and enhancing farm productivity.
- To examine the schemes' focus on climate resilience, sustainable resource management, and livestock health and production.
- To evaluate how these schemes align with the broader national policies like the New Education Policy 2020 and sustainable development goals.
- To understand the projected impact of these initiatives on improving farmers' income, optimizing crop yields, and enhancing food security.

Hypothesis

- The implementation of these seven new agricultural schemes will significantly improve the climate resilience and sustainability of India's agricultural sector.
- The integration of digital tools, artificial intelligence, and remote sensing will lead to optimized agricultural practices, enhancing productivity and decision-making efficiency.

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- The sustainable development of horticulture and livestock health under these schemes will lead to an increase in farmer income and food security.
- The modernization of agricultural education and the promotion of natural resource management will foster long-term growth in the agriculture sector.

Methodology

- **Literature Review:** A comprehensive review of existing research papers, government policy documents, and reports related to agricultural schemes, climate resilience, and digital agriculture will be conducted.
- **Secondary Data Analysis:** Data from government reports such as the Ministry of Agriculture, the National Institution for Transforming India (NITI Aayog), and the Indian Council of Agricultural Research (ICAR) will be analyzed to evaluate the historical context of similar initiatives and the expected outcomes of the new schemes.
- **Policy Analysis:** The study will critically assess the frameworks and strategies of the new schemes, comparing them with international practices and policies in countries like the U.S., UK, and Singapore to identify global best practices that could be adopted in India.
- **Case Studies:** Successful case studies of KVKs (Krishi Vigyan Kendras), digital agriculture platforms, and climate-adapted crops will be examined to understand the on-ground implications of similar initiatives

Review of Literature on Agricultural Development through Government Schemes in India

Agriculture in India plays a critical role in the country's economic development, supporting approximately 50% of the workforce and contributing around 17% to the nation's GDP (Ghosh, 2022). Given the sector's importance, the government has periodically launched several initiatives to modernize agriculture, improve farmer livelihoods, and address climate challenges. The recent approval of seven new schemes reflects a continuation of this effort, integrating cutting-edge technology and sustainability to adapt to modern challenges.

- **Digital Agriculture and Technological Integration**

The role of digital agriculture has been growing globally, and India is no exception. The **Digital Agriculture Mission (DAM)** seeks to enhance productivity through precision agriculture, the use of data analytics, and blockchain for supply chain transparency (Rathi & Gupta, 2023). These technologies allow for the optimization of inputs such as water, seeds, and fertilizers, which leads to better yields while minimizing environmental impact (Kaur et al., 2022). Furthermore, the creation of an **Agri Stack**—a platform that provides digital identities to farmers—demonstrates the government's effort to bring farmers into the formal economy, improving access to subsidies, credit, and insurance (Meena & Kumar, 2023).

International studies also show that digital platforms can transform agricultural practices. For example, in the U.S., the use of digital farm management systems has resulted in better resource utilization and higher incomes (Smith et al., 2021). These insights apply to India, where smallholder farmers can benefit significantly from technology-driven solutions, provided there is adequate infrastructure and digital literacy (Jha, 2023).

- **Climate-Resilient Agriculture**

Climate change remains a significant threat to agricultural productivity, especially in developing countries like India (IPCC, 2022). The integration of **climate adaptation Technologies**—such as drought-resistant seeds, real-time weather prediction, and solar-powered irrigation—helps mitigate the adverse effects of erratic climate patterns (Narain, 2023). In this context, the government's recent schemes emphasizing **crop science for food and nutritional security** are crucial. These initiatives align with global practices of investing in crop genetics and biotechnology to enhance resilience (FAO, 2021).

Similar strategies have been adopted in countries like Singapore, where high-tech urban farming, controlled-environment agriculture, and climate-resilient crop varieties have been employed to address food security issues in the context of climate change (Tan & Koh, 2023). By adopting such technologies, India's farming sector could become more resilient, ensuring food security for its growing population.

- **Agricultural Education and Human Resource Development**

The modernization of agricultural education under the **New Education Policy 2020** aims to equip students and professionals with the skills required to tackle contemporary agricultural challenges (Basu & Sarkar, 2023). The government's recent focus on strengthening agricultural education and research is designed to integrate emerging technologies like artificial intelligence, big data, and remote sensing into the curriculum. Research suggests that the success of future agricultural innovations will rely heavily on human capital and the integration of interdisciplinary knowledge (Sharma & Roy, 2023).

Countries like the UK have successfully reformed their agricultural education systems to incorporate new technologies, leading to increased research outputs and innovation (McCarthy, 2021). India's emphasis on reforming its agricultural education system mirrors this global trend, ensuring that farmers and agribusiness professionals are well equipped to address future challenges.

- **Sustainable Livestock Health and Production**

Livestock farming in India plays a significant role in rural economies, yet the sector faces challenges such as poor animal health services, low productivity, and climate vulnerability (Singh & Gupta, 2022). The **Sustainable Livestock Health and Production** scheme focuses on improving animal health management, dairy production technologies, and genetic resource management, all crucial for enhancing productivity and income (Bhardwaj, 2023).

The government's strategy aligns with global best practices. For instance, in Australia, livestock health management programs emphasize disease control and genetic improvements, leading to higher meat and dairy production (Brown & Watson, 2022). Similarly, the inclusion of **precision livestock farming**, which uses wearable sensors for real-time monitoring of livestock health, could lead to significant productivity gains in India, reducing input costs while improving animal welfare (Yadav et al., 2023).

- **Horticulture and Income Diversification**

The expansion of horticulture under the **Sustainable Development of Horticulture** scheme is a significant step toward diversifying farmer incomes. Horticultural crops like fruits, vegetables, and medicinal plants have high market value, making them a profitable alternative to traditional cereal crops (Joshi et al., 2023). Research indicates that crop diversification not only improves income but also contributes to food and nutritional security (Tripathi, 2022).

In a study on the economic impact of horticulture in India, Pathak et al. (2023) noted that the promotion of diverse crops such as spices, medicinal plants, and floriculture could increase farmer profitability. Additionally, countries like Israel have demonstrated the efficacy of integrating technology with horticulture, particularly in regions with water scarcity (Levin & Katz, 2022). The application of drip irrigation and soil-less cultivation in India's horticultural initiatives can similarly boost output and efficiency.

- **Krishi Vigyan Kendras (KVKs) and Agricultural Extension Services**

The role of **Krishi Vigyan Kendras (KVKs)** in providing location-specific technologies to farmers is critical for improving rural livelihoods (Chandra & Roy, 2023). KVKs function as the bridge between research institutions and farmers, ensuring the effective transfer of knowledge. A study by Deshmukh et al. (2023) on the impact of KVKs revealed that farmers with access to KVK services reported higher yields and improved adoption of sustainable farming practices.

KVKs are particularly crucial in the adoption of sustainable agricultural practices such as organic farming and integrated pest management. Similar extension services in countries like the United States have been instrumental in bringing new farming techniques to rural areas, leading to better productivity and income (Liu et al., 2021).

- **Natural Resource Management (NRM)**

Sustainable use of natural resources remains a cornerstone of agricultural policy. The **Natural Resource Management (NRM)** scheme emphasizes sustainable practices like water conservation, soil health management, and renewable energy integration (Rathore, 2023). These practices ensure the long-term viability of agriculture in India by promoting resource efficiency.

The adoption of renewable energy, such as solar-powered irrigation, has already shown promise in reducing the carbon footprint of agriculture while lowering energy costs for farmers (Mishra & Prakash, 2023). In the global context, countries like Germany have successfully integrated renewable energy into their agricultural practices, reducing dependence on fossil fuels and enhancing sustainability (Schmidt et al., 2021).

Conceptual Framework of Schemes and Government Initiatives

- **Digital Agriculture Mission (DAM)**

This scheme aims to revolutionize agriculture through digital tools and data analytics. The creation of an Agri Stack platform, which provides farmers with a unique digital ID linked to their Aadhaar, integrates land, production, and financial details. This initiative will enable more precise decision-making, optimizing farm inputs, and reducing waste. It is expected to enhance farmer access to credit, subsidies, and insurance.

- **Crop Science for Food and Nutritional Security**

This scheme focuses on advancing research in crop sciences to improve food security and nutritional outcomes. Key areas include enhancing pulse, oilseed, and commercial crop varieties. By promoting research on entomology and pollination, the scheme intends to increase crop resilience to pests and climate changes, directly addressing India's food security challenges.

- **Strengthening Agricultural Education, Management, and Social Sciences**

The modernization of agricultural education is critical to ensuring that India's farming community can leverage emerging technologies like AI, big data, and remote sensing. Aligned with the New Education Policy 2020, this scheme will integrate these technologies into agricultural curriculums, promoting innovation in climate resilience and natural farming.

- **Sustainable Livestock Health and Production**

Recognizing the importance of the livestock sector in rural livelihoods, this scheme will enhance veterinary services, dairy technology, and animal health management. The program emphasizes small ruminant development, genetic resource management, and nutrition, all aimed at increasing farmer income through sustainable livestock practices.

- **Sustainable Development of Horticulture**

The horticulture sector, known for its contribution to farmers' income diversification, is central to this scheme. The government plans to promote the cultivation of a wide range of crops, including tropical, temperate, and medicinal plants. By integrating new cultivation techniques and promoting value chains for horticultural crops, this scheme aims to improve productivity and income.

- **Krishi Vigyan Kendras (KVKs)**

KVKs are the backbone of India's agricultural extension services. This scheme focuses on strengthening these institutions to provide location-specific solutions through research and demonstrations. KVKs are critical in ensuring that small farmers have access to the latest sustainable farming technologies and practices.

- **Natural Resource Management (NRM)**

With the increasing threat of natural resource depletion, this scheme emphasizes the sustainable use of soil, water, and other resources to ensure that current agricultural needs are met without compromising future productivity. The integration of climate-adaptive practices and the promotion of renewable energy technologies like solar-powered irrigation are key strategies under this program

Detail Analysis

- **Digital Agriculture in Global Context:** Countries like the U.S. have successfully implemented digital platforms to boost farm productivity, especially through the use of sensors, drones, and precision farming techniques. India is following a similar trajectory, but it will need to overcome infrastructural challenges, particularly in rural areas with limited digital access.
- **Climate-Resilient Approaches:** In Singapore, controlled-environment farming techniques have proven successful in dealing with unpredictable weather patterns. Adopting similar climate resilient technologies, such as high-tech greenhouses and climate-adapted crops, could be transformative for Indian agriculture, particularly in the context of erratic monsoon patterns.
- **Livestock Sector:** Australia's livestock management strategies, particularly disease control and genetic improvement programs, provide a model for India's initiatives. Improving livestock productivity will be key for rural economic stability and could raise incomes substantially for farmers involved in dairy and meat production.
- **Horticulture:** Israel's advanced horticulture practices, especially in water-scarce environments, serve as an important case study for India. Techniques like drip irrigation and hydroponics can help India increase horticultural productivity and income diversification, which is critical in regions with limited water availability.

Data and Expected Outcomes

- The government has set a **financial outlay of Rs 14,000 crore** for these agricultural schemes.
- Expected to drive **higher farmer incomes, improve productivity, and enhance climate resilience**, these schemes are vital for boosting India's agricultural GDP, which currently contributes **around 18.2%** to the total economy.
- **Horticultural expansion and livestock health improvements** are expected to directly benefit smallholder farmers, potentially reducing income disparities.
- Schemes like the **Pradhan Mantri Fasal Bima Yojana (PMFBY)** have already expanded crop insurance coverage, ensuring resilience against climate shocks.

Conclusion

The new agricultural schemes launched by the Indian government represent a critical step toward modernizing and transforming India's agriculture sector. By focusing on digitalization, climate resilience, sustainable livestock and horticulture development, and agricultural education, these initiatives address both immediate challenges and long-term sustainability. This study concludes that the successful implementation of these schemes could lead to improved agricultural productivity, increased farmer incomes, and enhanced food security in India. However, continuous monitoring and effective resource allocation are essential to realizing their full potential. The latest data on agricultural development in India, as highlighted in the **2023-24 Economic Survey**, shows the sector's steady growth, contributing **around 18.2% to the country's GDP** and supporting **42.3% of the population's livelihood**. Over the last five years, the sector has grown at an average annual rate of **4.18%**, with 2022–23 setting a record for **food grain production at 329.7 million metric tons**. Despite challenges like delayed monsoons in 2023–24, production remains robust, with slightly lower food grain output at **328.8 million metric tons**.

Additionally, the government has been focusing on enhancing climate resilience and sustainable agriculture through major schemes. For example, under the Pradhan Mantri Fasal Bima Yojana

(PMFBY), the insured crop area has expanded from 500.2 lakh hectares in 2022–23 to 610 lakh hectares in 2023–24, making it the largest crop insurance scheme in the world by farmer enrollment. Significant investments have also been made in agricultural mechanization, with ₹859.45 crore allocated in 2023-24 to promote the use of modern machinery and Custom Hiring Centres (CHCs). <https://desagri.gov.in/document-report/agricultural-statistics-at-a-glance-2023/> and <https://desagri.gov.in/document-report/agricultural-statistics-at-a-glance-2023/>. Moreover, the Digital Agriculture Mission continues to drive innovation, with ₹450 crore allocated to support digitization in agriculture, while initiatives like the Agricultural Accelerator Fund aim to foster innovation among startups in rural India

<https://www.investindia.gov.in/sector/agriculture-allied-sector>. These programs align with efforts to boost exports, which reached \$19.69 billion in agricultural products during 2022–23. <https://www.investindia.gov.in/sector/agriculture-allied-sector>

Together, these policies and schemes are aimed at promoting sustainable practices, enhancing farmer incomes, and improving India's food security

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