

Agricultural Insurance in India: Strengthening Farmers' Resilience Against Climate Risk

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INTRODUCTION

Agriculture is the lifeline of the Indian economy, providing food, employment, and livelihoods to millions of people while serving as the foundation of rural development. Despite remarkable advancements in agricultural technologies and production systems, farming remains one of the most risk-prone economic activities due to its heavy dependence on weather and natural resources. Increasing occurrences of droughts, floods, cyclones, hailstorms, pest infestations, diseases, and climate change-induced extreme weather events have significantly heightened the vulnerability of Indian farmers. For small and marginal farmers, who constitute the majority of the farming community, a single crop failure can lead to severe financial distress, indebtedness, and loss of livelihood. In this context, agricultural insurance has emerged as a vital risk management tool that protects farmers against unforeseen losses and promotes income stability. Beyond providing financial compensation, it encourages investment in modern technologies, facilitates institutional credit, and enhances resilience against climatic uncertainties. Over the years, the Government of India has introduced several farmer-centric initiatives, including the **Pradhan Mantri Fasal Bima Yojana (PMFBY)**, **Restructured Weather Based Crop Insurance Scheme (RWBCIS)**, livestock insurance, and aquaculture insurance, supported by digital innovations such as artificial intelligence, satellite imagery, drones, and remote sensing. This article explores the importance, types, government initiatives, technological advancements, challenges, and future prospects of agricultural insurance in building a resilient, sustainable, and climate-smart agricultural sector in India.

Agriculture: The Backbone of India's Economy

Agriculture is the backbone of the Indian economy, supporting food security, employment, and rural development. Despite rapid industrialization, the sector continues to contribute around **16–18% of India's Gross Domestic Product (GDP)** and provides livelihoods to nearly **46% of the workforce**. India is among the world's leading producers of cereals, pulses, fruits, vegetables, milk, spices, and several commercial crops, reflecting its rich agro-climatic diversity. Agriculture also supplies essential raw materials to agro-based industries and significantly contributes to export earnings, making it a key driver of inclusive economic growth.

However, Indian agriculture faces increasing challenges due to climate change, erratic rainfall, droughts, floods, pest outbreaks, rising input costs, and market uncertainties. Since nearly **86% of Indian farmers are small and marginal landholders**, these risks directly threaten their livelihoods and income security. Building a resilient agricultural sector through climate-smart technologies, improved infrastructure, institutional support, and comprehensive agricultural insurance is therefore essential. Such measures will not only protect farmers against unforeseen losses but also strengthen sustainable agriculture and contribute to the vision of **Viksit Bharat 2047**.

Need of Agricultural Insurance for Indian Farmers

Indian agriculture has become increasingly vulnerable to a wide range of risks, making agricultural insurance more important than ever before. Unpredictable weather events

such as droughts, floods, cyclones, hailstorms, heat waves, and unseasonal rainfall frequently damage standing crops, while pest infestations and disease outbreaks further reduce productivity. These challenges are intensified by climate change, rising input costs, fluctuating market prices, and limited financial resources, particularly for small and marginal farmers. A single adverse event can result in substantial income loss, indebtedness, and financial distress for farming households.

Agricultural insurance acts as a crucial financial safety net by compensating farmers for losses caused by natural calamities and other insured risks. It helps stabilize farm income, reduces dependence on informal credit, encourages investment in modern technologies, and enhances access to institutional finance. By minimizing production risks and improving farmers' confidence, agricultural insurance not only safeguards livelihoods but also strengthens food security, promotes sustainable agricultural development, and builds resilience against future climate uncertainties.

Understanding Agricultural Insurance

According to the Food and Agriculture Organization (FAO), **agricultural insurance is a financial instrument that transfers agricultural production risks from farmers to insurers in exchange for a premium, thereby safeguarding farm income and enhancing resilience against climatic and biological risks**. In simple terms, agricultural insurance serves as a financial safety net that enables farmers to recover from unforeseen losses, sustain agricultural production, and promote long-term agricultural and rural development. By providing financial

compensation for crop, livestock, aquaculture, or farm asset losses, it helps farmers recover quickly, maintain their livelihoods, and continue agricultural activities without severe economic hardship. In recent years, agricultural insurance in India has evolved from a simple compensation scheme into a comprehensive risk management system supported by digital technologies, satellite imagery, weather-based indices, artificial intelligence, and remote sensing. Government initiatives such as the **Pradhan Mantri Fasal Bima Yojana (PMFBY)** and the **Restructured Weather Based Crop Insurance Scheme (RWBCIS)** have expanded insurance coverage, improved claim settlement mechanisms, and strengthened farmers' resilience against climate-related risks. Agricultural insurance is therefore not only a financial safeguard but also a vital instrument for promoting sustainable agriculture, rural prosperity, and long-term food security.

Types of Agricultural Insurance

Agricultural insurance encompasses a range of insurance products designed to protect farmers against diverse production and financial risks. Depending on the nature of agricultural activities and the assets being protected, it is broadly classified into four major categories.

1. Crop Insurance: Crop insurance provides financial protection against yield losses caused by natural calamities, adverse weather conditions, pest infestations, and diseases. It safeguards farmers throughout the crop production cycle—from sowing to post-harvest—and helps stabilize farm income following crop failure.

2. Livestock Insurance: Livestock insurance covers the loss of economically important animals such as cattle, buffaloes, sheep, goats, pigs, horses, and poultry due to accidents, diseases, natural disasters, or death. It protects farmers from financial losses and supports sustainable livestock production.

3. Aquaculture Insurance: Aquaculture insurance protects fish, shrimp, and other aquatic farming enterprises against losses resulting from disease outbreaks, water quality deterioration, natural calamities, and environmental hazards. It promotes investment and risk management in the rapidly expanding fisheries sector.

4. Package Insurance: Package insurance offers comprehensive protection by combining multiple insurance covers under a single policy. It typically includes crop, livestock, farm assets, personal accident, and life insurance, providing holistic risk coverage for farming households and enhancing overall agricultural resilience.

PMFBY: Transforming Crop Risk Management

The **Pradhan Mantri Fasal Bima Yojana (PMFBY)**, launched by the Government of India on **18 February 2016**, has revolutionized crop risk management by providing comprehensive and affordable insurance coverage to farmers. Replacing earlier schemes such as the **National Agricultural Insurance Scheme (NAIS)** and the **Modified National Agricultural Insurance Scheme (MNAIS)**, PMFBY aims to minimize farmers' financial losses arising from natural calamities, adverse weather conditions, pests, and diseases. The scheme covers food crops, oilseeds, commercial crops, and horticultural crops

throughout the crop production cycle, from sowing to post-harvest stages.

One of the key strengths of PMFBY is its farmer-friendly premium structure. Farmers pay only **2% of the sum insured for Kharif crops, 1.5% for Rabi crops, and 5% for commercial and horticultural crops**, while the remaining premium is jointly subsidized by the Central and State Governments. The scheme provides protection against prevented sowing, mid-season adversity, localized calamities, and post-harvest losses, ensuring comprehensive risk coverage. It also integrates advanced technologies such as satellite imagery, drones, artificial intelligence (AI), remote sensing, GPS-based crop monitoring, the **National Crop Insurance Portal (NCIP), WINDS, CROPIC**, and mobile applications to improve enrolment, crop loss assessment, transparency, and timely claim settlement. These digital innovations have significantly enhanced the efficiency and credibility of agricultural insurance, making PMFBY one of the world's largest crop insurance programmes and a cornerstone of India's climate-resilient agricultural strategy.

Benefits of Agricultural Insurance to Farmers

- **Provides financial protection** against crop losses caused by droughts, floods, cyclones, hailstorms, pests, diseases, and other natural calamities.
- **Stabilizes farm income** by compensating farmers for production losses and reducing income uncertainty.
- **Reduces indebtedness** by minimizing dependence on informal loans after crop failure.

- **Encourages adoption of modern technologies** such as improved seeds, mechanization, precision farming, and climate-smart agricultural practices.
- **Enhances access to institutional credit**, as insured farmers are considered less risky by banks and financial institutions.
- **Supports timely recovery** after disasters, enabling farmers to resume cultivation without prolonged financial distress.
- **Protects investments** made on seeds, fertilizers, pesticides, irrigation, labour, and other farm inputs.
- **Improves farmers' confidence** to undertake commercial and high-value crop cultivation.
- **Promotes livelihood security** for small and marginal farmers by reducing production risks.
- **Strengthens rural economic stability** through sustained agricultural production and employment.
- **Contributes to national food security** by ensuring continuity of agricultural production despite adverse events.
- **Builds climate resilience** by helping farmers adapt to increasing climate variability and extreme weather events.

Technology Revolution in Agricultural Insurance

The integration of digital technologies has transformed agricultural insurance in India by improving transparency, accuracy, and the speed of claim settlement. Advanced tools such as artificial intelligence (AI), satellite imagery, drones, remote sensing, weather analytics, and digital platforms have significantly enhanced crop monitoring, damage assessment, farmer enrolment, and insurance administration.

These innovations have reduced manual interventions, minimized errors, and enabled faster delivery of insurance benefits to farmers.

Key technological initiatives include:

- **National Crop Insurance Portal (NCIP):** A unified digital platform for farmer enrolment, premium payment, policy management, claim processing, and monitoring of crop insurance schemes.
- **Artificial Intelligence (AI):** AI-powered analytics help predict crop losses, assess production risks, detect anomalies, and improve decision-making for insurers and policymakers.
- **Drone Technology:** Drones capture high-resolution images of crop fields for rapid and accurate assessment of crop damage, reducing dependence on manual field inspections.
- **Satellite Imagery and Remote Sensing:** Satellite data enables continuous monitoring of crop growth, vegetation health, acreage estimation, and disaster impact over large geographical areas.
- **CROPIC (Collection of Real-Time Observations & Photo of Crops):** A mobile-based application that records geo-tagged photographs of crop conditions throughout different growth stages, facilitating transparent and evidence-based claim assessments.
- **WINDS (Weather Information and Network Data Systems):** A nationwide weather data network that provides hyper-local weather information for accurate weather-based insurance, risk assessment, and timely claim settlement.
- **Mobile Applications:** Digital apps enable farmers to register for insurance

schemes, report crop losses with geo-tagged photographs, track claim status, and receive updates directly on their mobile phones.

The adoption of these technologies has strengthened the efficiency, credibility, and transparency of agricultural insurance, making claim settlement faster, reducing disputes, and supporting the development of a resilient and climate-smart agricultural sector in India.

Challenges in Adoption of Agricultural Insurance

Despite significant progress in agricultural insurance, several challenges continue to limit its effectiveness and widespread adoption:

- **Low awareness and financial literacy** among farmers regarding insurance schemes and their benefits.
- **Delay in claim settlement**, reducing farmers' confidence in insurance programmes.
- **Complex enrolment and documentation procedures**, particularly for small and marginal farmers.
- **Inadequate understanding of claim procedures** and reporting requirements.
- **Limited insurance coverage**, with many eligible farmers remaining uninsured.
- **Dependence on manual crop loss assessment** in some regions, leading to delays and inaccuracies.
- **High basis risk** in weather and area-yield index insurance, where actual farm losses may differ from assessed losses.
- **Poor digital infrastructure and connectivity** in remote rural areas,

limiting access to online insurance services.

- **Slow adoption of advanced technologies** for crop monitoring and damage assessment in certain states.
- **Withdrawal of insurance companies** from some regions due to high claim ratios and operational challenges.
- **Insufficient coordination** among farmers, banks, insurance companies, and government agencies.
- **Climate change and increasing frequency of extreme weather events**, making risk assessment and premium pricing more challenging.

Future Outlook of Agricultural Insurance in India

The future of agricultural insurance in India lies in building a **technology-driven, farmer-centric, and climate-resilient risk management system**. With increasing climate variability and extreme weather events, insurance will play a crucial role in ensuring income security and promoting sustainable agricultural development. The integration of advanced digital technologies, policy reforms, and greater farmer participation will further strengthen the effectiveness and outreach of agricultural insurance programmes.

Key future directions include:

- **Expansion of insurance coverage** to include more farmers, crops, livestock, fisheries, and allied agricultural activities.
- **Greater adoption of Artificial Intelligence (AI), Machine Learning (ML), drones, satellite imagery, and remote sensing** for accurate crop monitoring and faster claim assessment.

- **Strengthening digital platforms** such as the National Crop Insurance Portal (NCIP) for seamless enrolment, claim processing, and transparency.
- **Promotion of parametric and weather-index insurance products** to enable quicker and objective claim settlements.
- **Improved awareness and financial literacy programmes** to enhance farmers' understanding and participation in insurance schemes.
- **Development of customized insurance products** tailored to regional crops, climatic conditions, and farming systems.
- **Enhanced collaboration** among government agencies, insurance companies, financial institutions, agri-tech startups, and Farmer Producer Organizations (FPOs).
- **Integration of climate-smart agriculture and insurance** to improve resilience against climate change and natural disasters.
- **Use of big data and predictive analytics** for better risk forecasting, premium pricing, and policy planning.
- **Contribution towards Viksit Bharat 2047** by ensuring resilient agriculture, stable farm incomes, enhanced food security, and sustainable rural livelihoods.

The continued modernization of agricultural insurance, supported by technological innovation and farmer-friendly policies, will transform it from a compensation mechanism into a comprehensive agricultural risk management system, empowering farmers and strengthening India's agricultural economy.

CONCLUSION

Agricultural insurance has emerged as a cornerstone of India's agricultural risk management framework, protecting farmers against financial losses arising from climate change, natural disasters, pests, diseases, and other production-related uncertainties. Government initiatives such as the **Pradhan Mantri Fasal Bima Yojana (PMFBY)**, **Restructured Weather Based Crop Insurance Scheme (RWBCIS)**, livestock insurance, and aquaculture insurance have significantly expanded insurance coverage while promoting income stability and sustainable agricultural development. Furthermore, the integration of advanced technologies—including artificial intelligence, satellite imagery, drones, remote sensing, the National Crop Insurance Portal (NCIP), CROPIC, and WINDS—has improved transparency, efficiency, and the timeliness of claim settlements, transforming

agricultural insurance into a modern, technology-enabled risk management system.

Despite these achievements, challenges such as low awareness, delayed claim settlements, limited insurance penetration, digital infrastructure gaps, and increasing climate variability continue to hinder its full potential. Addressing these issues through policy reforms, technological innovation, farmer awareness programmes, and stronger collaboration among governments, insurers, financial institutions, and Farmer Producer Organizations (FPOs) will be crucial. A resilient and inclusive agricultural insurance ecosystem will not only safeguard farmers' livelihoods but also strengthen rural prosperity, ensure national food security, and accelerate India's journey towards **Viksit Bharat 2047** by fostering a sustainable, climate-resilient, and globally competitive agricultural sector.