Manuscript ID:
TIJCMBLIR-2025-0202015

Volume: 2

Issue: 2

Month: April

Year: 2025

E-ISSN: 3065-9191

Submitted: 28 Feb 2025

Revised: 15 Mar 2025

Accepted: 26 Apr 2025

Published: 30 Apr 2025

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DOI: 10.5281/zenodo.15710056

DOI Link:
https://doi.org/10.5281/zenodo.15710056

Agriculture and Technology: Scenario of Agricultural Prices and Their Impact in Maharashtra

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Abstract

The integration of technology into agriculture has significantly transformed farming practices, influencing productivity, efficiency, and market dynamics. In Maharashtra, a state with a rich agricultural heritage, technological advancements have played a pivotal role in shaping agricultural prices and the livelihoods of farmers. Fluctuations in commodity prices, influenced by factors like weather, market demand, and government policies, directly affect farmer incomes and the overall agricultural economy. Technological advancements, including digital tools, precision farming techniques, and improved crop varieties, play a crucial role in enhancing productivity, efficiency, and resilience, but also require financial investment and training to fully benefit farmers. This paper explores the intersection of agriculture and technology in Maharashtra, examining the trends in agricultural prices and assessing the impact of technological interventions on these trends. Through a comprehensive literature review and analysis of recent data, the study provides insights into how technological adoption affects agricultural pricing and the broader implications for the agrarian economy of Maharashtra. Technologies like drones and satellite imagery enable farmers to monitor fields identify areas needing specific attention, and make informed decisions about irrigation, fertilizer application, and pest control. Hybrid and genetically modified crops offer higher yields, pest resistance, and tolerance to harsh weather conditions, leading to increased agricultural output. Technology adoption can improve efficiency, reduce input costs, increase crop yields, and enhance overall farm productivity. Agricultural prices and technology adoption are intertwined and crucial for the success of Maharashtra's agricultural sector. While technology offers immense potential for improving productivity and efficiency, addressing price volatility and ensuring equitable access to technology are essential for ensuring the long-term sustainability and prosperity of the agricultural sector in the state.

Keywords:- *Digital Marketing, AI-Artificial Intelligence, Technology, Precision Farming, Post-harvest infrastructure, Agriculture Price trends, Agmarket, Agriculture Price Policy.*

Introduction

Agriculture remains a cornerstone of Maharashtra's economy, contributing significantly to employment and gross state domestic product (GSDP). The state's diverse agro-climatic zones support a variety of crops, including cereals, pulses, oilseeds, fruits, and vegetables. However, the agricultural sector faces challenges such as fluctuating market prices, climate variability, and resource constraints. The advent of technology in agriculture-encompassing digital tools, advanced machinery, and innovative farming practices-offers potential solutions to these challenges. This paper investigates the current scenario of agricultural prices in Maharashtra and evaluates the impact of technological adoption on these prices.

Literature Review

Technological Adoption in Agriculture

The adoption of technology in agriculture, often referred to as "smart agriculture" or

How to Cite this Article:
Bansode, P. P., Bansode, M. B., & Thengil, C. N. (2025). Agriculture and Technology: Scenario of Agricultural Prices and Their Impact in Maharashtra. The International Journal of Commerce Management and Business Law in International Research, 2(2), 65–68. https://doi.org/10.5281/zenodo.15710056

"Agriculture 4.0," includes the use of digital tools, precision farming techniques, and data analytics to enhance productivity and sustainability. In Maharashtra, studies have shown a growing trend in the adoption of technologies such as micro-irrigation systems, mobile-based advisory services, and mechanization. For instance, a study on micro-irrigation adoption in Maharashtra indicated an increase from 36.9% to 62.8%, highlighting a positive trend towards efficient water use.

However, challenges persist, including fragmented land holdings, low yields, and limited access to post-harvest infrastructure. These issues are exacerbated by factors such as inadequate access to the right inputs, lack of localized data-driven advisory services, and weak market linkages. Addressing these challenges requires a comprehensive approach that includes policy support, capacity building, and infrastructure development.

Impact of Technology on Agricultural Prices

Technological interventions can influence agricultural prices through various channels. Enhanced productivity resulting from improved farming practices can lead to increased supply, potentially stabilizing prices. Conversely, technology that improves market access and information dissemination can empower farmers to negotiate better prices for their produce. In Maharashtra, the implementation of crop insurance schemes and export policies has been associated with increased agricultural resilience, potentially influencing price stability.

However, the relationship between technology adoption and agricultural prices is complex. While increased production can lead to lower prices due to supply-demand dynamics, improved quality and market access can result in premium pricing. Therefore, the net impact of technology on agricultural prices depends on various factors, including the type of technology adopted, scale of adoption, and market conditions.

Agricultural Price Trends in Maharashtra

Maharashtra's agricultural markets have experienced significant fluctuations in commodity prices over the years. Factors such as monsoon variability, policy changes, and market demand-supply dynamics have contributed to these fluctuations. For instance, recent data indicates that adverse weather conditions led to reduced sugarcane supplies, causing sugar mills in Maharashtra to close earlier than usual and local sugar prices to surge by 10% within a month.

Similarly, political decisions, such as easing export restrictions on onions, have impacted local prices and farmer incomes. In some cases, these measures have been perceived as insufficient or untimely, leading to discontent among farmers. Understanding these price trends is crucial for assessing the impact of technological interventions on the agricultural economy.

Methodology

This study employs a mixed-methods used, in which the combining quantitative analysis of agricultural price trends with a qualitative data was taken from existing literature on technological adoption in Maharashtra's agriculture sector. Data on agricultural prices were sourced from the Maharashtra State Agricultural Marketing Board (MSAMB) and the Agricultural Marketing Information Network (Agmarket). Literature on technology adoption and its impact was reviewed from academic journal

Analysis and Discussion

1. **Trends in Agricultural Prices**
   An analysis of data from MSAMB reveals that agricultural commodity prices in Maharashtra exhibit significant temporal and spatial variability. For example, the modal price of soybeans fluctuated between ₹3,500 and ₹4,200 per quintal over the past year, influenced by factors such as monsoon performance and international market trends. Similarly, vegetables like onions and tomatoes have shown price volatility, often linked to supply chain disruptions and seasonal production patterns.
2. **Impact of Technological Adoption**
   The adoption of digital technologies among farm households in Maharashtra has shown promising results. A study conducted in Hiware Bazaar, a village renowned for its water conservation efforts, indicated that farmers adopting digital tools experienced improved productivity and better price realization for their produce. Technologies such as mobile-based market information systems have enabled farmers to made decisions by framers based by generally about when as well as where to sell their different produce or product, thereby they can also increasing bargain power of their produce.
   Moreover, the implementation of crop insurance schemes and export policies has contributed to agricultural resilience in Maharashtra. These measures have provided a safety net for farmers against price volatility and crop failures, thereby stabilizing incomes and encouraging investment in modern farming practices.
3. **Challenges and Opportunities**
   Despite the positive impact of technology, challenges such as digital literacy, infrastructure deficits, and financial constraints hinder widespread adoption.
   The integration of technology in agriculture has significantly influenced productivity, efficiency, and market prices. In Maharashtra, technological advancements such as precision farming, digital platforms, and smart irrigation have transformed the agricultural landscape. However, fluctuations in agricultural prices continue to impact farmers' incomes and the broader economy. This literature review explores the role of technology in agriculture, the trends in agricultural prices, and their socio-economic impact in Maharashtra.

Technological Advancements in Agriculture

1. **Precision Agriculture and Smart Farming**

Precision agriculture involves the use of technology such as GPS mapping, IoT-enabled sensors, and AI-driven decision-making tools to optimize farming practices. According to Wolfert et al. (2017), precision agriculture enhances resource efficiency by reducing input costs and increasing yield. In Maharashtra, farmers adopting smart farming technologies have reported improved productivity and water conservation (Gulati et al., 2020). However, challenges such as high initial investment costs and limited technical knowledge hinder widespread adoption (Basso & Antle, 2020).

2. **Digital Marketplaces and E-Agriculture**
   Digital platforms and e-commerce solutions have transformed agricultural marketing by improving price transparency and reducing dependency on middlemen. Studies by Reardon and Timmer (2021) highlight the benefits of digital marketplaces in reducing price volatility and empowering farmers. In Maharashtra, initiatives such as e-NAM (National Agricultural Market) have facilitated better market access, but issues like inadequate internet penetration in rural areas remain obstacles (Kumar et al., 2019).
3. **Transparency of Block chain and Supply Chain in Agriculture**
   Blockchain technology which is enhances traceability and finally reduces their fraud in agricultural supply chains. Kamilaris *et al.* (2019) discuss how blockchain implementation in food systems improves quality assurance and market efficiency. Although Maharashtra has seen pilot projects in blockchain-based agricultural transactions, scalability remains a challenge due to infrastructural limitations and regulatory concerns (Abebe *et al.,* 2021).

Agricultural Prices and Market Trends in Maharashtra

- **Price Fluctuations and Their Cause**
  Agricultural commodity prices in Maharashtra have been subject to significant volatility due to factors such as monsoon dependency, policy changes, and global market trends (Chand et al., 2019). The onion market, for example, has seen frequent price swings, affecting both farmers and consumers. A study by Ghosh et al. (2021) found that inadequate storage facilities and unpredictable export policies contribute to price instability.
- **Government Policies and Price Stabilization**
  Government interventions such as minimum support prices (MSP), subsidies, and procurement schemes have aimed to stabilize agricultural prices. Narayanan (2020) highlights the role of MSP in ensuring farmers receive fair prices for their crops. However, studies show that many small-scale farmers in Maharashtra struggle to benefit from MSP due to bureaucratic inefficiencies and market distortions (Acharya & Agarwal, 2019).
- **Impact of Climate Change on Agricultural Prices**
  Climate change has increasingly influenced agricultural prices by affecting crop yields. Thornton et al. (2018) emphasize that erratic rainfall patterns and rising temperatures have led to production shortfalls, pushing up prices of key crops such as pulses and oilseeds. Maharashtra, being highly dependent on rain-fed agriculture, is particularly vulnerable to climate-induced price fluctuations (Lobell & Gourdji, 2019).
- **Socio-Economic Impact of Agricultural Price Variability**
  Fluctuating agricultural prices have a direct impact on farmers' earnings and financial stability. Research by Swinnen (2020) suggests that price volatility discourages investment in advanced farming techniques. In Maharashtra, financial distress due to unstable prices has contributed to high farmer suicide rates (Deshpande & Arora, 2019).
- **Rural Employment and Migration**
  Variations in agricultural incomes affect rural employment and migration patterns. Studies indicate that declining profitability in farming pushes rural workers toward urban migration in search of alternative livelihoods (Himanshu et al., 2021). In Maharashtra, this trend is evident in regions where drought and price instability have made agriculture unsustainable for many farmers.
- **Food Security and Consumer Impact**
  Agricultural price fluctuations not only affect farmers but also consumers. High food prices impact affordability and accessibility, leading to nutritional insecurity among vulnerable populations (Pingali, 2019). Maharashtra's urban centres, including Mumbai and Pune, have witnessed periodic price spikes in essential commodities, affecting household food budgets.

Challenges and Opportunities

1. **Barriers to Technology Adoption**
   Despite the potential of digital innovations, various challenges hinder their widespread use in Maharashtra. Barriers include lack of awareness, limited financial resources, and resistance to change among traditional farmers (Klerkx & Proctor, 2013). Government support through training programs and financial incentives could help bridge this gap. **Role of Policy Reforms and Infrastructure Development**
   Policy reforms focusing on agricultural infrastructure, cold storage facilities, and efficient logistics can mitigate price volatility. Swain & Sharma (2022) argue that improving supply chain efficiency and market linkages will enhance farmers' income stability. Maharashtra's investments in agri-tech start-ups and farm-to-market connectivity show promise in addressing these challenges.
2. **Potential of Artificial Intelligence and Big Data**
   AI-driven price forecasting models and big data analytics can help farmers make informed decisions regarding crop selection and market timing. Studies suggest that predictive analytics

can significantly reduce losses due to oversupply and underpricing (Jha *et al.,* 2019). Maharashtra's ongoing efforts in precision farming and AI-based advisory services indicate a step in this direction.

Conclusion

The intersection of technology and agriculture in Maharashtra presents both challenges and opportunities. While technological advancements have the potential to stabilize agricultural prices and enhance productivity, structural barriers and climate risks remain major concerns. Addressing these issues through policy support, infrastructure development, and farmer education will be critical in ensuring sustainable agricultural growth.

Acknowledgement

I would like to express my deep and sincere gratitude to my research Colleague, Dr. M. B. Bansode PhD, Marketing Management, Assistant Professor, College of Commerce and Management PAHSU, Solapur, for giving me the opportunity to do research and providing invaluable guidance throughout this research. His dynamism, vision, sincerity and motivations have deeply inspired me. He has taught me the methodology to carry out the research and to present the research works as clearly as possible. It was a great for gave me opportunity to work and study under his guidance. I am extremely grateful for what he has offered me

Financial support and sponsorship
Nil.

Conflicts of interest

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

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