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Original Article

A STUDY OF MODERN AGRICULTURAL TECHNOLOGIES IN ENHANCING AGRICULTURAL PRODUCTIVITY IN PANDHARPUR TEHSIL

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Abstract:

Modern agricultural technologies play a crucial role in improving agricultural productivity, especially in regions affected by climatic and resource constraints. Pandharpur Tehsil of Solapur District faces challenges such as semi-arid conditions, irregular rainfall, and limited water availability. The adoption of technologies including improved seed varieties, advanced irrigation methods, farm mechanization, soil health management, and modern crop protection practices can significantly enhance agricultural output in the region.

This study examines the extent of adoption of modern agricultural technologies among farmers in Pandharpur Tehsil and assesses their impact on agricultural productivity. Based on primary and secondary data, the study finds that farmers adopting modern technologies achieve higher productivity levels than non-adopters. However, adoption remains uneven due to factors such as financial limitations, lack of awareness, and insufficient extension support. The study emphasizes the need for improved credit facilities, effective extension services, and supportive government policies to encourage wider adoption and sustainable agricultural growth.

Keywords: Modern Agricultural Technologies, Agricultural productivity, Technology Adoption, Farm Mechanization, Irrigation Practices, Socio-Economic Factors.

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Introduction:

Agriculture is a key sector of the Indian economy, supporting livelihoods and ensuring food security. In recent decades, modern farming technologies—such as high-yielding seeds, advanced irrigation, mechanization, chemical inputs, and digital tools—have improved farm efficiency, crop yields, and farmers' incomes. Pandharpur Tehsil in Solapur district, characterized by semi-arid conditions, low rainfall, and water scarcity, faces significant challenges in agricultural production. While modern technologies can boost productivity, their adoption is uneven due to factors like socio-economic conditions, landholding size, credit

availability, and limited extension support. This study analyzes the adoption and impact of modern agricultural technologies in Pandharpur Tehsil to provide insights for policymakers and extension agencies to promote sustainable, technology-driven agricultural development.

Objectives

1. To assess the extent of adoption of modern agricultural technologies by farmers in Pandharpur Tehsil.
2. To examine the impact of modern agricultural technology adoption on agricultural productivity in Pandharpur Tehsil.
3. To identify the constraints faced by farmers in adopting modern agricultural technologies
4. To suggest suitable measures to improve their agricultural productivity

Significance of the study:

The study is significant as it examines the role of modern agricultural technologies in improving productivity in Pandharpur Tehsil, a semi-arid region with limited water resources. By analyzing the extent of technology adoption and its impact, the research highlights how modern practices can help farmers overcome climatic and resource-related challenges. The findings are valuable for farmers by identifying effective technologies to increase yields and income, for policymakers by providing insights to design supportive programs and extension services, and for researchers by contributing to literature on technology adoption and sustainable agriculture. Overall, the study aims to promote technology-driven agricultural growth and improve the socio-economic conditions of farmers in the region.

Scope of the Study:

The study is limited to Pandharpur Tehsil of Solapur District and focuses on selected modern agricultural technologies, including improved seeds, fertilizers, irrigation methods, farm machinery, and crop protection practices. It examines their impact on crop productivity, farm income, and overall agricultural output, while considering socio-economic and institutional factors influencing adoption. The findings aim to assist farmers in improving efficiency, guide policymakers in designing supportive programs, and provide researchers with insights into technology-driven sustainable agriculture in semi-arid, drought-prone areas.

Limitations of the Study:

1. The study is confined to Pandharpur Tehsil of Solapur District, so the findings may not represent other regions with different climatic or socio-economic conditions.
2. It focuses on selected modern agricultural technologies, including improved seeds, fertilizers, irrigation methods, farm machinery, and crop protection practices, and does not cover all emerging technologies.
3. The study is based on a limited time period and data from a sample of farmers and secondary sources, which may not capture long-term effects, seasonal variations, or external factors such as market fluctuations, policy changes, and extreme weather events.

Choice of the topic:

Agriculture in Pandharpur Tehsil faces challenges such as a semi-arid climate, irregular rainfall, limited water resources, small landholdings, and labour shortages. Although modern technologies like high-yielding seeds, advanced irrigation, farm mechanization, soil health management, and digital advisory services are

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available, their adoption remains uneven. Financial constraints, lack of awareness, limited technical knowledge, and weak extension support hinder effective use. Consequently, agricultural productivity is below potential, affecting farmers' income and livelihoods. This study examines the adoption and impact of modern agricultural technologies, identifies constraints, and suggests measures to promote wider and more effective use in the region.

Choice of Topic:

The study may be framed around various interrelated aspects of modern agriculture in Pandharpur Tehsil. It can explore how the use of advanced farming technologies such as mechanization, improved seed varieties, and efficient irrigation methods has influenced agricultural productivity. Attention may also be given to the growing importance of digital and information-based tools in helping farmers make better farming decisions and enhance crop performance. Another significant dimension of the study could focus on sustainable and climate-adaptive technologies, especially considering the water scarcity conditions of the region. Additionally, the research may assess the economic and social effects of adopting modern agricultural technologies, including their impact on farm income, production costs, and livelihood security. Comparative evaluations of traditional and modern farming practices, as well as crop-specific analyses, can further strengthen the study while ensuring originality and academic integrity.

Review of literature:

Research by *Singh and Sharma (2018)* indicates that the adoption of precision farming techniques such as soil testing, GPS-based field mapping, and controlled fertilizer application leads to measurable increases in productivity and cost efficiency. Their findings suggest that technology-driven input management helps optimize nutrient use and reduces wastage, contributing to higher yields. This aligns with later studies which emphasize the role of precision tools in reducing environmental stress while enhancing farm output.

Studies examining irrigation technologies have reported similar positive impacts. For example, *Kumar et al. (2019)* found that the use of drip and sprinkler irrigation significantly improved water use efficiency in semi-arid regions, leading to higher crop productivity compared to traditional flood irrigation. These technologies are particularly relevant in drought-prone areas, demonstrating how modern irrigation can overcome climatic limitations to agricultural output.

According to *Deshpande (2021)*, farmers who adopted mechanization and improved inputs reported higher net returns and greater labour productivity. However, the study also noted that access to credit and technical knowledge were key determinants influencing technology adoption among smallholder farmers.

In a study conducted in a similar agro-ecological context, *Patil and Kulkarni (2022)* demonstrated that plots using modern technologies outperformed those relying on conventional methods in terms of yield, input efficiency, and profitability. The authors argue that integrating modern practices with traditional knowledge can enhance sustainability and farmer resilience.

Research Methodology:

Research Design:

Aspect	**Description**
Research Design	Descriptive and analytical research design
Study Area	Pandharpur Tehsil of Solapur District
Basis of Selection	Agricultural importance and increasing use of modern farming practices
Nature of Data	Primary data

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Source of Data	Farmers directly involved in agricultural activities
Target Population	Farmers who have adopted or have knowledge of modern agricultural technologies
Technologies Covered	Improved seed varieties, farm mechanization, advanced irrigation methods, digital advisory services
Sample Size	96 farmers
Sampling Purpose	To ensure adequate representation of different categories of farmers
Data Collection Tools	Structured questionnaire and personal interviews
Parameters Studied	Awareness and adoption of modern technologies, changes in agricultural productivity, input utilization, and challenges faced

Modern Agricultural Technologies:

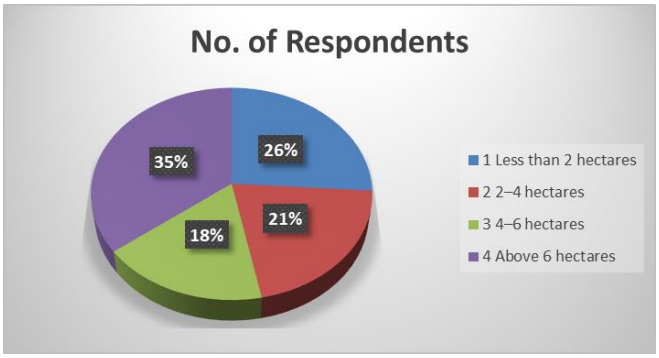
1. Precision Farming
2. Drip and Micro-Irrigation Systems
3. Use of Drones and Remote Sensing
4. High-Yielding and Hybrid Seeds
5. Soil Health Management Technologies
6. Mechanization and Automation in Agriculture
7. Climate-Smart Agricultural Practices
8. Information and Communication Technology (ICT) Tools
9. Weed and Pest Management Technologies
10. Artificial Intelligence and Decision Support Systems
11. Weather Forecasting and Climate Monitoring
12. Agro-Tech Digital Platforms

Data Analysis:

Table No.1 Showing Size of landholding of the Respondents.

Sr. No.	Size of Land	No. of Respondents	Percentage (%)
1	Less than 2 hectares	25	26
2	2–4 hectares	20	21
3	4–6 hectares	17	18
4	Above 6 hectares	34	35
5	**Total**	**96**	**100**

Chart No.1 Showing Size of landholding of the Respondents.



The table presents the distribution of respondents based on landholding size. Out of 96 respondents, the highest number of farmers belong to the above 6 hectares category. This is followed by farmers owning less than 2 hectares, then those with 2–4 hectares, and 4–6 hectares. Overall, the data shows representation of small, medium, and large farmers, providing a balanced sample for the study.

Table No.2 Showing Awareness of Modern Agricultural Technologies.

Sr. No.	Awareness	No. of Respondents	Percentage (%)
1	Yes	64	65
2	Somewhat	22	23
3	No	12	12
4	**Total**	**96**	**100**

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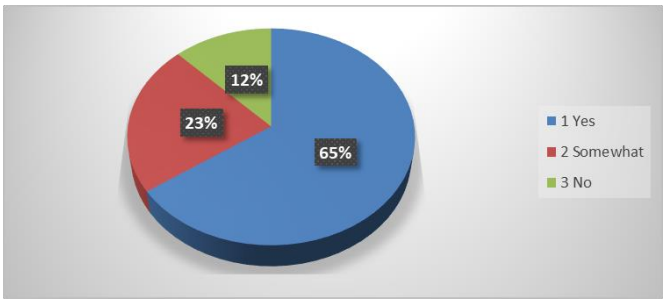
Chart No .2 Showing Awareness of Modern Agricultural Technologies

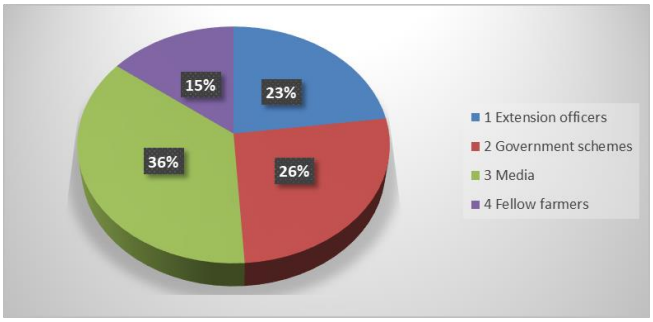


The table presents the awareness level of modern agricultural technologies among the respondents. Among the 96 farmers surveyed, most farmers are aware of these technologies, while some have partial awareness. Only a few respondents reported no awareness, indicating that overall awareness is high, though not all farmers are fully informed.

Table No. 3 Indicating Source of information about modern agricultural technologies.

Sr. No.	Source of Information	No. of Respondents	Percentage (%)
1	Extension officers	22	23
2	Government schemes	25	26
3	Media	35	36
4	Fellow farmers	14	15
5	**Total**	**96**	**100**

Chart No. 3 Indicating Source of information about modern agricultural technologies.

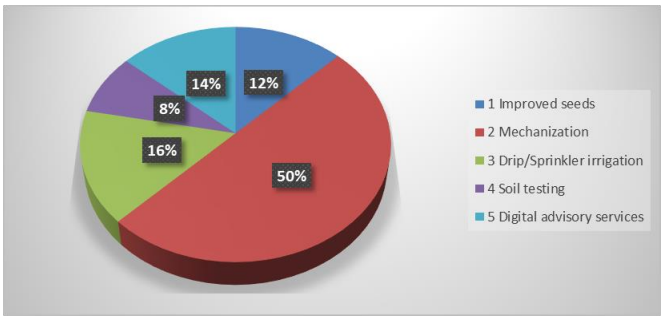


The table highlights the different sources from which farmers receive information on modern agricultural technologies. Most respondents rely on media as their primary source, followed by government schemes and extension officers. Information shared by fellow farmers is comparatively less. Overall, the table indicates that farmers depend on a mix of official sources and informal interactions to access agricultural information.

Table No. 4 Displaying Modern agricultural technologies adopted by the Respondents.

Sr. No.	Technologies Adopted	No. of Respondents	Percentage
1	Improved seeds	12	13
2	Mechanization	48	50
3	Drip/Sprinkler irrigation	15	16
4	Soil testing	08	8
5	Digital advisory services	13	13
6	**Total**	**96**	**100**

Chart No. 4. Displaying Modern agricultural technologies adopted by the Respondents



The table shows the adoption of various modern agricultural technologies by the respondents. Mechanization is the most widely adopted technology, with 50% of farmers using it. This is followed by drip/sprinkler irrigation at 16% and digital advisory services at 13%. Improved seeds are also adopted by 13% of respondents, while soil testing has the lowest adoption at 8%. Overall, the table indicates that mechanization is the

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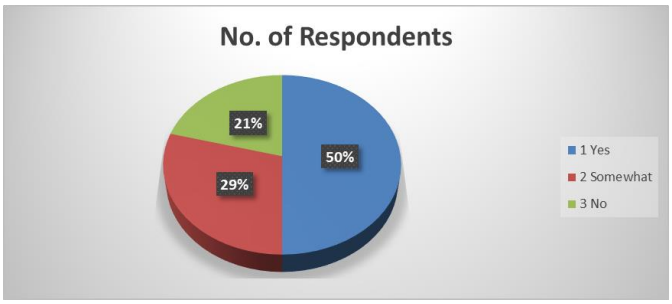
preferred technology, while other modern practices are adopted to a lesser extent.

Table No. 5 Shows the increases in the crop yield due to the adoption of modern agricultural technologies by the Respondents.

Sr. No.	Increase in the crop yield	No. of Respondents	Percentage (%)
1	Yes	48	50
2	Somewhat	28	29
3	No	20	21
4	**Total**	**96**	**100**

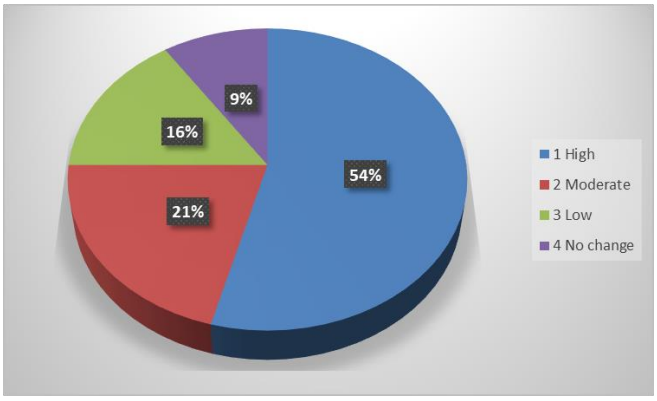


The table illustrates the impact of modern agricultural technologies on crop yield among the respondents. Out of 96 farmers, 50% reported an increase in crop yield due to these technologies. 29% of farmers experienced some improvement, while 21% observed no change in yield. This indicates that modern agricultural practices have a positive effect on crop productivity for the majority of farmers, though a portion still sees limited or no impact. give in short

Table No. 6 Shows that extent of Productivity due to adoption of Modern Agricultural Technologies by the Respondents.

Sr. No.	Extent of Productivity	No of Respondents	Percentage (%)
1	High	52	54
2	Moderate	20	21
3	Low	15	16
4	No change	09	09
5	**Total**	**96**	**100**

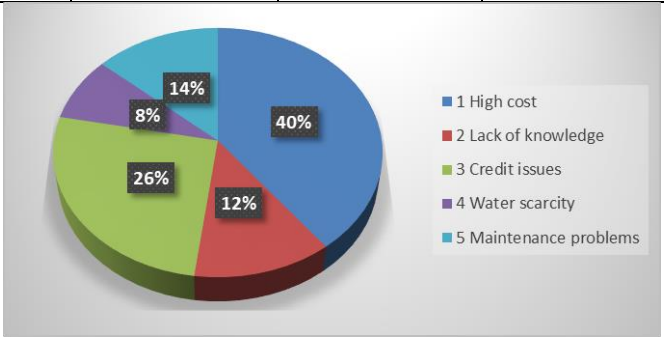
Chart No. 6 Explains that extent of productivity due to adoption of Modern Agricultural Technologies by the Respondents



The table shows that out of 96 respondents, a majority of 52 (54%) reported high productivity, while 20 respondents (21%) experienced moderate productivity. In contrast, 15 respondents (16%) reported low productivity, and 9 respondents (9%) indicated no change. Overall, most respondents experienced high to moderate levels of productivity.

Table No. 7 shows the major constraints faced in adopting modern agricultural technologies by the respondents.

Sr. No.	Major Constraints Faced	No of Respondents	Percentage (%)
1	High cost	38	40
2	Lack of knowledge	12	12
3	Credit issues	25	26
4	Water scarcity	08	8
5	Maintenance problems	13	14
6	**Total**	**96**	**100**



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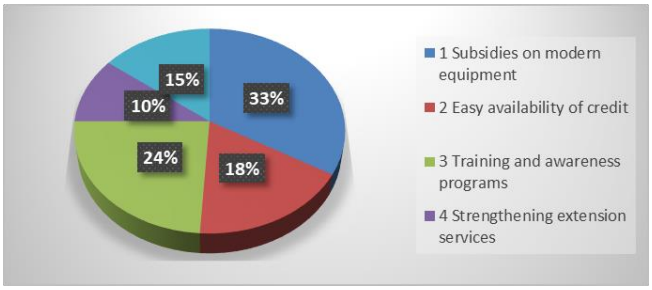
The table indicates that **high cost** is the primary constraint, reported by **40% of the respondents (38). Credit issues** rank second, affecting **26% (25 respondents). Maintenance problems** were reported by **14%,** followed by **lack of knowledge** at **12%. Water scarcity** is the least common constraint, mentioned by **8%** of the respondents. Overall, high cost and credit-related issues emerge as the most prominent challenges faced by the respondents

Table No.8 Shows that measures would help improve adoption of modern agricultural technologies adopted by respondents.

Sr. No.	Measures for improvement	No of Respondents	Percentage (%)
1	Subsidies on modern equipment	32	33
2	Easy availability of credit	17	18
3	Training and awareness programs	23	24
4	Strengthening extension services	10	10
5	Timely information and guidance	14	15
6	**Total**	**96**	**100**



The table shows that **subsidies on modern equipment** are the most important measure to improve adoption, as reported by **33%** of respondents. This is followed by **training and awareness programs (24%)** and **easy access to credit (18%). Timely information and guidance (15%)** and **strengthening extension services (10%)** were considered less important. Overall, financial assistance and knowledge support are the key measures for improving the adoption of modern agricultural technologies.

Findings:

1. The majority of respondents (35%) are large farmers with over 6 hectares, while smallholders under 2 hectares make up 26%. Overall, the sample includes a balanced mix of small, medium, and large farmers.
2. Most farmers (65%) are aware of modern agricultural technologies, while 23% have partial awareness and 12% lack awareness, indicating overall good but not complete knowledge among respondents.
3. The majority of farmers (36%) obtain information on modern agricultural technologies from media, followed by government schemes (26%) and extension officers (23%), while fewer rely on fellow farmers (15%). This shows a mix of formal and informal information sources among respondents.
4. Mechanization is the most widely adopted technology (50%), followed by drip/sprinkler irrigation (16%) and digital advisory services (13%), while soil testing has the lowest adoption (8%). Overall, farmers prefer mechanization over other modern agricultural technologies.
5. Half of the farmers (50%) reported an increase in crop yield due to modern agricultural technologies, while 29% observed some improvement and 21% saw no change. This indicates a generally positive impact on productivity.

6. The majority of farmers (54%) experienced high productivity from modern agricultural technologies, while 21% reported moderate, 16% low, and 9% no change. This shows a significant positive effect on overall farm productivity.
7. The main constraints faced by farmers in adopting modern technologies are high cost (40%) and credit issues (26%), followed by maintenance problems, lack of knowledge, and water scarcity. Financial and knowledge barriers are the most significant challenges.
8. Farmers believe that subsidies on modern equipment (33%) and training/awareness programs (24%) are the most effective measures to improve adoption of modern agricultural technologies. Access to credit, timely guidance, and stronger extension services are also important but less prioritized.

Suggestions:

1. Government should provide **enhanced subsidies and easy institutional credit** to reduce financial barriers, especially for small and marginal farmers.
2. **Regular training and awareness programmes** should be conducted to improve farmers' knowledge and effective use of modern agricultural technologies.
3. **Extension services must be strengthened** to offer continuous technical guidance, demonstrations, and on-field support.
4. Wider use of **media, digital platforms, and ICT tools** is needed for timely dissemination of information on technologies, weather, and markets.
5. Promotion of **water-efficient irrigation methods and soil testing services** is essential to improve productivity and sustainability in the semi-arid region.

Conclusion:

The study concludes that modern agricultural technologies have a significant impact on improving agricultural productivity in Pandharpur Tehsil. The use of precision farming, drip and micro-irrigation systems, soil testing, high-yielding seed varieties, farm mechanization, and digital advisory services has contributed to higher crop production, efficient use of resources, and reduction in cultivation costs. These technologies have also helped farmers overcome key challenges such as water scarcity, declining soil fertility, labor shortages, and climatic uncertainties.

At the same time, the study highlights that the adoption of modern agricultural technologies varies among farmers due to factors such as limited awareness, lack of technical skills, and financial constraints. To overcome these challenges, there is a need to strengthen agricultural extension services, enhance irrigation facilities, provide financial assistance, and promote training and capacity-building programs. In conclusion, wider adoption of modern and sustainable agricultural technologies, supported by effective government policies and institutional support, can ensure sustainable agricultural development, improve farmers' livelihoods, and enhance long-term agricultural productivity in Pandharpur Tehsil.