



# Reimagining Indian Agriculture: Regional Shifts in Commercialization After COVID-19

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## Abstract

India's agricultural sector has historically been the backbone of its economy, transitioning from subsistence farming to commercial agriculture, influenced by colonial trade, industrialization, and globalization. This study explores the historical evolution of Indian agriculture, with a particular focus on the commercialization process and the disruptions caused by the COVID-19 pandemic. The research aims to (1) examine the historical development of commercial agriculture in India, (2) analyze the regional disparities in agricultural commercialization post-COVID-19, and (3) assess the major challenges and adaptive strategies of farmers across different age groups. The study employs a descriptive and analytical research approach, using primary data collected from 420 farmers across India through structured surveys and interviews. A Kruskal-Wallis test and descriptive statistical tools were applied to identify regional variations in agricultural commercialization and the impact of post-pandemic challenges. Findings indicate that Southern and Western India experienced greater modernization and digital integration in agriculture, while Eastern India faced significant financial constraints and weaker institutional support. Key challenges included supply chain disruptions, rising input costs, labour shortages, and declining market demand, with younger farmers struggling more with financial and technological barriers, while older farmers faced procurement price fluctuations. The study concludes that post-pandemic agricultural transformations have been regionally diverse, with Western and Southern India demonstrating resilience through AgriTech adoption and commercialization, whereas Eastern India requires stronger financial and policy support. The research highlights the need for region-specific policy interventions, increased access to credit, technological integration, and improved market linkages to ensure sustainable agricultural growth in the post-pandemic era.

**Keywords:** Agricultural Commercialization, Post-COVID Challenges, Regional Disparities, Sustainable Farming

## 1. Introduction

Agriculture has historically been the backbone of the Indian economy, providing employment and livelihood to millions (Chand, 2020). With its diverse climatic conditions, fertile lands, and a wide variety of crops, India has long been a global agricultural powerhouse (FAO, 2024). Among various agricultural practices, commercial farming plays a crucial role in the country's economic development, enabling farmers to cultivate crops primarily for profit rather than for personal consumption (Patel & Sharma, 2019).

The commercialization of agriculture in India has its roots in the colonial period, when European traders first arrived in the subcontinent to trade agricultural products such as cotton, jute, indigo, and spices (Gupta, 2018). Over time, the British colonial rulers gained control of Indian farmlands and encouraged large-scale commercial production, primarily for exports (Bose, 2016). The Industrial Revolution of 1813 further increased the demand for high-quality Indian agricultural products, attracting European investors and accelerating the commercialization process (Kumar & Rao, 2017).

However, commercialization did not remain confined to the colonial period. Over the years, India has evolved into one of the largest agricultural economies, ranking among the top producers of dairy, jute, cotton, spices, fish, and meat (NITI Aayog, 2022). Following economic liberalization in 1991, Indian agriculture became increasingly integrated into the global market, opening up new trade opportunities and encouraging large-scale commercial farming (Mukherjee, 2015). Various government initiatives, such as the PM Fasal Bima Yojana, Kisan Credit Card Program, Paramparagat Krishi Vikas Yojana, and PM Kisan Samman Nidhi, have further supported the growth of commercial agriculture by providing financial aid, insurance, and infrastructure development (Ministry of Agriculture & Farmers Welfare, 2023).

However, the COVID-19 pandemic, which emerged in late 2019, significantly disrupted global economies, including India's agricultural sector and commercial farming industry (World Bank, 2021). Over the past decade, commercial agriculture in India has undergone a significant transformation, driven by technological advancements, policy reforms, and globalization (Chand, 2021). However, the COVID-19 pandemic caused unprecedented disruptions, altering the landscape of agricultural commercialization (World Economic Forum, 2022). Some of the major issues faced by commercial farmers include:

- **Market Instability** – The closure of wholesale markets and transportation restrictions disrupted supply chains, leaving farmers unable to sell their produce (FAO, 2022).
- **Rising Input Costs** – The cost of fertilizers, pesticides, and farm machinery increased due to global supply chain disruptions, adding financial strain to farmers (UNDP, 2021).
- **Labor Shortages** – Reverse migration of labourers from urban to rural areas created a shortage of skilled farmworkers, affecting large-scale commercial farms (ICAR, 2021).
- **Technological and Financial Barriers** – While some farmers embraced e-commerce and AgriTech solutions, many faced limited access to credit and technology, preventing them from modernizing their farming practices (Singh, 2021).

At the same time, the pandemic presented new opportunities for Indian agriculture, including:

- Increased focus on organic and sustainable farming due to rising consumer demand for healthy, chemical-free produce (Bhattacharya, 2024).
- Expansion of digital marketing and e-commerce platforms, allowing farmers to sell directly to consumers without relying on intermediaries (Aggarwal et al., 2021).
- Growth in contract farming and corporate partnerships, enabling farmers to access better financial and technical support (Pandey, 2021).

## 2. Scope and Significance of the Study

The COVID-19 pandemic had a profound impact on all sectors of the Indian economy, but agriculture was among the most affected industries (Economic Survey of India, 2021). As the government imposed nationwide lockdowns and restricted the movement of goods and labour, farmers faced major challenges in production, transportation, and marketing (Mehta et al., 2021). Supply chain disruptions, labour shortages, and fluctuating market demand led to financial distress among commercial farmers (Deshpande & Mishra, 2022).

Despite these challenges, the pandemic also accelerated key transformations in Indian agriculture. Farmers increasingly adopted digital platforms, e-commerce, and direct-to-consumer models to sell their products (Agarwal, 2021). The use of technology in agriculture (AgriTech) gained momentum, leading to innovations in precision farming, organic cultivation, and value-added processing (Singh & Kumar, 2020). The government also introduced various stimulus measures to support commercial farmers, but their effectiveness varied across regions (Sharma, 2021).

This study aims to explore the regional variations in the commercialization of agriculture in post-COVID-19 India by categorizing the country into four major zones (Census of India, 2021):

- North India – Characterized by wheat, mustard, and sugarcane farming, this region experienced an increase in contract farming and agribusiness investments post-COVID-19 (Kaur & Singh, 2023).
- South India – Known for spices, coffee, coconut, and horticultural crops, this region witnessed a rise in export-oriented farming and the adoption of digital marketing strategies (Reddy et al., 2021).
- East India – A predominantly rice and jute-producing region, farmers here faced logistical challenges but benefitted from cooperative farming models (Ghosh & Sen, 2021).
- West India – A major producer of cotton, groundnut, and horticultural crops, this region saw growth in precision farming, AgriTech adoption, and e-commerce-based agricultural trade (Joshi, 2024).

By examining regional disparities, policy interventions, and market trends, this study seeks to provide valuable insights into the opportunities and challenges shaping India's post-pandemic agricultural commercialization landscape.

### 3. Statement of the Problem

The COVID-19 pandemic brought unprecedented disruptions to the global economy, significantly impacting the agricultural sector in India. As a country where a large portion of the population depends on agriculture for livelihood, the pandemic-induced restrictions on mobility, supply chain disruptions, and market uncertainties posed serious challenges to farmers across different regions (Chand, 2020). However, the nature and extent of these challenges varied across the North, South, East, and West zones of India, necessitating a regional analysis of the significant changes that took place in the post-pandemic period (NITI Aayog, 2022). This raises an important research question: What significant changes occurred in agriculture across the North, South, East, and West zones of India during the post-COVID-19 period?

Furthermore, farmers of different age groups exhibited varying responses to the crisis, with younger farmers adapting to technology-driven solutions, while older farmers relied more on traditional methods and government support (Mehta, Singh, & Kumar, 2021). Understanding how these diverse groups navigated the post-pandemic challenges is crucial for developing policies that cater to their specific needs (FAO, 2021). Therefore, this study seeks to answer: How did farmers from different age groups manage the challenges in agriculture after the COVID-19 pandemic?

Additionally, several new challenges emerged in the agricultural sector during the post-COVID-19 era, including fluctuations in input costs, labour shortages, market instability, and the need for technological integration (Ministry of Agriculture & Farmers Welfare, 2023). Identifying these issues is crucial for shaping policies and interventions aimed at improving resilience in the agricultural sector. In this context, the study addresses the question: What were the key challenges that emerged in the agricultural sector during the post-COVID-19 era?

In line with these research questions, the study is designed to:

1. Identify the significant changes that occurred in agriculture during the post-COVID-19 period across the North, South, East, and West zones of India.
2. Assess the key challenges that emerged in agriculture during the post-COVID-19 era and their implications on commercial farming.
3. Analyze how different age groups of farmers managed the challenges that arose in the post-pandemic agricultural landscape.

By examining these aspects, this research aims to provide a comprehensive analysis of the impact of COVID-19 on India's commercial agricultural landscape. The findings will help policymakers, researchers, and stakeholders develop sustainable strategies to support commercial farmers in adapting to the new agricultural realities.

## 4. Methodology of the Study

This research adopts a descriptive and analytical approach to examine the impact of COVID-19 on commercial agriculture across India's four major regions (Ministry of Agriculture & Farmers Welfare, 2022). This study is based on both primary and secondary data. The target population comprises commercial farmers across India (Chand, 2020). Primary data was collected directly from farmers engaged in commercial agriculture through structured surveys and interviews (Mehta, Singh, & Kumar, 2021). A convenience sampling method was utilized to select 40 respondents from different regions of the country (NITI Aayog, 2022). For a regional analysis, India was classified into four zones: North, South, East, and West. From each region, a representative state was chosen—Tamil Nadu from South India, Uttar Pradesh from North India, Bihar from East India, and Maharashtra from West India (Ministry of Agriculture & Farmers Welfare, 2023).

- **Primary Data Collection:** A survey was conducted among 420 farmers from different regions using a structured questionnaire. The farmers were selected through a convenience sampling method, ensuring representation from various farming communities (Kumar, 2021).
- **Secondary Data Collection:** The study analyzed government reports, agricultural policies, market trends, academic research papers, and economic data to provide a comprehensive understanding of post-pandemic agricultural commercialization.
- **Data Analysis:** Here, farmers who are registered in various government portals and farmers who have not registered anywhere were also considered. Since the list of all farmers are not exactly available, Non-Parametric analysis tool of Kruskal Wallis test is used to find out the difference between farmers based on their geographical location and age. The study employed Mean, Percentage-based analysis and Kruskal Wallis test to identify key trends, and assess regional variations.

## 5. Review of Literature

The COVID-19 pandemic had a profound impact on agriculture, influencing various aspects of the sector, including government intervention, social protection mechanisms, agricultural markets, and consumer behaviour. Several studies have analyzed these effects, providing insights into the challenges and responses in the Indian agricultural system.

The role of social protection programs and government support in mitigating the pandemic's impact on the agricultural sector has been widely analyzed. Varshney et al. (2021) examined how COVID-19 influenced social protection and its impact on agriculture in India. Their study found that funds allocated through various government schemes played a crucial role in alleviating constraints related to credit availability, thereby increasing investment in agricultural inputs. Moreover, emergency relief packages effectively reached the vulnerable sections of Indian society, ensuring stability in the agricultural workforce. Similarly, Carbery and Padhee (2020) highlighted the need for strategic government-level interventions to mitigate the financial strain on farmers. Their research emphasized that investments in agricultural logistics and relaxation of APMC (Agricultural Produce Market Committee) regulations were critical measures to ensure market accessibility for farmers. Dev (2020) further stressed the importance of smooth supply chain

operations, inclusion of agricultural labourers in government assistance programs, and the promotion of e-commerce platforms to ease the burden on farmers.

The agricultural sector experienced severe disruptions in production, supply chains, and market access due to pandemic-related restrictions. Adeeth Kariappa et al. (2021) assessed the broader impact of COVID-19 on Indian agriculture and found that the pandemic triggered a chain reaction affecting various stakeholders, from farmers to consumers. Their study highlighted that 90% of consumers altered their shopping behaviour, shifting towards digital platforms and localized markets. This transformation forced agricultural producers and retailers to restructure their business models, focusing on direct-to-consumer channels and digital marketing. Dev (2020) reinforced these findings, emphasizing that market accessibility, labour shortages, and disruptions in supply chains were the primary obstacles that farmers faced during the lockdown period. Several studies have recommended long-term structural changes to enhance the resilience of India's agricultural sector. Carbery and Padhee (2020) suggested that relaxing market norms, allowing farmers to sell beyond regulated mandis (wholesale markets), and making strategic investments in logistics infrastructure would strengthen agricultural trade. In addition, Varshney et al. (2021) emphasized that state-level policies should focus on social safety nets, offloading buffer stocks, and increasing credit access to farmers. These interventions could ensure a more sustainable and resilient agricultural system in the post-pandemic period.

## 6. Results and Discussions

### 6.1 Changes in agriculture during the Post Covid 19 Era

Significant changes that occurred in agriculture during the post-COVID-19 period across the North, South, East, and West zones of India.

**Table: 1** Descriptive Statistics

Changes in Agricultural Sector	Northern India		Southern India		Eastern India		Western India	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Modernisation in agriculture	2.50	1.293	3.15	1.183	2.31	1.205	3.78	.933
Reduced the size of cultivable land	1.96	1.016	2.81	1.649	1.70	.863	2.35	.959
Changes in the food habits of people	2.16	.898	2.76	1.220	2.20	1.316	2.89	.951
Changes in agricultural import export policies of major world economies	2.79	.727	3.31	1.117	1.91	.917	3.35	1.012
Increased spread of home gardens	1.50	.503	2.67	1.111	2.10	.543	2.62	1.216
More emphasis to commercial crops rather than Food crops	1.80	1.384	2.38	1.471	2.30	1.267	2.62	1.523

Farmers turned as agro entrepreneurs	3.19	.898	3.76	1.063	2.28	.981	3.74	.946
More diversification in agriculture by farmers	2.37	1.043	4.04	.691	1.60	.851	3.25	1.270
Improvement in Co-operative model agriculture	2.30	.608	2.52	1.141	1.90	1.463	3.49	1.032
Increase in the quality of natural resources required for farming	4.03	1.043	2.79	1.119	3.65	1.342	4.07	.980

**Source: Primary Source**

The descriptive statistics highlight significant regional variations in agricultural changes across India post-COVID-19. Modernization in agriculture is more prominent in Western (3.78) and Southern India (3.15), while Eastern India (2.31) lags behind, suggesting disparities in technology adoption. Reduction in cultivable land size is most pronounced in Southern India (2.81), possibly due to urbanization and land fragmentation, while Eastern India reports the least impact (1.70). Changes in food habits are moderately observed across all regions, with the highest in Western India (2.89), due to increased dietary diversification. Changes happened in agricultural import-export policies of biggest economies are most likely affected the Western (3.35) and Southern India (3.31), indicating stronger integration with global markets, while Eastern India (1.91) experiences minimal impact. The spread of home gardens is highest in Southern (2.67) and Western India (2.62), because of increased self-sufficiency efforts, whereas Northern India (1.50) sees limited adoption.

A shift towards commercial crops is relatively moderate across all regions, with the highest emphasis in Western India (2.62), suggesting greater market-driven agriculture. Farmers transitioning into agro-entrepreneurs is highly evident in Southern (3.76) and Western India (3.74), indicating better institutional support and market access, while Eastern India (2.28) trails behind. Agricultural diversification is most prominent in Southern India (4.04), showcasing high adaptability, while Eastern India (1.60) exhibits the least diversification. The co-operative model in agriculture shows the greatest improvement in Western India (3.49), while Eastern India (1.90) remains underdeveloped in this regard. The quality of natural resources for farming is perceived as highest in Northern (4.03) and Western India (4.07), whereas Southern India (2.79) reports lower quality, potentially due to resource depletion. Overall, Western and Southern India demonstrate higher resilience and adaptation in the agricultural sector post-COVID-19, while Eastern India exhibits comparatively lower transformation. To identify the significance of difference across different geographical regions, Kruskal Wallis test is applied, and the following hypothesis is developed for the purpose:

$H_1$ : There is no significant difference in changes in agriculture after covid 19 across different geographical locations of India.

**Table: 2** **Kruskal Wallis test**

Changes in Agricultural Sector	Mean Rank				Chi Square	p Value
	Northern India	Southern India	Eastern India	Western India		
Modernisation in agriculture	312.23	429.49	278.81	551.81	209.708	.000
Reduced the size of cultivable land	372.79	475.58	326.16	470.95	177.099	.000
Changes in the food habits of people	334.34	445.16	329.45	486.33	116.009	.000
Changes in import export policies of major world economies	378.03	482.51	199.96	487.41	203.668	.000
Increased spread of home gardens	201.00	475.75	452.23	362.44	115.430	.000
More emphasis to commercial crops rather than Food crops	396.13	403.60	303.17	432.22	68.190	.000
Farmers turned as agro entrepreneurs	346.35	486.49	173.49	464.25	159.505	.000
More diversification in agriculture by farmers	242.77	575.41	125.35	400.41	285.980	.000
Improvement in Co-operative model agriculture	380.11	406.25	267.36	581.12	276.819	.000
Increase in the quality of natural resources required for farming	463.30	236.89	401.73	468.26	142.501	.000

**Source: Primary Source**

The Kruskal-Wallis test results indicate significant regional differences ( $p < 0.05$ ) in various agricultural changes across India post-COVID-19. Western India consistently ranks highest in modernization (551.81), cooperative model improvement (581.12), and import-export policy changes (487.41), reflecting a stronger transformation. Southern India leads in agricultural diversification (575.41) and home gardens (475.75), indicating adaptive farming practices. Northern India ranks highest in natural resource quality (463.30), suggesting better environmental conditions. Eastern India generally has the lowest ranks, particularly in diversification (125.35) and agro-entrepreneurship (173.49), highlighting slower adaptation. The overall significant Chi-square values confirm regional disparities in how agriculture evolved post-pandemic.

## 6.2 Challenges Emerged in Agriculture During the Post-COVID-19 Era

Assess the key challenges that emerged in agriculture during the post-COVID-19 era and their implications on commercial farming.

**Table: 3** **Descriptive Statistics**

Challenges Emerged in Agricultural Sector	Northern India		Southern India		Eastern India		Western India	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Disturbed entire agriculture supply chain system	3.39	.575	4.40	.709	3.45	1.078	3.61	.741
Shortage of labour	2.52	.870	4.02	1.041	2.90	.960	3.42	1.376
Reduced onsite demand due to spread of home delivery network of big dealers	2.23	.704	3.29	1.305	2.22	.949	3.21	1.076
Boom in input price and food price	3.38	1.277	3.69	1.784	3.55	1.422	3.25	1.099
Decreased production capacity	1.80	1.384	2.38	1.471	2.34	1.331	2.62	1.523
Reduced purchase power of farmers and customers	2.36	.641	2.21	.469	2.86	1.532	2.21	.517
Decline in average crop Income	3.51	.503	3.06	.348	4.55	1.332	3.01	1.131
Drop in procurement price due to reduced demand from institutional buyers	4.01	1.107	4.24	.774	2.51	1.369	4.25	1.145
Difficulty in raising agro finance	4.64	1.301	3.58	1.349	4.50	1.432	2.53	.788
Higher dependence on informal credit sources	4.02	.960	2.90	1.041	4.54	1.377	2.52	.870

**Source: Primary Source**

The descriptive statistics reveal significant regional disparities in the challenges faced by the agricultural sector post-COVID-19. Southern India experienced the most disruption in the supply chain (4.40) and severe labour shortages (4.02), indicating its heavy reliance on migrant labour and structured distribution networks. Eastern India reported the highest decline in average crop income (4.55) and the greatest dependence on informal credit (4.54), highlighting financial struggles. Northern India faced the greatest difficulty in raising agro-finance (4.64), suggesting institutional barriers, while Western India reported the highest drop in procurement prices (4.25), likely due to reduced demand from institutional buyers. Additionally, the boom in input and food prices affected all regions similarly (3.25–3.69), indicating widespread inflation. The data underscores that while all regions faced challenges, Eastern and Northern India struggled more with financial constraints, Southern India with labour and supply chain issues, and Western India with market

price declines. To identify the significance of difference in challenges across different geographical regions, Kruskal Wallis test is applied, and the following hypothesis is developed for the purpose:

H<sub>1</sub>: There is no significant difference in challenges in agriculture after covid 19 across different geographical locations of India.

**Table: 4** **Kruskal Wallis test**

Challenges Emerged in Agricultural Sector	Mean Rank				Chi Square	p Value
	Northern India	Southern India	Eastern India	Western India		
Disturbed entire agriculture supply chain system	258.07	547.52	312.79	320.03	172.362	.000
Shortage of labour	317.00	419.65	244.26	528.70	269.692	.000
Reduced onsite demand due to spread of home delivery network of big dealers	314.32	507.89	317.40	516.59	121.759	.000
Boom in input price and food price	428.13	440.23	455.83	420.52	44.095	.000
Decreased production capacity	299.96	400.52	397.29	429.77	74.990	.000
Reduced purchase power of farmers and customers	381.31	347.12	597.30	338.03	179.171	.000
Decline in average crop Income	477.59	248.78	583.21	413.41	321.951	.000
Drop in procurement price due to reduced demand from institutional buyers	420.69	445.53	195.94	478.48	128.901	.000
Difficulty in raising agro finance	405.10	404.08	563.04	392.53	207.534	.000
Higher dependence on informal credit sources	439.92	315.93	527.58	243.01	270.562	.000

**Source: Primary Source**

The Kruskal-Wallis test results indicate significant regional differences ( $p < 0.05$ ) in the challenges faced by the agricultural sector post-COVID-19. Southern India ranks highest in supply chain disruption (547.52) and reduced onsite demand (507.89), reflecting severe logistical and market access issues. Western India experiences the most severe labour shortages (528.70) and procurement price drops (478.48), suggesting a labour-intensive agricultural sector heavily reliant on institutional buyers. Eastern India struggles the most with reduced purchasing power (597.30), declining crop income (583.21), and difficulty in raising agro

finance (563.04), highlighting financial distress. Northern India faces the highest dependence on informal credit (439.92), indicating weaker access to formal financial systems. The overall high Chi-square values confirm that while all regions faced challenges, Eastern India suffered the most financial strain, Southern India encountered severe supply chain disruptions, and Western India struggled with labour and market price fluctuations.

### 6.3 Challenges in Farming across Different Age Groups

Analyze how different age groups of farmers managed the challenges that arose in the post-pandemic agricultural landscape.

**Table: 5** Descriptive Statistics

Challenges Emerged in Agricultural Sector	Below 30		30 - 50		50 - 70		Above 70	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Disturbed entire agriculture supply chain system	4.65	.576	4.40	1.065	4.04	.974	3.00	.918
Shortage of labour	4.35	.857	4.37	.983	3.74	1.394	2.80	1.044
Reduced onsite demand due to spread of home delivery network of big dealers	3.27	1.599	3.79	1.004	3.96	1.418	4.20	1.084
Boom in input price and food price	2.51	1.500	2.84	1.091	1.82	1.697	1.54	.819
Decreased production capacity	2.56	.658	1.71	.820	1.61	.766	1.11	.417
Reduced purchase power of farmers and customers	3.12	1.033	2.37	.866	2.20	1.427	1.46	.709
Decline in average crop Income	3.80	1.178	3.71	.767	3.42	1.271	3.22	1.470
Drop in procurement price due to reduced demand from institutional buyers	3.00	.786	3.55	1.069	3.91	1.255	4.75	.435
Difficulty in raising agro finance	3.58	.804	3.36	1.022	2.61	1.345	2.25	.663
Higher dependence on informal credit sources	4.07	.980	3.92	.882	3.58	1.376	3.99	1.084

**Source: Primary Source**

The descriptive statistics highlight how challenges in the agricultural sector post-COVID-19 vary across different age groups of farmers. Younger farmers (below 30) faced the most severe disruptions in the supply chain (4.65) and labour shortages (4.35), indicating their reliance on external networks and workforce. Older farmers (above 70) experienced the highest drop in procurement prices (4.75) and the greatest impact from reduced onsite demand (4.20), suggesting greater dependency on traditional market structures. Middle-aged

farmers (30-50) reported moderate challenges across most factors, particularly in declining crop income (3.71) and dependence on informal credit (3.92). Farmers aged 50-70 saw the highest financial struggles, reporting the lowest purchasing power (2.20) and significant procurement price drops (3.91). Additionally, younger farmers were more affected by reduced purchasing power (3.12) and informal credit dependence (4.07), whereas older farmers (above 70) reported the lowest impact on production capacity (1.11) and financing difficulties (2.25), possibly due to smaller-scale operations or established financial stability. The results indicate that younger and middle-aged farmers faced greater financial and supply chain challenges, while older farmers struggled more with market price fluctuations and demand shifts. To identify the significance of difference in challenges across various age category farmers, Kruskal Wallis test is applied, and the following hypothesis is developed for the purpose:

H<sub>1</sub>: There is no significant difference in challenges in agriculture after covid 19 across farmers of different age category.

**Table: 6** Kruskal Wallis test

Challenges Emerged in Agricultural Sector	Mean Rank				Chi Square	p Value
	Below 30	30 - 50	50 - 70	Above 70		
Disturbed entire agriculture supply chain system	554.85	515.09	415.78	202.44	259.273	.000
Shortage of labour	518.23	505.82	405.74	212.43	216.258	.000
Reduced onsite demand due to spread of home delivery network of big dealers	298.99	322.12	406.50	411.85	97.025	.000
Boom in input price and food price	427.03	457.06	334.11	283.14	115.614	.000
Decreased production capacity	502.13	306.96	284.06	167.24	404.275	.000
Reduced purchase power of farmers and customers	593.28	470.01	389.89	265.20	284.821	.000
Decline in average crop Income	447.86	408.76	382.40	362.90	23.386	.000
Drop in procurement price due to reduced demand from institutional buyers	202.27	327.81	426.56	598.36	307.806	.000
Difficulty in raising agro finance	544.71	490.25	339.69	265.74	226.348	.000
Higher dependence on informal credit sources	470.82	433.11	391.75	459.40	141.668	.000

Source: Primary Source

The Kruskal-Wallis test results indicate significant differences ( $p < 0.05$ ) in the challenges faced by farmers of different age groups post-COVID-19. Younger farmers (below 30) experienced the highest disruptions in the supply chain (554.85), difficulty in raising agro finance (544.71), and reduced purchasing power (593.28), highlighting their vulnerability to financial and logistical challenges. Older farmers (above 70) faced the most severe drop in procurement prices (598.36), indicating their struggle with declining market demand. Farmers aged 30-50 encountered moderate challenges across most factors, particularly in informal credit dependence (433.11) and financing difficulties (490.25). Those aged 50-70 ranked highest in onsite demand reduction (406.50) and procurement price drops (426.56), suggesting challenges in adapting to changing market trends. The high Chi-square values confirm that younger farmers struggled more with financial access and supply chain disruptions, while older farmers were more impacted by declining market prices and demand shifts.

## 7. Conclusion

In conclusion, the post-COVID-19 agricultural landscape in India exhibits significant regional and demographic disparities. Western and Southern India have shown greater resilience and adaptation through modernization, commercialization, and farmer entrepreneurship, while Eastern India lags in diversification and institutional support. The challenges vary regionally, with Southern India facing severe supply chain disruptions and labour shortages, Eastern India struggling with financial constraints, Northern India encountering agro-finance difficulties, and Western India experiencing procurement price declines. Age-wise, younger farmers suffered the most from supply chain disruptions and financial constraints, while older farmers faced greater market instability and demand fluctuations. These findings highlight the need for region-specific and age-tailored policy interventions to support farmers in overcoming financial, market, and operational challenges in the post-pandemic era.

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