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Research paper

Exploring The Relationship between Agricultural Production and The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS): Evidence from Aspirational States of India

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Abstract

Growth in the comparatively backward states of India, namely Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar, is essential for the balanced development of the country. Assessing and improving agricultural production is also an important element of economic growth in these states. This study analyses the cropping intensity and gross irrigated area in these states. Furthermore, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is a flagship programme that provides employment and creates the infrastructure in rural India that directly or indirectly boosts the country's rural economy. This study attempts to associate the activities under MGNREGS, like drought-proofing, micro-irrigation work, and land development, with agricultural production. Towards this, the study applies panel data methods on the data for the period 2014-15 to 2020-21. The study finds that land development activities under MGNREGS significantly impact agricultural output, while other activities, namely drought-proofing and micro-irrigation works, have no significant impact on agricultural yield. The study also reports a contentious finding of a negative impact of cropping intensity on agricultural output. Finally, the study advocates diversifying activities under MGNREGS to promote cropping intensity, which positively contributes to the agricultural output.

Keywords: *MGNREGS; Infrastructure Creation; Agricultural Production; Rural Development.*

1. Introduction

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) of India is one of the social welfare rural development programmes enacted in 2005 and implemented on 2nd February 2006. It was the first initiative of this kind in the world that provided adult participants the right base, assured one hundred working days in each financial year, in exchange for their willingness to perform manual labour without training and to build long-term assets in rural areas (MGNREGA Sameeksha, 2012). It is the largest employment-providing scheme worldwide (UNDP, 2015). It is a right-to-work policy providing around two-thirds of the population with an economic safety net (Ranjan, 2016). This is at an expense of 0.8% of the gross domestic product (GDP), where 2.8 billion workdays were provided to individuals and more than 54 million households during the 2009–2010 peak year (Ghose,2015). It was implemented in a phased manner. Two hundred of the nation's most impoverished districts were covered in the first phase between 2006 and 2007. It covered one hundred thirty (130) more districts in the second phase in 2007–2008, and six hundred forty-five (645) rural districts throughout were covered in the last phase in 2008 (NREGA Gazette document,2014).
One of the primary causes of rural underdevelopment is a lack of suitable infrastructure. The development of rural regions can be fostered by constructing basic infrastructure facilities under MGNREGS (Biswas, 2015). MGNREGA impacted the creation of assets and jobs in rural India and showed that the MGNREGA scheme created wage employment opportunities and durable community assets in rural areas of the country. However, it is not satisfactory in employing STs and SCs overall (Mishra,2011). The scheme enhanced the livelihood security of the rural poor through employment generation and the creation of valuable community assets that rival the rural economy (Sonali, 2022). MGNREGA not only provided guarantees of 100 days of employment but also focused on inclusive growth and sustainable assets creation (Harish et al., 2011) as it increased rural earnings and labour participation (Azam, 2012). It also empowered women and the participation of STs and SCs (Khera and Nayak, 2009; Prasad, 2012).

MGNREGA has been identified as critical for enabling more significant rural development by creating sustainable, productive rural assets (Aggarwal et al., 2012; Verma and Shah,2018). The programme operates across rural India, where agriculture is the primary source of employment, but employment opportunities still need to be improved, especially during the non-agricultural season. The most crucial aspect of the scheme reflects his vision of ensuring social and economic justice for all citizens. The scheme has twofold objectives: to enhance livelihood security and create the infrastructure that impacts the agricultural productivity in rural areas of the country. The scheme provides income support to rural households and aims to boost rural infrastructure and improve agricultural productivity in the country. Under MGNREGS, eligible households can demand work through written applications and are government-legally bound to employ within fifteen (15) days (MGNREGA Sameeksha, 2012). Women's participation is actively encouraged within the application's submission, with at least one-third (1/3) of the beneficiaries being women, and schemes promoting gender equality and empowerment of women.

One of the programme's unique features is its emphasis on public accountability and transparency. Social audits allow local communities to review the programme's implementation and ensure that funds are utilized appropriately and that the works undertaken align with the needs and priorities of the beneficiaries. It has impacted the rural economy by reducing poverty in rural India, giving millions of rural people the chance to get employment, strengthening the local government through the involvement of the Panchayati Raj Institution, and promoting sustainable asset creation. MGNREGS plays a crucial role in prompting inclusive growth and empowering rural communities across rural India. The study takes the variables such as drought proofing, micro irrigation work, land development, crop intensity, and gross irrigated area, that is the most influential factors in enhancing productivity in the aspirational states of India, like Uttar Pradesh, Madhya Pradesh, Bihar, and Rajasthan.

Activities like drought-proofing under MGNREGS help in ensuring water conservation and sustainable agricultural practices in drought-prone areas of the country. There are various activities through which drought-proofing and drought relief activities are carried out, such as water conservation structures, watershed development, irrigation infrastructure, afforestation and horticulture, soil improvement, livelihood diversification, social forestry, and monitoring and evaluation, which help to improve drought-proofing areas that contribute to agricultural productivity in rural India. Micro-irrigation work under the MGNREGS is an important scheme that uses sprinkler and drip irrigation to improve the efficiency of water usage in agriculture, improve agricultural productivity, and enhance the livelihood of rural farmers. It has a vital role in providing livelihood in drought-prone areas and water-scarce regions by making agriculture more efficient and sustainable. Land development under MGNREGS is a crucial activity that enhances agricultural productivity, social conservation, and rural livelihoods through various activities such as land levelling, soil conservation, farm ponds, afforestation, rainwater harvesting, and biodiversity conservation land development under MGNREGA makes the land more productive, resilient to climate variation, employing rural people, enhances sustainable land use and enhancing the overall well-being of rural communities by employing rural people.

Gross irrigated area means the total land area that is being supplied with water artificially to support agricultural activities. It indicates the extent to which a region or area is supported by crop cultivation through artificial watering methods. Government and agricultural organisations often take steps to track gross irrigated areas to assess the effectiveness of irrigation infrastructure and water management practices. Increasing gross irrigated areas impacts crop yields, reduces dependency on rainfall, and contributes to food production stability in the region where acute shortages of rainfall occur. Crop intensity measures the degree to which available land is cultivated for crop cultivation in a region or area. Crop intensity provides ideas regarding agricultural productivity and efficiency of a region, helps in crop diversification and optimum land use, and improves overall agricultural productivity.

Traditionally, the five extremely backward states have been referred to as BIMARU states. Economic performance of these 'aspirational' Indian states has been explored by studies like Kumar (2010), Sharma (2015), and Yadav (2017). Similarly, there are studies like Bajpai and Volavka, 2005; Rao, 2009; Kumar et al., 2010; Kumar (2015; Tripathi, 2016; and Mohanty et al., 2017, which studied the agricultural production of Indian states, emphasising the role of inputs and climatic factors. Also, there are studies on the performance of MNREGA, like Aggarwal et al., 2012; Murthy, 2014; Verma and Shah, 2018; Narayan, 2022. The current study feels that there is a literature gap in terms of studies relating agricultural development and MNREGS. The novelty of this study is that it attempts to identify the determinants of agricultural output (particularly non-climatic) for the 'aspirational' states in India and relate them to MNREGS. In the process, it attempts to explore whether the activities done under a social welfare scheme, MNREGS, have any impact on agricultural production. Towards this study proceeds with the following hypotheses:

Ho1: Drought-proofing has no significant impact on agricultural output in the aspirational states of India.
Ho2: Micro irrigation work has no significant impact on agricultural output in the aspirational states of India.
Ho3: Land development activities have no significant impact on agricultural output in the aspirational states of India.
Ho4: Cropping intensity has no significant impact on agricultural output in the aspirational states of India.
Ho5: Gross irrigated area has no impact on agricultural output in the aspirational states of India.

2. Literature Review

Yada (2017), in his research on aspirational/BIMARU states, has highlighted the plight and the reasons for the poor performance of these states. The study examined the BIMARU states' position relative to India's socioeconomic growth and pointed out that among 17 states, Bihar, Uttar Pradesh, and Madhya Pradesh are ranked lowest in socio-economic development, and Rajasthan is ranked as middle socio-economic development. Sharma (2015) investigated whether the BIMARU states are still BIMARU? The study found that BIMARU states have yet to make much progress; still, they remain BIMARU since many indicators show that they are still below the national average. Kumar (2010), in his study on demographic transition in Indian states, found that BIMARU states are traditionally low-growing and perform poorly on different accounts of social and physical infrastructures. Tripathi et.al (2025) studied the agricultural productivity through MGNREGA in India using panel data and found that rural employment schemes enhance agricultural productivity by creating assets like irrigation, land development, and drought-proofing. Such interventions improve cultivated area, yields, and output, making employment and infrastructure key to agrarian growth. Mondal and Roy (2025) found that MGNREGA enhances climate resilience by improving water management, sustainable land use, and biodiversity conservation. Through natural resource management initiatives like water conservation, afforestation, soil conservation, and irrigation, it supports livelihoods and ecological sustainability. Patel (2024) examined MGNREGA and agricultural productivity in India and found that variations in poverty levels are more closely linked to agricultural productivity, primarily resulting from irrigation investments, than to MGNREGA participation or migration intensity. Enhanced irrigation increases cropping intensity and farm output, which raises farm incomes, boosts labour demand, improves rural wages and employment, and ultimately reduces poverty among both landowning and landless households. Roy and Terway (2024) studied the role of MGNREGA among agricultural households in India and found that MGNREGA plays a supportive role in boosting non-farm employment and rural infrastructure to ensure sustainable livelihoods, increase agricultural growth, and reduce rural poverty. Pankaj and Bhattacharya (2022). Studied the income and livelihood promotion through MGNREGS and evaluated the impact of individual assets created under Category-B of MGNREGA on rural incomes and agricultural productivity. Beneficiaries experienced livelihood enhancement, better asset utilisation, and increased income, while communities benefited from improved food security and crop output. Chakraborty (2025) analysed the impact of the employment guarantee scheme on farming efficiency and found that MGNREGA offers crucial income and employment support; it does not directly enhance farm-level technical efficiency, which depends on factors like input access, knowledge, and landholding size. However, its liquidity benefits may offset labour diversion by enabling continued input use or the hiring of additional farm labour. Varshney et.al (2018) studied the impact of MGNREGA on agricultural outcomes and the rural labour market and showed that modest, state- and time-specific changes in cropping patterns, with limited evidence of yield improvements despite MGNREGA's irrigation investments. There is no consistent impact on wages, suggesting MGNREGA did not crowd out casual agricultural labour. Mishra and Mishra (2018) analysed the asset creation under MGNREGA and agricultural growth and found that MGNREGA contributed to agricultural growth through activities like soil conservation, land development, and irrigation. Convergence with programs like sericulture and horticulture has enhanced land productivity and diversified agricultural livelihoods, especially in West Bengal. Esteves (2013) examined the agricultural and livelihood vulnerability reduction through MGNRGA and pointed out that MGNREGA has improved soil, water, and irrigation conditions, boosted crop productivity, and reduced agricultural vulnerability. It also enhances climate resilience and offers environmental co-benefits, supporting sustainable rural livelihoods. Reddy et.al (2014) analysed the impact of MGNREGA on the rural labour market and agriculture and pointed out that effective state- and village-level implementation of MGNREGA, especially when integrated with local planning, boosts employment, asset creation, and agricultural potential. It enhances inclusivity for marginalised groups, reduces hunger and poverty, and strengthens rural labourers' bargaining power through higher wages and better work conditions.

Studies have identified the role of MNREGA in developing rural infrastructure. Kumari et al. (2013) reported that the effect of MGNREGS on the wage rate, food security, and rural-urban migration, and showed that water conservation is the leading activity, subsequently, initiatives for rural connection, irrigation availability, resilience to drought, land development, and flood control. Gnanavelan (2020) investigated MGNREGS's social and economic impact on the Indian economy and found that MGNREGS reduced overall poverty and developed rural India, and recommended that every state needs to monitor the scheme properly. Varman and Kumar (2020) studied the impact of MGNREGS on the consumption expenditure of households and the creation of assets in villages. They found that MNREGS increased participant households' monthly expenses related to per capita consumption and created sustainable rural infrastructures. Panda and Tripathy (2021) conducted a study on the analysis of MGNREGS on rural development. Showed that there is no discrimination of caste, tribe, or gender in the implementation. The average man-days of employment per year increased after joining the scheme. Sahu et al. (2022) examined the effect of the MGNREGS scheme on rural livelihood. According to the study, the MGNREGS scheme improved participants' socioeconomic status through the generation of valuable assets, which made a significant contribution to their capability to maintain their standard of living. Narayan (2022) analysed fifteen years of India's MNREGS and found that it not only provided employment but also empowered women and marginalised groups of people, built up productive assets, and transformed the rural landscape.

Many state-specific studies have also investigated the performance of MNREGA. Murthy (2014) examined the impact of MGNREGS on two selected villages in Karnataka using a social accounting matrix (SAM) and pointed out that public investment in rural infrastructure development made under the Employment Guarantee Act has a feeble multiplier impact on the rural economy. Singh and Dhanai (2015) evaluated the effects of MGNREGS in Uttarakhand's Pauri Garhwal district of Uttarakhand and pointed out that MGNREGS benefited primarily from land and water improvement, including water harvesting and conservation, soil conservation and protection, irrigation provisioning and improvement, renovating traditional water bodies, land development, and drought-proofing. Devi and Nabakumar (2016) found that families in Manipur felt positively about the influence of MGNREGS on village infrastructure development or asset building. Dey (2016) analysed employment creation and asset building through MGNREGA in West Bengal and pointed out that MGNREGA did not provide 100 days of employment and exerted excessive load on the Gram Panchayat, leading to the generation of low-value assets that may not be sustainable in nature. Naikoo and Thakur (2017) studied the impact of MGNREGS among the people of Block Behibag District Kulgam (J&K). The study highlighted that MGNREGS improved the overall quality of life of people, and it provided adequate water supply, adequate irrigation techniques, and suitable construction for the development process of the study block. Mishra and Mishra (2018) found that the scheme performed better in West Bengal in comparison to Odisha in most of the physical assessments, and more than 100 days of employment were generated. Das (2019) examined the effect of MGNREGA on socio-economic and environmental sustainability in West Bengal. The study found that MGNREGA generated employment facilities and changed the socio-economic, political, and ecological setup. It enhanced people's purchasing power, developed rural infrastructure, and created fixed assets that indirectly led to strengthening the rural economy. Krishnan and Premraj (2019) carried out research on whether MGNREGS affected the socioeconomic status of the beneficiaries with a special emphasis on the Tamil Nadu district of Trichy. The study reported that it contributes to the general development of rural areas by improving soil fertility, water availability, afforestation, infrastructure development, and environmental protection, among many other things. It also generates employment opportunities.

Few studies have investigated the performance of MNREGS in aspirational states. Sudarshan and Agrawal (2017) analysed the effect of MGNREGS on the socio-economic upliftment of the beneficiaries in the Chhindwara District of M.P. The study found that MGNREGS had several advantages by generating jobs and contributing to the general development of rural areas. This improves water availability, social forestry, crop production, forestation, infrastructure development, and environmental protection. (Khan and Saxena,2017) Conducted a study in the Uttar Pradesh Pilibhit district, found that MGNREGA positively impacted rural people and rural areas through rural asset creation and employment generation in rural areas.

There are studies on employment creation and asset building through MGNREGS in different states and regions of India. However, there is a literature gap of studies relating a rural area-based activity (MNREGS) to agriculture. Only in one related study, Haque (2011) reported that MNREGS led to the renovation of water bodies like canals and ponds, which augmented the irrigated area, leading to increased agricultural production. More specifically, no such studies are found that show linkages of the MGNREGS variables, such as drought proofing, micro irrigation work, and land development on agricultural production in aspirational states of India like Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar. Therefore, this study explores and examines the effect of MGNREGS's variables on agricultural productivity and suggests recommendations to improve agricultural productivity in the aspirational states of India.

3. Methodology

The study uses a panel of four backwards states of India, namely Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar. These are primarily aspirational states of India. The study plans to analyse the effect of variables such as drought proofing, land development, micro irrigation work, gross irrigated area, and crop intensity from 2014-15 to 2020-21. The data is analysed through STATA 12. Additionally, the study considers drought proofing, land development, micro irrigation work, gross irrigated area, and crop intensity as the independent variables and attempts to check their impact on agricultural productivity in the aspirational states of India. All the data is transformed into log format.

3.1. Data Sources and Sample Construction

MGNREGS's Infrastructure Creation data, such as Drought proofing, Micro irrigation work, and Land development, is taken from the Ministry of Rural Development, Government of India (nreganarep.nic.in). The data on the Agricultural and Allied sector, such as Gross Sown Area, Gross Irrigated Area, and Crop Intensity, is taken from the Reserve Bank of India (rbi.org.in).

3.2. Conceptual Framework Diagram

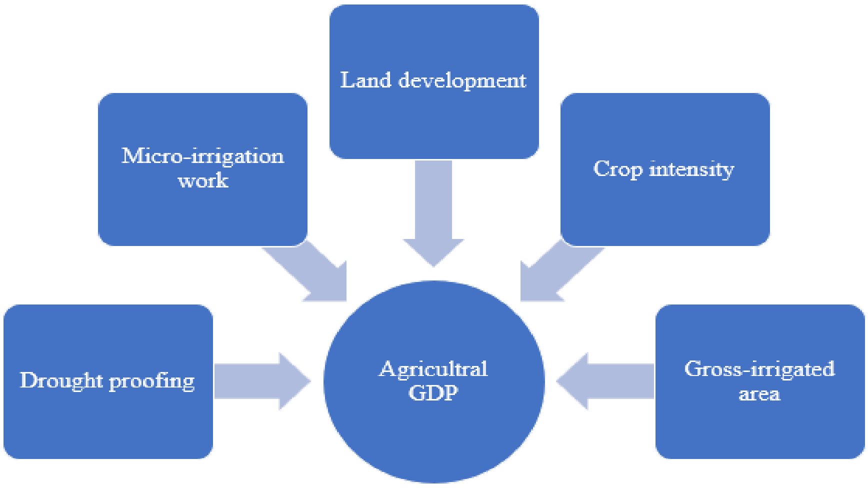

Fig. 1:

Source: Author's illustration

This study used the following variables, namely agricultural GDP, drought proofing, micro-irrigation work, land development, gross irrigated area, and crop intensity, to analyse the effect on agricultural GDP in the states of Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar. Agricultural GDP represents the total value added by the agricultural sector to the national or regional economy. It reflects the economic output of agriculture and allied activities. Drought-proofing Measures and infrastructure are put in place to protect agriculture against drought conditions, such as water harvesting structures, contingency planning, etc. Micro-irrigation work means the use of drip or sprinkler systems that efficiently deliver water to crops, reducing wastage and improving water use efficiency. Land development includes efforts like levelling, bunding, and reclamation to improve land quality and productivity. Crop intensity refers to the number of crops grown on the same piece of land each year. Higher crop intensity generally implies better land utilisation and productivity. Gross irrigated area means the total land area provided with irrigation facilities. More irrigated land typically supports higher yields and reduces crop failures.

3.3. Statistical Modelling

The study uses pooled OLS, Fixed, Random, and Hausman effects. Since the pooled OLS model presumes an absence of any cross-sectional or time series effects, OLS gives accurate and reliable parameters. The general form of the equation is:

$$\gamma_{it} = \beta_0 + \beta_1 DP + \beta_2 MIW + \beta_3 LD + \beta_4 CI + \beta_5 GIA + \mu_{it}$$

where,
Y_{it} = Agricultural GDP, β_1= Drought proofing, β_2= Micro-irrigation work, β_3= Land development, β_4= Crop intensity, β_5= Gross- irrigated area, uit = Error term

The fixed effect model assists in studying the influence of variables on an item. Within the states, it analyzes the relationship between the dependent and independent variables. Each state has unique characteristics that may affect the dependent variable. An increase in land development and gross irrigated area is leading to an increase in agricultural productivity in the aspirational states of India. At the same time, it may lead to a decrease in another state. The fixed effect model seeks to manage the variables that the model assumes can influence the outcome variable within a state. To evaluate solely the net effect of the independent variable on the dependent variable, the model makes an effort to exclude the influence of these time-invariant properties. Furthermore, this approach assumes that the time-invariant characteristics are specific to every state and should not be connected to other aspects. Since every state is unique, there is no correlation between the error terms of one state and those of another. The fixed effect is inappropriate if there is a correlation between the error terms of different entities.

The fixed effect model is of the

$$\gamma_{it} = \beta_0 + \beta X_{it} + \mu_{it}$$

Here, the null hypothesis is; H_O: u1 = 0; H_A: u1 ≠0;
Here F-test looks for all μ_{it} = 0. As the null hypothesis is not accepted, it implies the presence of fixed effects.

The random effect model is subsequently estimated in the study. This model assumes that the fluctuation between states is random and unrelated to the independent variables. When there is a possibility that variations between states will influence the dependent variables, this model is suitable. The intercept term of the fixed effect model included time-invariant features, which are also included in this model. Time-invariant variables can be used to serve as explanatory factors in this model since they additionally imply that the error terms have no relationship with the independent variable.

The random effect model is of the

$$\gamma_{it} = \beta_0 + \beta X_{it} + \mu_{it}$$

The random effect model is appropriate when it is very probable that there are no omitted variables, or even if there are, they do not have a relationship with the independent variables. However, suppose any omitted variables are associated with the model's variables. In that case, the fixed effect model works well with omitted variables because it assumes that the omitted variables' effects will be constant or fixed. To achieve this, time-invariant values and time-invariant effects for the left-out variables must be obtained. Although the random effect model estimates the impact of time-constant variables, the fixed effect model is not effective when the variables do not vary over time because the model does not assess the effect of variables whose values do not change over time. The Hausman test is applied to decide which model is selected because the fixed effect and random effect models are both statistically significant. In this case, the fixed effect model is the alternative hypothesis, and the null hypothesis is that the random effect model is appropriate. Lastly, Pesaran's test of cross-sectional independence is applied to find out whether serial correlation is a problem.

4. Empirical Results

4.1. Descriptive Statistics Analysis

Table 1 below explains that the highest agricultural GDP contribution in Uttar Pradesh is 13545664.5, and the lowest agricultural GDP contribution in Bihar is 3820469. The highest average amount of gross irrigated area in Madhya Pradesh is 12293.86, and the lowest amount of gross irrigated area in Bihar is 5379.571. The highest average amount of crop intensity in Madhya Pradesh is 168.4714, and the lowest amount of crop intensity in Rajasthan is 142.5667. Drought-proofing is the highest in Bihar, at 16835.57, and the lowest amount of drought-proofing is in Rajasthan, at 4225.5. The highest micro irrigation work in Uttar Pradesh is 15828, and the lowest amount of investment is 253.1429. Land development is highest in Uttar Pradesh, with an amount of 59871.83, and the lowest amount of investment in Land development is in Rajasthan, with 3819.5.

Table 1: Descriptive Statistics

Item	Gross Irrigated Area[1]	Cropping Intensity[2]	Drought Proofing[3]	Micro Irrigation Works[4]	Land Development[5]	Agricultural GDP[6]
			Uttar Pradesh			
Mean	21351.4	160.82	16087.83	15828	59871.83	13545664.5
St. Dev	392.88	2.37	3309.91	2883.83	31379.21	1030843.89
Range	799	5.2	7649	8005	68563	2561601
Minimum	20882	157.5	12481	12503	19919	12055193
Maximum	21681	162.7	20130	20508	88482	14616794
			Rajasthan			
Mean	10811.83	142.5667	4225.5	4687.833	3819.5	7756905.83
St. Dev	551.83	5.30	1469.39	822.89	1479.42	542784.49
Range	1618	14.3	4316	2389	4131	1495551
Minimum	10171	138.3	2698	3362	2284	7261760
Maximum	11789	152.6	7014	5751	6415	8757311
			Madhya Pradesh			
Mean	12293.86	168.4714	6430.571	253.1429	22281.57	11329971.3
St. Dev	2395.66	13.28	3401.21	250.08	20112.32	1697752.59
Range	6254	34.2	10185	689	47234	4609372
Minimum	10029	155.1	3316	56	3919	8949745
Maximum	16283	189.3	13501	745	51153	13559117
			Bihar			
Mean	5379.571	144.3	16835.57	7310.857	12816.29	3820469.29
St. Dev	95.69	0.88	15026.58	4026.44	5979.20	243232.71
Range	246	2.2	38570	12188	16079	645999
Minimum	5247	143.3	4242	2291	4354	3525385
Maximum	5493	145.5	42812	14479	20433	4171384

Source: Author's calculation. [1]Thousand hectares, [2]Percentage (%), [3]Work completed, [4]Work completed, [5]Work completed, [6]Thousand

4.2. Pooled OLS

The study uses the panel methods to analyses the data, and the pooled OLS Table 2 below show that drought-proofing is significant at a p-value of approximately 0.001, but the t-value is negative and does not much affect the agricultural productivity in the aspirational states of India like Uttar Pradesh, Madhya Pradesh, Bihar, and Rajasthan, micro irrigation work is significant at a p-value 0.000 but t-value is negative that has lower affects the productivity in aspirational states of India, land development is significant at a p-value approximately 0.001 and t-value is positive which affect the agricultural productivity in the aspirational states of India, crop intensity is significant at p-value at 0.000, and t-value is negative that shows that variable does not affect the productivity in the aspirational states of India due to soil degradation, water distress and pest dieses build up etc., and the gross irrigated area is significant at p-value at 0.000 that impacts the productivity in the aspirational states of India. Overall, land development and gross irrigated area are crucial to agricultural productivity in aspirational states of India.

Table 2: Pooled OLS

Variable	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
DP	-0.07983	0.021334	-3.74	0.001	-0.12433	-0.03532
MIW	-0.07249	0.007578	-9.57	0.000	-0.0883	-0.05668
LD	0.059732	0.014856	4.02	0.001	0.028742	0.090721
CI	-7.46331	0.231566	-32.23	0.000	-7.94635	-6.98027
GIA	1.719292	0.053306	32.25	0.000	1.608098	1.830486
_cons	17.27989	0.192786	89.63	0.000	16.87774	17.68203

Source: Author's calculation.

4.3. Random Effect

The Random Effect model, Table 3 results show that the drought-proofing variable is significant at a p-value of 0.000, and the z-value is negative, showing that it does not have a significant impact on the agricultural productivity in the aspirational states of India, like Uttar Pradesh, Madhya Pradesh, Bihar, and Rajasthan. Micro irrigation work is significant at a p-value of 0.000, and the z-value is negative, which has less effect on the agricultural productivity in aspirational states of India. Land development is significant at a p-value of 0.000, and a positive z-value that shows that the variable affects the agricultural productivity in aspirational states of India. Crop intensity is significant at 0.000, but the z-value is negative and does not affect the productivity in the aspirational states of India due to soil degradation. Water distress and pest diseases build up, etc. The gross irrigated area is significant at a p-value of 0.000, and the z-value is positive, which affects the agricultural productivity in the aspirational states of India.

Table 3: Random Effect

Variable	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
DP	-.079826	.0213341	-3.74	0.000	-.1216402	-0.0380118
MIW	-.072489	.0075783	-9.57	0.000	-.0873422	-0.0576358
LD	.0597315	.0148563	4.02	0.000	.0306136	0.0888494
CI	-7.463308	.2315657	-32.23	0.000	-7.917168	-7.009447
GIA	1.719292	.0533057	32.25	0.000	1.614815	1.823769
_cons	17.27989	.1927861	89.63	0.000	16.90203	17.65774

Source: Author's calculation.

4.4. Fixed Effect

The fixed effect models in Table 4 are appropriate to study variables such as drought proofing, micro irrigation work, land development, and crop intensity for the period 2014-15 to 2020-21, and study the impact of these variables on agricultural productivity in aspirational states of India like Uttar Pradesh, Madhya Pradesh, Bihar, and Rajasthan. The results show that the coefficient for drought proofing (DP) is approximately -0.0383. It has a t-statistic of -1.73 and a p-value of 0.102, indicating that it is not statistically significant at the 0.05 level. Therefore, the effect of DP on agricultural productivity is not significant in the aspirational states of India. The coefficient for Micro irrigation work (MIW) is approximately -0.0690. It has a t-statistic of -1.92 and a p-value of 0.072, which is close to the 0.05 threshold. This suggests that MIW may have no statistically significant effect on agricultural productivity in the aspirational states of India. The coefficient for Land development (LD)is approximately 0.0917. It has a t-statistic of 2.78 and a p-value of 0.013, which is less than 0.05. This indicates that LD is statistically significant, and it has a positive effect on agricultural productivity in the aspirational states of India. The coefficient for Gross irrigated area (GIA) is approximately 1.8927. It has a t-statistic of 6.13 and a p-value of 0.000, indicating that GIA is statistically significant and has a strong positive effect on agricultural productivity in the aspirational states of India. The coefficient for Crop intensity (CI) is approximately -8.2173. It has a t-statistic of -6.16 and a p-value of 0.000, which is much less than 0.05. This suggests that CI is statistically significant, and it hurts agricultural productivity in the aspirational states of India. The results of the fixed effects model are taken as final as the Hausman's test is significant.

Table 4: Fixed Effect Model

Variable	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
DP	-.0382581	.0221324	-1.73	0.102	-.0849532	.0084371
MIW	-.06902	.0359496	-1.92	0.072	-.144867	.006827
LD	.0917002	.033025	2.78	0.013	.0220234	.1613769
CI	-8.217282	1.33296	-6.16	0.000	-11.02958	-5.404982
GIA	1.892682	.308623	6.13	0.000	1.241545	2.54382
_cons	16.64338	.2633674	63.19	0.000	16.08773	17.19904
Hausman test: Chi-square=13.93; p-value = 0.0160						
Pesaran's test of cross-sectional independence =-0.339, Pr = 0.7343						

Source: Author's calculation.

The study goes with the results of the fixed effects model as suggested by the Hausman test. Ho1 regarding drought proofing and Ho2 regarding micro irrigation works having no impact on agricultural output are accepted, whereas Ho3 regarding land development, Ho4 regarding cropping intensity, and Ho5 regarding gross irrigated area having no impact on agricultural output are not accepted. This indicates that, except for drought proofing and micro irrigation works, all the remaining variables, namely land development, cropping intensity, and gross irrigated area, have a significant relationship with agricultural production.

The study reports an unusual finding wherein cropping intensity is negatively associated with agricultural output in these aspirational states. Nevertheless, this could be due to various factors, such as soil degradation, continuous cultivation without allowing the land to fallow or rest, which can result in the deterioration and depletion of soil nutrients, resulting in lower crop yields. Also, pest disease buildup carried on farming the same crops can foster the growth of diseases and pests that harm those particular crops. Further, lower production may come from increased insect and disease pressure. Most important of all, whenever there is a high cropping intensity, there may be an increase in the amount of water that is needed, which could cause crops to experience water stress and lower yields in regions with a limited supply of water. Continuous cultivation without effective resource management, such as the use of fertilisers and organic matter, will deplete essential nutrients in the soil, which will slow down plant development and productivity.

5. Conclusion and Policy Recommendation

The study assesses the impact of variables, such as drought-proofing, micro irrigation work, land development, crop intensity, and gross irrigated area, on agricultural productivity in aspirational states of India, such as Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan. The study shows that the activities of drought-proofing and minor irrigation work done under the scheme of MNREGS have no significant effect on agricultural production in the aspirational states of India. However, land development has a positive effect on agricultural productivity in aspirational states of India. Also, as expected, gross irrigated area affects agricultural output in the aspirational states of India. A contentious finding of this study is that cropping intensity has a detrimental effect on agricultural production in the aspirational states of India. Based on these results, the study recommends integrating rural employment schemes with local agronomic needs to enhance agricultural productivity. Such alignment ensures timely labour support for critical farming operations, reducing underemployment and seasonal distress. It promotes sustainable resource use, climate resilience, and improved farm outcomes. This approach strengthens rural livelihoods and supports long-term agrarian development in India.

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Data are available upon request

Abbreviation

MGNREGS: Mahatma Gandhi National Rural Employment Guarantee Scheme, RBI: Reserve Bank of India

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