JAMEK (JURNAL AKUTANSI MANAJEMEN EKONOMI DAN KEWIRAUSAHAAN)
Vol 06, No 03, Bulan September2026
ISSN 2774-809X(media online)
Hal 519-525

Do Agriculture Input Resources Contribute to Agriculture GDP of India – An Empirical Analysis

Joseph Johns[1], M. Suvakkin[2*]

[1]Research Scholar, Department of Economics, St. Joseph's College (Autonomous), Trichy (Affiliated to Bharathidasan University) Tamil Nadu – 620002
[2]Associate Professor & Head, Department of Economics, St. Joseph's College (Autonomous), Trichy (Affiliated to Bharathidasan University) Tamil Nadu – 620002
Email: [1]josephjohnsvayattattil@gmail.com, [2*]smouldoss@gmail.com
(*: corresponding author)

Abstract

This study analyses secondary data from 1990 - 2024 to analyse the relationship between agricultural inputs and agricultural Gross Domestic Product growth rate in the Indian Economy by using a Multiple Regression Analysis. Agricultural GDP growth rate is used as the dependent variable, and net irrigated area, fertilisers, electricity, rainfall and institutional credit are taken as independent variables. The study finds that variables like fertilisers, rainfall and institutional credit are not statistically significant, which means they do not have a significant impact on agricultural GDP during the data period. The study further reveals that variables like net irrigated area and electricity are statistically significant, and these variables have a significant impact on agricultural GDP during the study period. To promote GDP growth, the focus should be on improving input use efficiency through precision farming, stabilising critical inputs, and implementing risk management strategies. Policymakers should promote modern farming techniques like hydroponics & aeroponics, micro-irrigation, polyhouse & greenhouse automation, and vertical farming.

Keywords: Agricultural GDP, Net Irrigated Area, Fertilisers, Electricity, Rainfall, Regression Analysis

1. INTRODUCTION

The agriculture sector serves as the backbone of the Indian economy and continues to provide employment and livelihood across the country. In the 2023-2024 FY, this sector contributed around 16 per cent to India's total gross domestic product [1]. The agriculture sector achieved a steady average annual growth rate of 5% between FY17 and FY23, revealing strong resilience against various economic and environmental challenges [2]. "According to the Periodic Labour Force Survey (PLFS) for 2023–24, this sector employs 46.1% of the overall workforce in India and 64.6 per cent of the female workforce is engaged in this sector"[3]. This sector serves as a primary source of raw materials for several related industries, including food processing, textiles, biofuels and also provides a market for industrial products, employment opportunities, a significant share in the national income and earns foreign currency through the export of agricultural goods [4]. Indian agriculture has shifted from traditional inputs like human and animal labour, organic manures and indigenous seeds toward modern inputs like high-yield variety seeds, chemical fertilisers, farm machinery, and tubewell irrigation [5,6]. Between 2001–02 and 2017–18, there was a significant increase in the usage of inputs like certified seeds, fertilisers, pesticides, farm equipment, and power [7]. The agricultural output depends on the availability of quality inputs at reasonable prices [8].

Agricultural input factors such as seeds, fertilisers, pesticides, irrigation, crop-sown area, machinery, credit, and labour are important factors that have significantly contributed to increasing agricultural output [9]. The effective and optimal utilisation of these inputs will help to increase the GVA by increasing crop yields, enhancing crop quality, and lowering input costs. Evidence from cross-country panel studies and single-country time series analyses shows that agricultural inputs are proven, statistically significant drivers of agricultural output and GDP. While these inputs are important, their specific effect changes by country, time period, and statistical model [6,10,11]. Even after adjusting for human capital and land-labour ratios, cross-country panel analyses confirm fertiliser, modern seed varieties, and water are important inputs to increases in the production of cereal crops[12].

Numerous studies have examined the impact of these input factors on agricultural GDP and output. The recent slowdown in China's agricultural growth highlights the constraints on land, water, technology, and energy by emphasising that sustained agricultural development depends on increased capital investment, technological

JAMEK (JURNAL AKUTANSI MANAJEMEN EKONOMI DAN KEWIRAUSAHAAN)
Vol 06, No 03, Bulan September2026
ISSN 2774-809X(media online)
Hal 519-525

progress, and optimised input management [13]. In Nigeria, fertiliser supply has a significant impact on agricultural output, with a 1% increase in fertilisers, agricultural output increases by approximately 0.15 per cent[10]. Several inputs have inconsistent effects across research. In India (1980–2016), fertilisers and net irrigated area were not statistically significant, but pesticides and electricity had a negative association with agricultural GDP [6]. In Nepal, fertiliser consumption had a negative relationship and did not have a significant relationship with agricultural GDP, while pesticides had a significant positive effect [14]. This evidence indicates that agricultural inputs collectively drive agricultural GDP growth, but no single input produces uniform results across contexts — the magnitude, direction, and significance of each input depend on local production conditions, input quality, policy design, and the stage of economic transformation [6,11,15].

The implementation of modern technologies such as precision farming, genetically modified seeds, micro-irrigation methods, high-Yielding & disease-resistant crop varieties, and integrated pest management has further enhanced productivity in the agricultural sector [16,17]. The availability of government subsidies and agricultural credit is important for farmers to modernise farming practices, such as adopting machinery, superior seeds, and fertilisers. However, many farmers in developing and underdeveloped countries are unable to get credit for purchasing agricultural inputs [18]. The Indian agriculture sector has undergone a significant transition from traditional farming to modern methods, facing numerous challenges such as disparities in availability and inefficient use of inputs, and environmental concerns like climate change and excessive fertiliser and pesticide use, which affect the steady growth of the agricultural sector.

Furthermore, from the farmer's perspective, securing adequate, high-quality inputs like seeds remains a persistent struggle. Addressing these vulnerabilities requires targeted policy measures that promote balanced, sustainable input usage, improve quality control, and ensure timely distribution. With this backdrop, the study analyses the long-term trends in selected agricultural inputs. Then, this study examines the relationships between agricultural inputs and agricultural GDP growth rate using appropriate statistical and econometric techniques. A multiple regression framework is used to estimate the individual and combined effects of the selected inputs while controlling for the influence of the other variables. The study is expected to provide empirical evidence regarding which agricultural inputs are most strongly associated with agricultural GDP growth rate in India.

2. RESEARCH METHODS

The study concentrates on the Indian agricultural sector as a whole, and the main goal of this study is to examine the impact of agricultural inputs on the agricultural GDP growth rate of the Indian Economy. This study has used secondary data covering the time period from 1990 to 2024. Data were sourced from reputed publications including FAOSTAT, Agricultural Statistics at a Glance (Government of India), RBI, Handbook of Statistics on Indian Economy, Censuses, Economic Surveys, etc for analysis. A multiple regression analysis has been used here to establish a relationship between agriculture GDP growth rate and growth in various agriculture inputs required for the production process. Agriculture input variables used for the study are fertiliser consumption, net irrigated area, rainfall, institutional credit and electricity consumption.

The multiple linear regression model is expressed as:

$$Agriculture\ GDP = \beta_0 + \beta_1 \text{fertilisers} + \beta_2 \text{net irrigated area} + \beta_3 \text{rainfall} + \beta_4 \text{institutional credit} + \beta_5 \text{electricity} + \epsilon$$

Where:

The Agriculture GDP growth rate is the dependent variable, and growth in fertiliser consumption, net irrigated area, rainfall, institutional credit and electricity consumption are taken as independent variables.

β_0 = Constant term (Unit/% change in agriculture GDP when all independent variables are equal to zero.
β_1 = Unit % change in agriculture GDP due to 1 unit/% increase in fertilisers.
β_2 = Unit % change in agriculture GDP due to 1 unit/% increase in net irrigated area.
β_3 = Unit % change in agriculture GDP due to 1 unit/% increase in rainfall.
β_4 = Unit % change in agriculture GDP due to 1 unit/% increase in institutional credit.
β_5 = Unit % change in agriculture GDP due to 1 unit/% increase in electricity.
ϵ = Error term (residual)

Here Error term (ϵ) represents all the other input factors that have not been included as independent variables due to the unavailability of data in the given period, but they have an impact on the dependent variable.

So, as a researcher, in order to prevent omitted variable bias, we should reduce the error term by taking as many control variables as possible, which in turn will give us accurate and unbiased results. Here in our paper, we have dealt with the error term by taking more control variables that have impacts on the dependent variable (Agriculture GDP), which will improve our prediction, reduce our error term, make it close to zero, and avoid the problem of omitted variable bias.

3. ANALYSIS AND DISCUSSION

3.1 India's Position in World Agriculture in 2022

Table 1. India's Position in World Agriculture in 2022

Item (1)	India (2)	World (3)	% Share (4)	India's Rank (5)	Next to (6)
1. Area (Million Hectares)					
Total Area	328.73	14085.41	2.33	Seventh	Russian Federation, Canada, U.S.A., China, Canada, Brazil, Australia
Land Area	297.32	13015.16	2.28	Seventh	Russian Federation, Canada, U.S.A., China, Canada, Brazil, Australia
Arable Land	154.45	1383.84	11.16	First	
2. Crop Production (Million Tonnes)					
(A) : Total Cereals	362.47	3073.69	11.79	Third	China, U.S.A
Wheat	107.74	811.38	13.28	Second	China
Rice (Paddy)	203.62	788.93	25.81	Second	China
(B) : Pulses	27.62	96.04	28.75	First	-
(C): Oilseeds					
Groundnut(excluding shelled)	10.13	55.05	18.41	Second	China
Rapeseed	3.45	26.69	12.92	Fourth	Germany, Canada, China
(D): Commercial Crops					
Sugarcane	439.42	1925.5	22.82	Second	Brazil
Tea	6.23	30.89	20.16	Second	China
Coffee (green)	0.34	10.73	3.17	Seventh	Brazil, Vietnam, Indonesia, Colombia, Ethiopia, Peru
Jute	1.76	3.79	46.38	Second	Bangladesh
Tobacco Unmanufactured	0.76	5.77	13.23	Second	China

Source: Agricultural Statistics at a glance 2024 - 2025 [19].

Table 1 summarises India's global position in agriculture for the year 2022, detailing land area and crop production yields. India is the largest producer of pulses in the world and ranks seventh overall in total land area at 328.73 million hectares and holds the first position globally for arable land with 154.45 million hectares. In addition, the country ranks second among major producers of wheat and rice behind China. The country ranks second after Bangladesh in jute production while standing 2nd in tea and Tobacco production behind China and for sugarcane, second after Brazil.

3.2 Trends in Agricultural Inputs

In the agriculture sector, inputs are important for successful crop production and overall farm productivity. Agricultural inputs include seeds, fertilisers, irrigation, pesticides, farm machinery and equipment, electricity and agricultural credit. Over the years, India's net sown area has shown fluctuations, increasing from 140.79 million hectares in 2011–12 to 141.96 million hectares in 2022–23. These changes are influenced by market demand, climatic conditions and farming choices. On the other hand, the net irrigated area has shown an upward trend, increasing from 20.9 million hectares in 1950-1951 to 66.01 million hectares in 2011- 12 and then 79.31 million hectares in 2022-23. This increase signifies ongoing efforts to improve irrigation infrastructure and expand water availability for agriculture.

The use of fertilisers in the Indian agriculture sector has received a boost after the introduction of the High-Yielding Varieties Programme in 1966. The consumption of fertilisers increased from 66,000 tonnes in 1952-1953 to 125.46 lakh tonnes in 1990-1991, and fertiliser consumption increased to 273.75 lakh tonnes in 2018–19. The increase during 2018–19 suggests farmers aimed to boost crop yields for rising food demand

The consumption of fertilisers increased from 293.69 lakh tonnes in 2019–20 to 325.36 lakh tonnes in 2020–21. This spike can be attributed to food security concerns during the COVID pandemic, government initiatives like increasing the availability of fertilisers and subsidies, and adoption of high-yielding crop varieties which need more fertilisers. The consumption of fertilisers reduced slightly to 297.96 lakh tonnes in 2021–22 and stabilised at 298.44 lakh tonnes in 2022–23. This stabilisation reflects a return to pre-pandemic or typical agricultural practices with potential challenges in availability and costs of fertilisers. Pesticide consumption in India fluctuated between 2011–12 and 2021–22, starting at 52.98 thousand tonnes, dropping briefly to 45.62 thousand tonnes in 2012-13, and then peaking near 63.4 thousand tonnes in 2013-14 due to intense crop management. However, Pesticide consumption reduced to 52.47 thousand tonnes in 2022–23 due to proper awareness about the adverse effects of chemical pesticides and safer agricultural practices.

Quality seed availability in the agriculture sector shows a steady upward trend from 294.85 Lakh Quintals (2011-12) to 445.11 Lakh Quintals (2022-23). Due to seed modernisation by hybrid/high-yield varieties that boosted productivity without area expansion. The trends in actual rainfall in India from 2011-12 to 2022-23 have fluctuations that have an impact on agricultural productivity and water resource management. The food grain production has tripled from 872 kgs per hectare in 1970-1971 to 2601kgs per hectare in 2024-2025. This increasing trend shows the improvements in seed varieties, irrigation, and fertiliser usage. The production of wheat, rice, maize and cotton has increased significantly from 1970-71 to 2024-25 due to the adoption of hybrid varieties and Bt cotton in recent years.

3.3 Strengthening India's Agricultural Policy

The Indian government has launched multiple schemes aimed at improving agricultural productivity and ensuring farmer welfare, in alignment with the recommendations put forth in the Doubling Farmers' Income (DFI) Report 2016. The report emphasised critical strategies aimed at improving crop and livestock yields, increasing cropping intensity, and transitioning toward high-value agricultural commodities [1]. The Minimum Support Price (MSP) is used by the Government to protect agricultural producers from sharp price drops. The 2018 MSP reform improved price assurance by setting MSP at 1.5 times the cost of production. Between 2014 and 2026, the total MSP value was Rs. 26.32 lakh crore. This was Rs. 7.41 lakh crore from 2004 to 2014, which was 3.5 times more than the previous decade. This growth shows the market support for farmers.[20]

Public procurement expanded significantly with MSP support. This supports farmers by purchasing crops such as wheat, rice, pulses, etc at MSP rates. Total procurement increased from 698.7 million tonnes during 2004-2014 to 1,229.2 million tonnes during 2014-2026. This recorded a growth of about 76 per cent[20]. However, results show that MSP benefits are mostly concentrated in some states and among farmers who cultivate particular crops, such as rice and wheat.[21]

Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) provides direct income support to farmers and has improved cash flow for smallholders. Under this Scheme, more than Rs.4.47 lakh crore is transferred to the farmers' bank accounts in 23 instalments[20]. Nonetheless, difficulties such as exclusion errors, improper land records, and bureaucratic roles have limited its full potential. The e-NAM (e- National Agriculture Market) provides a unified electronic platform for trading agricultural products. This has been implemented to encourage the adoption of innovative agricultural technologies and improve price discovery mechanisms. Over 1.80 crore farmers and 4,724 FPOs were enrolled as of March 2026, and 1,656 mandis had been merged[20]. This market enables direct payments and transparent prices for farmers. However, its impact has been reduced by low digital literacy, lack of infrastructure, and limited involvement from traditional mandis. Overall, with the partial success of policy reforms, issues related to implementation, awareness, and regional disparities remain a challenge [21].

3.4 Descriptive and Empirical Analysis

Table 2. Descriptive Statistics of agricultural GDP growth and input variables

Variable	Mean	Std. Deviation	Minimum	Maximum
Agricultural GDP Growth Rate	0.112	0.051	-0.031	0.222

Fertilizer	0.033	0.058	-0.1	0.129
Net Irrigated Area	0.017	0.024	-0.053	0.059
Rainfall	0.012	0.113	-0.17	0.293
Institutional Credit	0.179	0.107	-0.049	0.448
Electricity	0.055	0.056	-0.068	0.164

Source: Computed Data

Table 2 summarises the descriptive statistics for the variables analysed over the 35 years from 1990 to 2024 ($N = 35$). The average Agricultural GDP Growth Rate was 11.2% ($M = 0.112, SD = 0.051$), fluctuating between a minimum of -3.1% and a maximum of 22.2%. Among the Independent variables, institutional credit have the highest mean annual growth rate at 17.9% ($M = 0.179, SD = 0.107$), while Rainfall have the highest volatility ($SD = 0.113$). Net Irrigated Area showed the most stable trajectory ($SD = 0.024$) with a mean growth rate of 1.7%. Normality was evaluated and confirmed for all variables using skewness and kurtosis, and all values fall within the acceptable threshold value of ± 2.0.

Table 3. Multiple Linear Regression Analysis Predicting Agricultural GDP Growth Rate

Source	**Sum of squares**	**Degrees of freedom**	**Mean sum of squares**	**Number of observations = 35**
Model	0.042	5	0.008	$F(5,29) = 5.274$
Residual	0.046	29	0.002	Probability > F = 0.001
Total	0.088	34		R-squared = 0.476
Variables	Coefficient B	Std. Error	t-value	p-value
Constant	0.077	0.016	4.864	< .001
Fertilizer	-0.014	0.128	-0.107	0.916
Net Irrigated Area	0.852	0.346	2.461	0.020
Rainfall	0.106	0.067	1.575	0.126
Institutional Credit	-0.004	0.066	-0.060	0.953
Electricity	0.352	0.127	2.780	0.009

Note: Model $R^2 = 0.476$, *Adjusted* $R^2 = 0.386$, $F(5,29) = 5.274, p = 0.001$, *Durbin-Watson* $= 1.552$.

A multiple linear regression was conducted to examine the impact of fertiliser, net irrigated area, rainfall, institutional credit, and electricity growth on Agricultural GDP Growth Rate ($N = 35$). The regression model was statistically significant, accounting for 47.6% of the variance in Agricultural GDP growth rate ($R^2 = 0.476$, Adjusted $R^2 = 0.386, F(5,29) = 5.274, p = 0.001$). The Durbin-Watson statistic of 1.552 shows that there is no severe autocorrelation among residuals. In the Robustness Tests, all the Variance Inflation Factor (VIF) values ranged from 1.071 to 1.423. This leads to the conclusion that the regression model is not affected by multicollinearity and independent variables are not at all related to one another in a linear fashion.

The study further reveals that Net Irrigated Area ($\beta = 0.395, t = 2.461, p = 0.020$): and electricity ($\beta = 0.388, t = 2.780, p = 0.009$): are statistically significant, and it is inferred that these variables have a significant impact on agricultural GDP during the data period. Due to a one percentage point increase in electricity use, agricultural GDP increases by 0.352 percentage. Due to a one percentage point increase in net irrigated area, agricultural GDP increases by 0.852 percentage points, and rainfall and electricity have a positive impact on GDP. The fertilisers ($p = 0.916$), rainfall ($\beta = 0.236, p = 0.126$) and institutional credit ($p = 0.953$) are not statistically significant, which shows that they do not have a significant impact on agricultural GDP during the time period. Institutional credit and fertilisers have a negative relationship with agricultural GDP.

The regression analysis suggests that physical agricultural inputs like fertilisers, rainfall, electricity, etc have immediate output or productivity. When compared with institutional credit, which provides financial support to farmers, the availability of credit to farmers does not guarantee an increase in the productivity of agriculture sector.

4. IMPLEMENTATION

The government can intervene in the workings of the agricultural sector from the input and output side. Policymakers may focus on infrastructural developments like solar-powered agricultural pumps, micro irrigation techniques, smart metering and also should focus on improving agricultural input efficiency by promoting precision agriculture techniques, which optimise input usage and reduce waste, thereby enhancing productivity while reducing costs. Implementing risk management strategies, such as crop insurance and weather-indexed insurance products, can help farmers reduce the impacts of fluctuations in rainfall and electricity consumption. However, over-reliance on agricultural inputs may lead to environmental degradation, highlighting the importance of balancing agricultural productivity with environmental sustainability [22].

Implementing educational programmes for farmers on the efficient use of agricultural inputs can improve their knowledge and farming practices. However, poverty may constrain access to educational opportunities, particularly among economically vulnerable populations, highlighting the importance of addressing educational barriers alongside agricultural development interventions [23-24]. Increased investment in agricultural research and development is very important for innovation that can improve crop yields while ensuring sustainability. Collaborative efforts between public and private sectors can make advancements in high-yield varieties (HYVs), pest-resistant crops, and efficient irrigation methods. Artificial Intelligence in farming has an important role in Smart Irrigation and Water Management, Detection of Early Pests and Diseases.

5. CONCLUSION

From the above discussion, it can be concluded that variables like net irrigated area and electricity are statistically significant, and these variables have a significant impact on agricultural GDP during the study period 1990-2024. This result shows that policymakers should promote modern farming techniques like hydroponics & aeroponics, micro-irrigation, polyhouse & greenhouse automation, and vertical farming. The study further reveals that variables like fertilisers, rainfall and institutional credit are not statistically significant, which means they do not have a significant impact on agricultural GDP during the time period. Institutional credit has a negative relationship with agricultural GDP, which shows that credit may be diverted for non-agricultural use, possibly due to lack of access and distribution gaps, and the effect of credit investment on agricultural output may impact in the long run. In the case of fertilisers, the negative relationship explain that over use of fertilisers. The heavy overuse of fertilisers may cause soil damage, an increase in costs, and a decrease in crop production over the period of time.

REFERENCES

[1] Ministry of Finance. (2025). Agriculture and food management (Chapter 9). In *Economic Survey 2024–25*. Department of Economic Affairs, Government of India.
https://www.indiabudget.gov.in/budget2025-26/economicsurvey/doc/eschapter/echap09.pdf.

[2] Ramesh Chand and Jaspal Rana, “Performance of Agriculture Sector 2014-24: Implications for Short-and Medium-term Strategy”, Economic and Political Weekly, September 2024, 59(39):70-73.

[3] Ministry of Statistics and Programme Implementation. (2024). *Annual report: Periodic Labour Force Survey (PLFS) (July 2023 – June 2024)*. Government of India, National Sample Survey Office.
https://www.mospi.gov.in/sites/default/files/publication_reports/AnnualReport_PLFS2023-24L2.pdf.

[4] Shareya, Sharma DD and Sharma V. 2024. Role of agriculture and allied sectors in Indian Economy: Some Challenges. International Journal of Multidisciplinary Research, 10(3): 164-166.

[5] Srivastava, S., Chand, R., & Singh, J. (2017). Changing Crop Production Cost in India: Input Prices, Substitution and Technological Effects. *Agricultural Economics Research Review*, *30*, 171-182. https://doi.org/10.5958/0974-0279.2017.00032.5

[6] Reddy, T., & Dutta, M. (2018). Impact of Agricultural Inputs on Agricultural GDP in Indian Economy. *Theoretical Economics Letters*, *08*, 1840-1853. https://doi.org/10.4236/tel.2018.810121

[7] Pathania, A., Chaudhary, R., & Kumar, K. (2020). Analysis of Agriculture Input Consumption by Indian Farmers. *International Journal of Economic Plants*. https://doi.org/10.23910/2/2020.0369

[8] Kavya, C., Shree, K., & Nagaraja, G. (2015). Indian agro input industry. *International Journal of Commerce and Business Management, 8*, 244-250. https://doi.org/10.15740/has/ijcbm/8.2/244-250

[9] Zeng, S., Qi, B., & Wang, M. (2022). Agricultural Insurance and Agricultural Economic Growth: The Case of Zhejiang Province in China. *International Journal of Environmental Research and Public Health*, *19*(20), 13062. https://doi.org/10.3390/ijerph192013062
[10] Opeyemi, G., Olusegun, S., Taiwo, A., & Mobolaji, A. (2021). Impact of Agricultural Input Supply on Agricultural Growth in Nigeria. *Journal of Applied Sciences and Environmental Management*. https://doi.org/10.4314/jasem.v25i7.30
[11] Osinowo, O. H., Tolorunju, E. T., & Osinowo, I. M. (2021). Drivers of agricultural productivity: Evidence from transforming economies. *Agricultura Tropica et Subtropica*, *54*, 14 - 23. https://doi.org/10.2478/ats-2021-0002
[12] McArthur, J., & McCord, G. C. (2014). Fertilizing growth: Agricultural inputs and their effects in economic development. *Journal of Development Economics*, *127*, 133 - 152. https://doi.org/10.1016/j.jdeveco.2017.02.007
[13] Zhao, M., Chen, Z., Zhang, H., & Xue, J. (2018). Impact Assessment of Growth Drag and Its Contribution Factors: Evidence from China's Agricultural Economy. *Sustainability*, *10*(9), 3262. https://doi.org/10.3390/su10093262
[14] Ghimire, S., & Dhakal, A. (2021). Effects of Agricultural Inputs Use on Agricultural Productivity in Nepal: An Empirical Study. *International Journal of Agricultural Economics*. https://doi.org/10.11648/j.ijae.20210605.12
[15] Abate, M.-C., Cai, B., Albert, T., Woldemariam, A., Zeng, R., Addis, A. K., Long, W., & Mekonen, M. K. (2025). Do agricultural input resources contribute to economic growth in China? A dynamic ARDL simulation approach. *Frontiers in Sustainable Food Systems*. https://doi.org/10.3389/fsufs.2025.1619447
[16] Gawande , V., Saikanth , D. R. K., Sumithra, B. S., Aravind , S. A., Swamy , G. N., Chowdhury , M., & Singh , B. V. (2023). Potential of Precision Farming Technologies for Eco-Friendly Agriculture. *International Journal of Plant & Soil Science*, *35*(19), 101–112. https://doi.org/10.9734/ijpss/2023/v35i193528
[17] Marimuthu, S., Vanitha, C., Surendran, U., El-Hendawy, S., & Mattar, M. A. (2024). Conception of Improved Blackgram (*Vigna mungo* L.) Production Technology and its Propagation among Farmers for the Development of a Sustainable Seeds Production Strategy. *Sustainability*, *16*(11), 4750. https://doi.org/10.3390/su16114750
[18] Khan, F. U., Nouman, M., Negrut, L., Abban, J., Cismas, L. M., & Siddiqi, M. F. (2024). Constraints to agricultural finance in underdeveloped and developing countries: a systematic literature review. *International Journal of Agricultural Sustainability*, *22*(1). https://doi.org/10.1080/14735903.2024.2329388
[19] Directorate of Economics and Statistics. (2024). *Agricultural statistics at a glance 2024–25*. Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.
[20] Press Information Bureau. (2026, June 5). *Empowering India's Annadatas* (PRID No. 2269182). Ministry of Information and Broadcasting, Government of India. https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2269182&reg=6&lang=1
[21] Gupta, V., Verniz, D. M., & Vashishtha, S. (2025). Impact of agricultural sector on the Indian economy. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, *13*(4), 2862–2867. https://doi.org/10.22214/ijraset.2025.68781
[22] Anas, K. T., & Natarajamurthy, P. (2025). Exploration of the nexus between economic development and environmental sustainability from theory to practice: A review. *South Asian Journal of Social Studies and Economics*, *22*(9), 33–43. https://doi.org/10.9734/sajsse/2025/v22i91137
[23] Alamelu, M. D., & Revathy, V. (2022). Impact of Poverty on Education in India. *International Journal of Health Sciences*, *6*(S1), 698-707. https://doi.org/10.53730/ijhs.v6nS1.4803
[24] Radhika, M., & Revathy, V. (2020). An assessment of India's path toward achieving Sarva Shiksha Abhiyan (SSA): A view. *International Journal of Management (IJM)*, *11*(11). https://iaeme.com/Home/article_id/IJM_11_11_408 https://doi.org/10.17605/OSF.IO/W85QN