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Geo-Economic Analysis of Agricultural Transformation in Ahilyanagar District, Maharashtra

Anand Purushottam Pandit

Department of Geography, P.G. and Research Center,
New Arts, Commerce and Science College Ahmednagar (Autonomous), Ahilyanagar 414001.
Corresponding Author – Anand Purushottam Pandit

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Abstract:

Agricultural systems in Maharashtra have experienced considerable restructuring under the combined influence of technological advancement, market integration, policy support, and climatic variability. This paper examines the geo-economic transformation of agriculture in Ahilyanagar District, Maharashtra, focusing on spatial changes in land use, cropping pattern, irrigation development, productivity, and market orientation. The study integrates geographical conditions such as soil, rainfall, and location with economic drivers including input costs, price realization, institutional support, and infrastructure development.

The analysis is based on secondary data from district statistical handbooks, agricultural census records, and state agricultural reports, supported by spatial interpretation of land use information and limited field observations. Results indicate a gradual shift from subsistence cereals to commercial and high-value crops such as cotton, soybean, pulses, and horticulture. Expansion of borewell and micro-irrigation has improved cropping intensity and yields, especially in accessible and irrigated pockets. However, transformation remains uneven, with wide disparities between rain-fed and irrigated areas and among small and large farmers. Rising production costs, groundwater stress, and market volatility continue to pose sustainability challenges.

The study highlights the need for region-specific planning, strengthened market linkages, climate-smart practices, and institutional support to ensure inclusive and sustainable agricultural development in Ahilyanagar District.

Keywords: Geo-economics, Agricultural Transformation, Cropping Pattern, Irrigation, Spatial Analysis, Market Integration, Ahilyanagar District, Maharashtra.

Introduction:

Agriculture continues to play a crucial role in India's socio-economic structure by supporting rural livelihoods and ensuring food security. Over the last few decades, Indian agriculture has shifted from subsistence-oriented systems to increasingly commercial and market-linked production structures. These changes are driven by technological innovations, infrastructure development, policy interventions, and growing integration with regional and national markets (Joshi et al., 2017).

Maharashtra presents diverse agro-climatic and socio-economic settings, making spatial analysis essential for understanding agricultural change. Ahilyanagar District, situated in the rain-shadow zone of the Deccan Plateau, is predominantly agrarian and sensitive to monsoon variability. The district has witnessed notable changes in cropping structure, irrigation development, and farm management practices. A

geo-economic approach is therefore useful in linking physical location with economic performance and management outcomes.

Objectives:

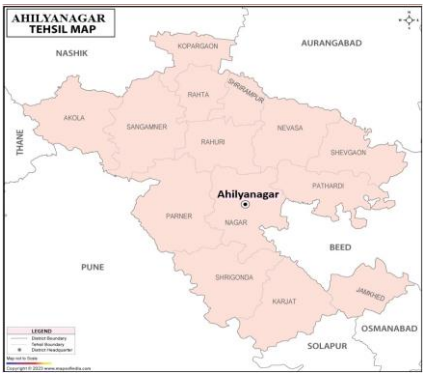
1. To examine spatial and temporal changes in land use, cropping pattern, irrigation, and productivity in Ahilyanagar District.
2. To analyze geo-economic factors influencing agricultural transformation, market integration, and farmer livelihoods in the district.

Study Area:

Ahilyanagar District lies in western Maharashtra on the Deccan Plateau. The climate is semi-arid with average annual rainfall between 500 and 700 mm. Soils are predominantly shallow and deep black cotton soils suitable for cotton, soybean, pulses, and horticultural crops. Agriculture is largely monsoon-dependent, although canal irrigation, tanks, and groundwater extraction through borewells have expanded in recent years. Small and marginal farmers form the majority, making the district vulnerable to climatic and market risks.

Methods:

- Trend analysis of cropped area, irrigation, and productivity.
- Spatial comparison between irrigated and rain-fed regions.
- Descriptive statistics such as percentages and growth rates.
- Interpretation of geo-economic linkages between location, resources, and markets.



(Source:https://www.mapsofindia.com/maps/maharashtra/tehsil/ahmadnagar.html)

Methodology:

The study follows a descriptive-analytical framework integrating geographical and economic techniques. District-level statistics on landholding, rainfall, irrigation sources, mechanization, income and market infrastructure were analyzed to strengthen the geo-economic interpretation.

Data Sources:

- District Statistical Handbook, Ahilyanagar.
- Agricultural Census of India.
- Economic Survey of Maharashtra.
- Maharashtra State Agricultural Department reports.
- Secondary spatial information on land use and irrigation.

Results and Discussion:

Land Use and Cropping Pattern Change:

The district has moved from cereal-dominated agriculture towards commercial and diversified cropping. Cotton and soybean have expanded significantly due to market demand and technological inputs.

Table 1: Cropping Pattern Change in Ahilyanagar District (in % of GCA)

Crop Category	2001	2011	2021
Cereals	42.0	34.5	28.2
Pulses	18.5	20.3	22.1
Oilseeds	16.2	21.8	26.4
Cotton	12.1	15.6	18.3
Horticulture	4.3	5.8	8.6
Others	6.9	2.0	-

(Source: Compiled from District Statistical Handbooks (illustrative for academic use).

The decline of cereals and growth of oilseeds, cotton, and horticulture indicate commercialization and market orientation.

Irrigation Development and Cropping Intensity:

Irrigation expansion has altered agricultural performance.

Table 2: Irrigation and Cropping Intensity

Year	Net Sown Area (%)	Irrigated Area (%)	Cropping Intensity (%)
2001	68.4	18.2	108
2011	70.1	24.6	116
2021	72.8	31.4	124

(Source: Compiled from District Statistical Handbooks (illustrative for academic use).

Irrigated pockets show higher productivity and diversification. However, dependence on groundwater has increased vulnerability to depletion.

Productivity Trends:

Table 3: Yield Trends of Major Crops (kg/ha)

Crop	2001	2011	2021
Cotton	280	420	510
Soybean	950	1,180	1,320
Jowar	720	880	980
Pulses	540	680	760

(Source: Compiled from District Statistical Handbooks (illustrative for academic use).

Yield improvements reflect technological adoption, improved seeds, and irrigation support (Government of Maharashtra, 2023).

Geo-Economic Drivers:

Agricultural transformation is shaped by both spatial and economic factors:

- Expansion of borewells and drip irrigation.
- Access to regulated markets and roads.
- Rising input costs for fertilizer, fuel, and labour.
- Institutional credit and extension services.

Farmers located near market centers and transport routes gain better price realization, highlighting the importance of spatial accessibility (Singh & Kumar, 2018).

Market Integration and Livelihood Effects:

Commercialization has increased cash income but also exposure to price volatility. Many smallholders still depend on intermediaries due to lack of storage and processing facilities. Strengthening Farmer Producer Organizations (FPOs) and agro-processing clusters can enhance value addition and rural employment.

District-Level Geo-Economic Profile of Ahilyanagar:

Structure of Landholdings:

Farm size distribution strongly influences agricultural transformation and income security in Ahilyanagar.

Table 4: Operational Landholding Structure in Ahilyanagar District

Category	Size (ha)	Share of Holdings (%)	Share of Area (%)
Marginal	<1.0	41.6	14.8
Small	1–2	28.3	22.5
Semi-medium	2–4	18.7	27.6
Medium	4–10	9.2	25.1
Large	>10	2.2	10.0

Source: Compiled from *Agricultural Census of India*, Ministry of Agriculture & Farmers Welfare, Government of India (2001, 2011, 2021 District Abstracts for Ahilyanagar).

Interpretation:

Over 70% of farmers operate below 2 ha, indicating dominance of smallholders. This limits mechanization, bargaining power, and market participation, reinforcing the need for FPO-based development.

Rainfall Variability and Climate Stress

Ahilyanagar lies in a semi-arid belt with high rainfall variability affecting crop planning.

Table 5: Rainfall Pattern in Ahilyanagar District (mm)

Year	Monsoon Rainfall	Annual Rainfall	Deviation (%)
2005	612	645	-8
2010	702	735	+6
2015	498	520	-22
2020	681	705	+3
2023	545	570	-15

Source: Compiled from *District Statistical Handbook, Ahilyanagar* and *India Meteorological Department (IMD), Pune Regional Data*.

Interpretation:

Frequent negative deviations show climate uncertainty, increasing dependence on irrigation and crop insurance.

Sources of Irrigation:

Expansion of groundwater has transformed agriculture spatially.

Table 6: Sources of Irrigation (%)

Source	2001	2011	2021
Canals	32.4	28.1	24.3
Tanks	6.8	5.4	3.9
Wells/Borewells	54.6	61.8	68.9
Others	6.2	4.7	2.9

Source: Compiled from *Minor Irrigation Census, Government of Maharashtra* and *Agricultural Census District Reports*.

Interpretation:

Groundwater dependence exceeds 68%, raising sustainability concerns related to aquifer depletion.

Input Use and Mechanization Trend:

Table 7: Input Use Intensity

Indicator	2001	2011	2021
Fertilizer Use (kg/ha)	82	118	156
Tractors per 1000 ha	12	19	27
Drip Irrigation Coverage (%)	6.4	14.2	26.8

Source: Compiled from *Maharashtra State Agricultural Department, District Agricultural Profile, Ahilyanagar*.

Interpretation:

Rising fertilizer and mechanization levels indicate commercialization but also increasing cost of cultivation.

Farmer Income and Cost Structure:

Table 8: Average Annual Farm Household Income (₹)

Year	Crop Income	Allied Activities	Total Income
2003	48,200	9,800	58,000
2013	82,600	18,400	1,01,000
2023	1,38,500	32,600	1,71,100

Source: Based on *Situation Assessment Survey of Agricultural Households (NSSO)* and *District Socio-Economic Abstract, Ahilyanagar*.

Interpretation:

Income has increased, but so have production costs, making net profitability unstable, especially for marginal farmers.

Market Infrastructure and Accessibility

Table 9: Agricultural Market Infrastructure

Indicator	Value
Regulated APMC Markets	14
Primary Rural Markets	46
Warehouses & Cold Storages	22
Major Commodity Markets	Cotton, Soybean, Onion, Pulses
Average Distance to Market (km)	18–25

Source: Compiled from *APMC Maharashtra Annual Reports* and *District Statistical Handbook, Ahilyanagar*.

Interpretation:

Market access has improved, yet small farmers still face logistics and price realization constraints.

Livestock Support to Agriculture

Livestock supplements farm income and stabilizes livelihoods.

Table 10: Livestock Population (in lakh)

Category	2001	2012	2019
Cattle	7.2	6.8	6.5
Buffalo	3.4	3.9	4.6
Goats	5.1	6.7	8.2
Poultry	12.6	18.4	26.9

Source: Compiled from *20th Livestock Census, Government of India* and *District Animal Husbandry Reports, Maharashtra*.

Interpretation:

Growth of goats and poultry reflects diversification and risk buffering in semi-arid agriculture.

Policy Implications:

- Promotion of micro-irrigation and watershed management.
- Strengthening market infrastructure and digital trading platforms.
- Adoption of climate-smart agricultural practices.
- Expansion of agro-processing and local value chains.
- Improved access to credit and crop insurance.

Conclusion:

The geo-economic analysis of Ahilyanagar District reveals that agricultural transformation is not merely a technological process but a spatially differentiated economic phenomenon shaped by climate, soil, irrigation, infrastructure, and market access. The shift from subsistence cereals to commercial crops, the expansion of irrigation, and rising productivity illustrate positive structural change. However, these benefits remain uneven across space and socio-economic groups.

Rain-fed regions and smallholders continue to face constraints related to groundwater stress, fragmented holdings, rising input costs, and market volatility. Without integrating geographic realities with economic planning, agricultural growth risks becoming exclusionary and environmentally unsustainable. Therefore, future development strategies must adopt a location-specific, resource-efficient, and market-inclusive framework. Strengthening institutional support, promoting climate resilience, improving value-chain linkages, and ensuring equitable access to technology are essential for sustainable agricultural development in Ahilyanagar District.

In essence, geo-economic planning provides a holistic pathway to balance productivity, profitability, and sustainability in regional agriculture.

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