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A Changing Climate and Maharashtra's Economy an Analysis of Agriculture, Regional Risk, and Public Finance

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Abstract

Climate change has emerged as one of the major challenges affecting economic development, agricultural sustainability, regional stability, and public financial management. Maharashtra, with its diverse agro-climatic conditions, varied geographical characteristics, and significant dependence on agriculture, is particularly vulnerable to climate-related risks such as irregular monsoon rainfall, rising temperatures, droughts, floods, heatwaves, and changing seasonal patterns. The present study, entitled "A Changing Climate and Maharashtra's Economy: An Analysis of Agriculture, Regional Risk, and Public Finance," examines the economic implications of climate change in Maharashtra, with special emphasis on agricultural performance, regional vulnerability, and the financial responsibilities of the government.

The study aims to analyse the relationship between changing climatic conditions and agricultural productivity, crop patterns, farmers' income, and rural livelihoods. It also explores regional variations in climate-related risks across different parts of Maharashtra, particularly drought-prone, flood-affected, and water-stressed regions. Special attention is given to the economic consequences of climate-related disasters, including agricultural losses, infrastructure damage, rural unemployment, and increasing financial pressure on households and government institutions.

Furthermore, the study examines the role of public finance in addressing climate change through government expenditure, agricultural subsidies, crop insurance schemes, disaster management funds, irrigation development, water conservation programmes, and climate adaptation initiatives. The research may be based on secondary data collected from government reports, economic surveys, agricultural statistics, climate records, budget documents, and published research studies. Appropriate statistical and comparative techniques may be employed to understand regional differences and emerging economic trends.

The study is expected to identify major climate-related economic challenges and assess the effectiveness of existing adaptation and mitigation measures. It also aims to suggest policy measures for strengthening climate-resilient agriculture, improving regional risk management, promoting sustainable resource utilisation, and enhancing climate-responsive public expenditure. Ultimately, the research seeks to contribute towards sustainable economic development, agricultural security, regional resilience, and long-term financial stability in Maharashtra.

Keywords: *Climate Change, Maharashtra Economy, Agricultural Productivity, Regional Vulnerability, Climate Risk, Public Finance, Agricultural Sustainability, Drought Management, Flood Risk, Farmers' Income, Climate Adaptation, Disaster Management, Government Expenditure, Rural Livelihoods, Sustainable Development.*

Introduction

Maharashtra's economy includes rainfed farming, irrigated agro-processing, metropolitan services, and coastal livelihoods. Their incomes and costs depend on water, temperature, land, and transport in different ways. A dry spell can delay sowing and reduce water storage. Intense rainfall over a short period can damage crops, warehouses, and roads. Heat stress can reduce safe working hours and raise demand for cooling [3–5].

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This paper uses environmental change to refer to climate-related hazards and their interaction with land use, water extraction, and urbanisation. It asks how apparently favourable statewide growth and rainfall averages can coexist with significant pressure on local production, household incomes, and public budgets.

Objectives, Methodology, and Scope

The study has four objectives. It compares statewide rainfall with the distribution of rainfall across talukas. It traces how weather-related shocks spread from agriculture to industry, services, and labour incomes. It examines sanctioned agricultural compensation and expenditure pressures on local governments. It proposes measurable adaptation priorities for Maharashtra.

The study uses secondary data. For the 2024 and 2025 monsoons it compares actual rainfall as a percentage of normal and counts talukas by rainfall category. The three categories cover 355 talukas in each year. The shares use 355 as the denominator. Sanctioned agricultural assistance for heavy rainfall and flooding is compared in nominal terms for the same June–September period in each year. Sectoral growth uses advance estimates of gross state value added at constant prices [1, 2].

The literature review draws on the state climate action plan, the IPCC assessment for Asia, peer-reviewed research on extreme rainfall over central India, and selected project documents [3–9]. Sangli–Kolhapur and Mumbai illustrate the different economic consequences of riverine and metropolitan flooding. These examples are based on published sources.

Literature Review and Analytical Framework

Roxy and colleagues found that widespread extreme rainfall events over their central Indian study region increased approximately threefold between 1950 and 2015 [4]. This finding applies to the geographical area they studied. Two monsoons provide insufficient evidence to estimate a long-run trend for Maharashtra. The IPCC assessment for Asia discusses the relationship between heatwaves, floods in monsoon regions, and livelihood vulnerability [5].

Economic risk depends on hazard, exposure, and vulnerability. Hazard refers to the intensity of heat, rainfall, or flooding. Exposure concerns the people, businesses, land, and assets within the affected area. Vulnerability concerns their capacity to withstand damage and recover. The same rainfall can cause different losses across two talukas because crop stages, soils, drainage, storage, and insurance coverage vary.

4 Rainfall Distribution and State Economic Growth

Table 1. Distribution of monsoon rainfall in Maharashtra

Indicator	2024	2025
Actual rainfall as a share of normal	116.8%	109.1%
Talukas with excess rainfall	203 (57.2%)	149 (42.0%)
Talukas with normal rainfall	68 (19.2%)	181 (51.0%)
Talukas with deficient rainfall	84 (23.7%)	25 (7.0%)
Talukas classified	355	355

Sources [1, 2]. Percentages in parentheses are the author's calculations. Totals may differ slightly because of rounding.

In 2025, statewide rainfall relative to normal was 7.7 percentage points below its 2024 level. Over the same period, the number of talukas with deficient rainfall fell from 84 to 25. These indicators measure different things. The taluka count gives every taluka equal weight, while the statewide figure measures rainfall relative to normal. The table does not capture the duration of dry spells, rainfall intensity, or timing relative to crop development

Table 2. Advance estimates of real economic growth

Indicator	2024–25 (%)	2025–26 (%)
Gross state domestic product	7.3	7.9
Agriculture and allied activities	8.7	3.4
Industry	4.9	5.7
Services	7.8	9.0

Sources [1, 2]. Figures are advance estimates from each year's survey. Sectoral rates refer to real gross state value added. The table uses the estimates as originally published.

In 2025–26, the advance estimate for services growth was 9.0 percent, while agriculture and allied activities grew at an estimated 3.4 percent. Aggregate growth therefore gives limited information on changes in farm incomes. Crop mix, the previous year's base, input use, and seasonal output may all contribute to changes in agricultural growth.

Agriculture, Water Resources, and Rural Income

Weather affects both crop output and production costs. A dry spell after sowing can require fresh spending on seed and cultivation. Water stress during flowering can lower yields. Heavy rain at harvest can reduce crop grades and selling prices. Estimating the effect on net farm income requires records of output, sale prices, and additional costs.

The provisional 2021–22 Agriculture Census placed Maharashtra's average operational holding at 1.23 hectares. Small and marginal holdings of up to two hectares accounted for 84.5 percent of all operational holdings [1, 2]. Alternative income, institutional credit, savings, and insurance shape recovery after a crop loss. Where compensation depends on land and crop records, accurate identification of the actual cultivator matters. Employment losses among landless workers require separate measurement.

The 2025–26 survey expected kharif cereal output to rise by 10.6 percent and pulses and oilseed output to fall by 28.2 and 47.4 percent respectively [2]. These divergent movements call for crop-specific analysis. Separating planted area from yield per hectare would show which component contributed to each change in production.

By the end of June 2024, major, medium, and minor state-sector projects had created irrigation potential of 57.16 lakh hectares. Utilisation in 2024–25 was provisionally estimated at 40.55 lakh hectares [2]. The ratio is approximately 70.9 percent. The denominator is capacity recorded on a particular date, while the numerator measures use during a financial year. Assessing project efficiency also requires data on reservoir availability, canal condition, seasonal allocation, and the area actually served.

Drip irrigation can reduce water use on a plot. If the saved water supports a larger irrigated area or more water-intensive crops, total pressure on the resource can persist. Water conservation should therefore be assessed alongside village water accounts, groundwater levels, and crop water budgets.

Industry, Services, and Regional Risk

Weather can affect industry through raw material supplies, electricity and water, transport, and inventories. In western Maharashtra, disruptions to sugarcane production and transport can affect mill crushing schedules and seasonal employment. Damage to orchards can increase the cost of packing, refrigeration, and transport per marketable unit. Recording production losses, transport disruptions, and delayed sales separately can identify the most vulnerable stage of the value chain.

Technical analysis of the 2019 Krishna basin floods in the Sangli–Kolhapur area examined rainfall, river flows, and reservoir operations together [6]. Linking flood depths and durations to farms, markets, and industrial areas would improve the economic assessment. Market closure days and the cost of rerouting goods indicate different aspects of business disruption. Bridge repair costs measure a separate category of loss.

The Mumbai Climate Action Plan treats urban flooding and water resources management as a distinct area of action [7]. Dense construction, limited infiltration, blocked drains, and tides influence how quickly water recedes. Road or rail closures can prevent workers from reaching their workplaces. Shops can lose transactions, and small businesses can face expenses for damaged stock and equipment. Municipal loss records should capture asset damage and the duration of service interruptions.

Rainfed areas of Marathwada and Vidarbha could prioritise monitoring sowing dates, groundwater availability, and hot days. Along the Konkan coast, exposed assets include settlements, fishing harbours, and roads connecting coastal producers to markets. Adverse conditions at sea can reduce fishing days, disrupting seasonal income and loan repayments. Indicators should reflect the hazards relevant to each district [3, 5].

Labour Productivity and Public Finance

During extreme heat, construction, farming, transport, and street vending may require changes to working hours. Daily wage workers may lose income when work is curtailed. Employers may face additional costs for scheduling, drinking water, and rest facilities. Measuring healthcare demand, lost working hours, and electricity used for cooling can help assess the wider economic effect. Maharashtra's heat action plan provides an administrative framework for preparedness [8].

Table 3. Agricultural assistance for heavy rainfall and flooding, June–September

Indicator	2024	2025
Affected area (lakh hectares)	37.67	94.82

Indicator	2024	2025
Farmers covered by sanctions (lakh)	50.36	116.40
Compensation sanctioned (₹ crore)	1,470.92	9,022.38

Sources [1, 2]. Sanctions are at current prices. The 2024 survey specifies a three-hectare ceiling for assistance.

In 2025, the reported affected area was around 2.52 times its 2024 level, while sanctioned assistance was approximately 6.13 times as large. Differences in rates, eligibility, area ceilings, and crop composition can influence the value sanctioned. Public accounts should distinguish sanctioned assistance, actual disbursements, and total losses so that each measure can be interpreted on its own terms.

After a flood, local governments face immediate spending on desilting, road repairs, and restoring water supply. Delays in collecting water charges or market fees can put pressure on cash flow at the same time. Separate budget lines for routine drain maintenance, capital investment in flood resilience, and post-disaster assistance would make preventive spending and emergency costs easier to track.

Policy Assessment

Maharashtra's State Action Plan on Climate Change for 2021–2030 guides state departments on adaptation and emissions reduction [3]. District implementation should identify the responsible agency, annual funding, and expected outcomes. For example, the length of drains cleared measures work completed, while the time needed to reopen a road after heavy rainfall measures the service outcome.

The second phase of the Maharashtra Project on Climate Resilient Agriculture illustrates institutional efforts to reduce agricultural climate risk [9]. Village-level assessment can examine water conservation, soil health, crop diversification, and weather advisories. Comparisons before and after implementation should account for rainfall variation and baseline differences, using comparable villages. Net income, drought-year yield losses, and groundwater levels are complementary measures.

Policy Recommendations

1. Link taluka-level climate and agriculture records

Use common taluka identifiers to link daily rainfall, crop stages, productivity, reported losses, and assistance. Publish consecutive dry days and days of intense rainfall alongside averages.

2. Base water allocation on available resources

Include drinking water, irrigation, and recharge in village water accounts. Assess micro-irrigation using both water use per hectare and total groundwater extraction.

3. Prioritise urban flood investments by exposure

Map the flood exposure of hospitals, schools, markets, and public transport. Design drainage improvements alongside infiltration areas and open spaces that can temporarily hold water.

4. Publish the timeliness and coverage of disaster assistance

Report median days from loss registration to payment, coverage of eligible beneficiaries, and the ratio of disbursements to sanctions. Use sample surveys to estimate labour income lost after disasters.

5. Connect heat action plans with worker protection

Specify arrangements for outdoor work hours, shade, and drinking water on heat-alert days. Health departments and local governments should review implementation by ward.

Limitations and Future Research

The comparative data cover two monsoons and two economic surveys. Advance growth estimates may be revised. Statewide rainfall categories do not fully capture variation within or across talukas. Compensation is reported in nominal terms, without adjustment for changes in assistance rules. The study does not estimate aggregate non-farm losses, forgone labour earnings, or local disaster expenditure.

Future research should assemble at least ten years of observations by taluka, crop, and season. Indicators should distinguish rainfall during harvest, dry spells after sowing, and days of extreme heat. Changes in yields could be examined while accounting for irrigation, input use, and market prices. In the Sangli–Kolhapur area, comparisons of closure days, turnover, and transport costs between flooded and comparable unaffected markets could help estimate the impact of river flooding on local trade.

Conclusion

Above-normal statewide rainfall coexisted with deficient rainfall in some Maharashtra talukas in both monsoons. In 2025, fewer talukas recorded a deficit, while sanctioned agricultural compensation for heavy rainfall and flooding increased. Policy decisions require separate measures of total rainfall, its local distribution, recorded losses, and assistance disbursed.

Climate risk reaches agro-processing, markets, transport, labour incomes, and the budgets of state and local governments. Accounting for these sectoral and regional effects can improve

decisions about where to invest in prevention. Maharashtra can strengthen adaptation by combining taluka-level assessment of farm risks, river basin and urban flood planning, and monitoring the outcomes of public spending.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of thesis paper.

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