Trend and CAGR Analysis of Pradhan Mantri Fasal Bima Yojana

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Abstract

Climate change is a severe threat to agriculture sustainability and rural livelihood in India where over 51% of the net sown area is rainfed and highly vulnerable to drought ,flood and monsoon variability. recent report by the world meteorological organisation (2024), Indian meteorological department (2024) and ICAR-NICRA (2024) highlight alarming warming trends, rainfall deficiency and climate induced risk affecting over 310 districts particularly Uttar Pradesh, Bihar, Assam, Jharkhand and Maharashtra . monsoon rainfall in 2023 was 6% below the long-term average with East and Northeast India receiving 80% below normal rainfall (dept of Agriculture, 2024). This study adopts quantitative analysis by applying trend analysis ,line graph, compound annual growth rate (CAGR) calculation and ratio analysis and the study find that Pradhan Mantri Fasal Bima Yojana performance from 2016-17 to 2023-24, sowing national farmer enrolment rising from 583 lakh to 1428 lakh nearly 2.5 times growth. budget allocation surge from 5501 crore in 2016-17 to 16,000 crore by 2021-22 with combined allocation for PMFBY and RWBCIS reached 69,515 crores in financial year 2025-26. Despite strong achievement challenges remain, including delayed settlement and exclusion like animal grazing loss which disproportionately hurt vulnerable state like Uttar Pradesh and Bihar

Keywords: PMFBY, Crop Insurance, Fasal Bima Yojana, Insurance Scheme

Introduction

Climate change poses a growing threat to agricultural sustainability and rural livelihood in Asia particularly India's agriculture sector is facing intensifying climate related challenges the state of the climate In Asia 2023 report by the World Meteorological organisation reveal alarming climate trends that have direct implication for agriculture dependent economies like India in 2023, Asia recorded its second warmest year on record with mean temperature 0.91°C above the 1991-2020 average and 1.87°C above the 1961-1990 average (WMO, 2024) this deviation are significantly impacting crop cycle water availability and farm level productivity

According to annual report of ministry of environment forest and climate change by the Indian meteorological department (IMD) the country recorded an annual mean land surface air temperature anomaly of 0.65°C making 2023 the second warmest year on record since 1901(IMD, 2024) the winter monsoon and post- monsoon season were all warmer than average. the agriculture sector contributing 13.44% of India's GHG emission remain higher vulnerable to climate induced risk such as temperature rise droughts and heavy rainfall.

Furthermore annual report of Department of Agriculture and farmer welfare 2024 India's Agriculture struggle with climate related uncertainty particularly rainfall deficiency and monsoon variability for instance monsoon rainfall in 2023 was 6% below the long period With East and Northeast and India receiving 18% below normal rainfall adversely impacting crop yield in key rainfed region.

Another report saying Indian agriculture is heavily vulnerable to the adverse impact of climate change over 51% of India's net sown area is rainfed and hence particularly vulnerable to climate socks such as heavy rainfall droughts flood and temperature variability historical data show that region like Central India and the northeast have experienced more than two drought per decade with a drought prone area increasing at a rate of 1.3 % since the 1950 (standing committee on agriculture, 2024) A vulnerability assessment by ICAR-NICRA using IPCC AR 5 methodology has identified 310 districts as climate risk prone, including 169 very high risk districts spread across key agrarian states such as Uttar Pradesh ,Bihar, Assam , Jharkhand and Maharashtra.

According to the Food and Agriculture organization (FAO, 2024) rural poor household in low and middle income countries loss on average 5% of their income annually due to heat stress and 4.4% due to floods compared to their nonpoor counterparts this leads to a widening annual income gap of over USD 41billion signalling the compounding vulnerability of smallholder farmers under climate stress (FAO,2024) 1°C rise in temperature increase the dependence of poor household on Agriculture by 53% while simultaneously reducing their non-farm income by 33% , indicating deterioration of economic diversification and adaptive capacity (FAO,2024).

Need and importance of PMFBY

The Pradhan Mantri Fasal Bima Yojana represent a significant advancement over previous crop insurance scheme, offering a more holistic technology- driven and farmer Centric approach launched in 2016. PMFBY is designed not merely as a risk mitigation mechanism but as a comprehensive support system to ensure sustainable agriculture production. PMFBY encompasses multiple objectives including income stabilisation ,promotion of modern farming practises, facilitation of institutional credit and enhancement of food security through crop diversification. PMFBY have information technology infrastructure which integrate all stakeholder farmer insurance company, financial institutions and government agency into a unified digital platform. this web- based ecosystem streamline service deliver , reduce manual process and allow for real time monitoring and data sharing such integration ensure greater transparency, faster claim settlement and improve coordination among implementing agencies the digitization of notification regarding insured crop, area and scheme details has significantly improved access to crop insurance services for farmers.

Current status of PMFBY

As per the Lok Sabha answer given by Sri Ram Nath Thakur state Minister of Agriculture and former welfare on 4th February 2025, PMFBY, launched in 2016, offers comprehensive risk coverage to farmers for various stages of crop production, from pre-sowing to post-harvest, at highly subsidized premiums. The scheme operates primarily on an area approach, where claims are determined based on yield data per unit area provided by state governments. The insurance companies directly transfer the admissible claim amounts to insured farmers' bank accounts through the National Crop Insurance Portal (NCIP) using the Digi Claim module. For losses arising from localized events such as hailstorms, landslides, floods, cloudbursts, and post-harvest damage due to cyclonic or unseasonal rains, claims are assessed on an

individual farm basis by joint committees comprising representatives from the state governments and insurance companies.

Since the scheme's inception, total claims assessed have reached ₹1,75,276.32 crore, with ₹1,72,138.36 crore (approximately 98.21%) already disbursed. Despite the high settlement rate, some claims remain pending, largely due to delays or errors in insurance proposal submissions by banks, discrepancies in yield data, disputes between state governments and insurers, or delays in state governments releasing their share of the premium subsidy.

To address these challenges and improve claim settlement efficiency, the government has implemented many modern technological solutions. These include the NCIP for digital administration and monitoring, the Digi-Claim module for automated and transparent claim calculation, and the integration of state e-land records covering approximately 90% of insured areas in major agricultural states. The CCE-Agri App has been introduced to digitally capture real-time data from crop-cutting experiments, ensuring more timely and transparent assessments.

From the 2023–24 agricultural year, the government has approved further innovations:

- YES-TECH (Yield Estimation System Based on Technology) introduces remote-sensing-based yield estimation;
- WINDS (Weather Information Network and Data System) establish a nationwide network of automatic weather stations for hyper-local data;
- CROPIC (Collection of Real-time Photos and Observations of Crops) uses geo-tagged imagery for objective crop damage assessments.

Objectives

The primary objective of this study is to analyse the evolving trends within the Pradhan Mantri Fasal Bima Yojana (PMFBY) since its launch in 2016, focusing on several critical performance indicators. The study seeks to understand how key indicator such as farmer enrolment, the area insured, claims paid, claim settlement ratios, and budget allocations have changed over time. By investigating these indicators, the research aims to provide insights into the scheme's effectiveness in mitigating agricultural risks and stabilizing farmer incomes. Additionally, the study seeks to identify regional variations across top 5 states, highlight patterns of success or concern, and assess how well the scheme aligns with its intended policy goals. Ultimately, the objective is to offer a data-driven evaluation of PMFBY's progress, helping inform recommendations for strengthening the future performance of India's flagship crop insurance program.

Methodology

This research adopts a quantitative, descriptive approach relying solely on secondary data sources. The analysis has drawn upon official data retrieved from the PMFBY portal, Lok Sabha question and answer archives, government publications from the Ministry of Agriculture and Farmers Welfare, and relevant reports from other sources. To identify and evaluate trends, the study will apply statistical techniques such as trend analysis, using tools like line graphs, bar charts, and compound annual growth rate (CAGR) calculations. Ratio analyses of claim-to-enrolment ratio. This methodology is limited to publicly available data and does not include any primary surveys or interviews. The focus remains on national- and state-level trends, providing a broad, policy-relevant perspective on the functioning and impact of PMFBY.

Result and data analysis

The provided below figure 1.0 is about budget allocation for Pradhan Mantri Fasal Bima Yojana the trend graph indicates that continuously budget increasing the data show government is conscious about climate change and agricultural risk.
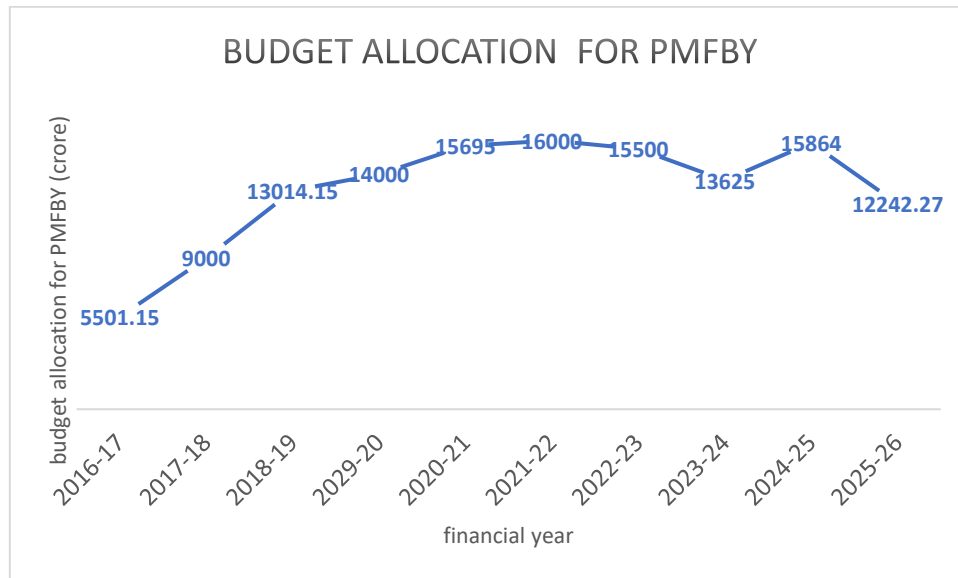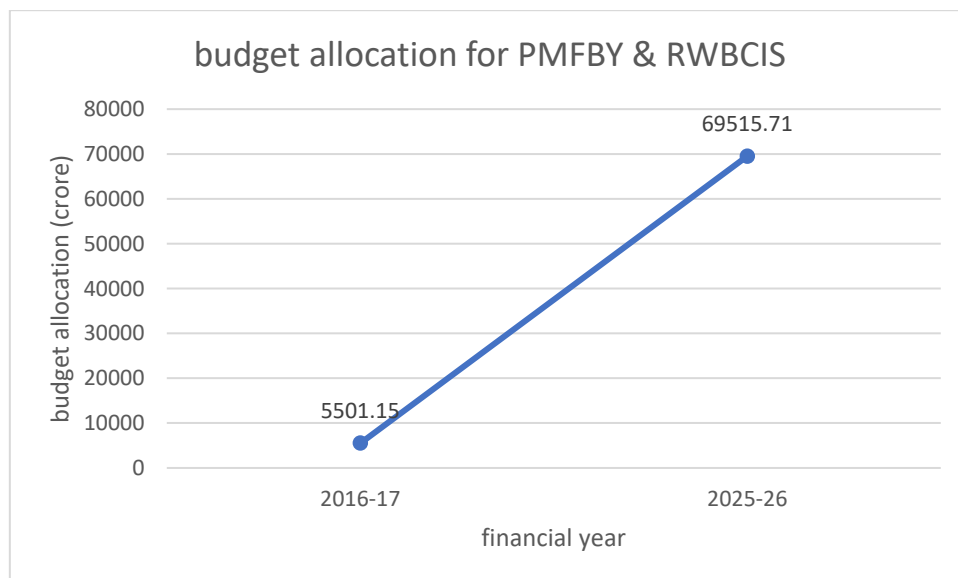

Figure 1.0

Figure1.1

Pradhan Mantri Fasal Bima Yojana start with 5501.15 crore budget and it is continuously growing year by year the compound annual growth rate of the budget allocation to the PMFBY is 9.13% annually witnessing the success of the scheme the Union Cabinet in January 2025 approved the continuation of Pradhan Mantri Fasal Bima Yojana and restructured weather based crop insurance scheme till 2025-26 and the total budget is 69,515.71 crore the budget increase for the scheme from financial year 2016-17 to 2025-26 is 1163.66% this data show the potential of the scheme.(figure1.1)
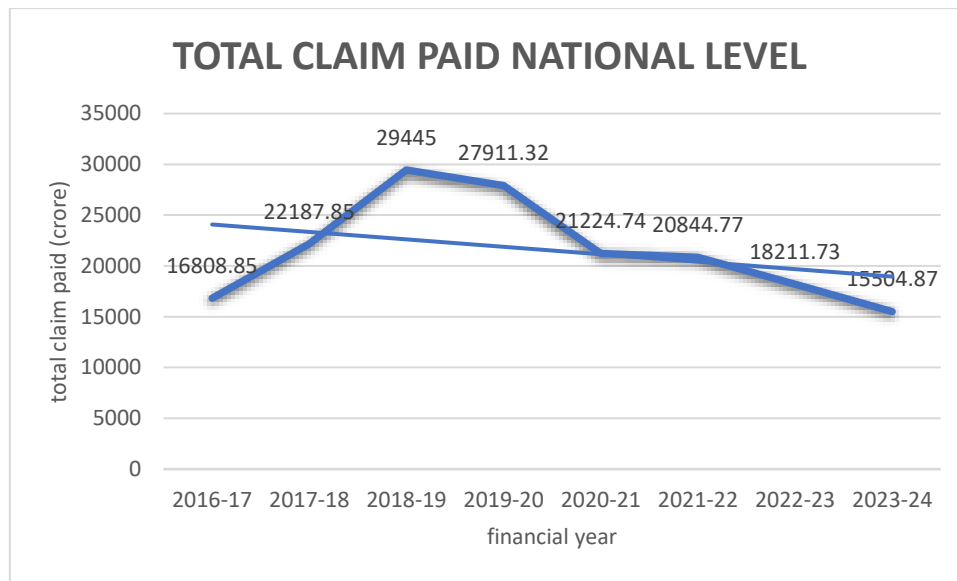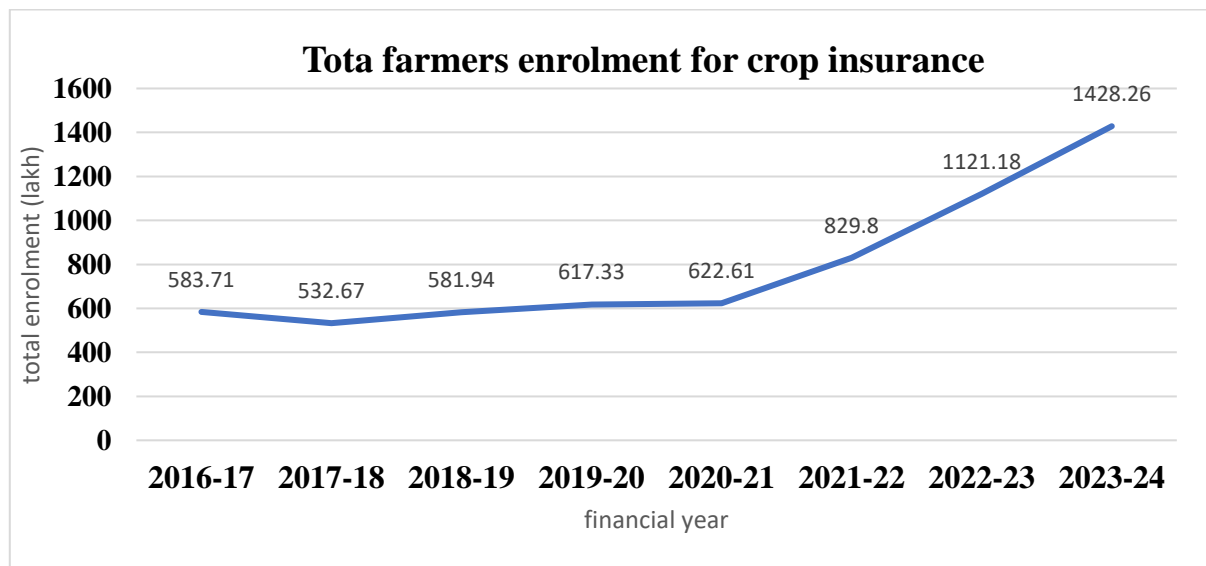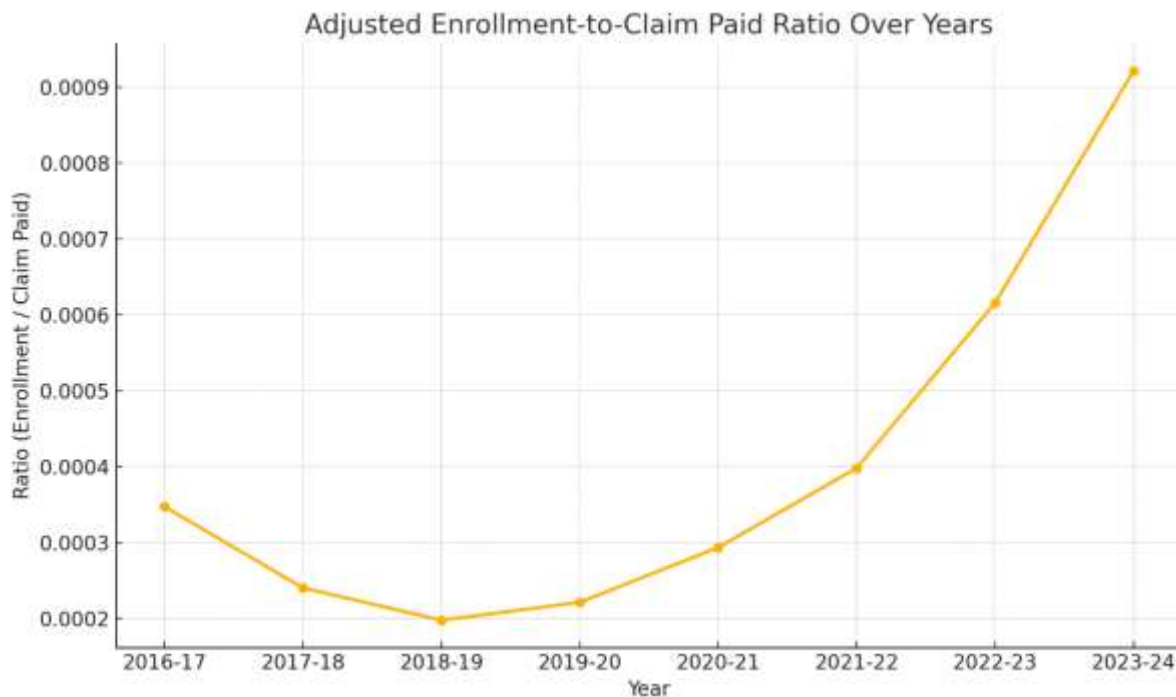
Figure 2.0

Figure 2.1

Figure 2.2

The total claim paid data trend for national level of Pradhan Mantri Fasal Bima Yojana and re structured weather- based crop insurance scheme is showing that claim paid is increasing for starting three financial years after inception of the scheme but in the financial year 2020-21 claim paid is drastically down falling, the compound annual growth rate of claim paid data is -1.14% that Indicate a negative growth trend in claim paid settlement. The total enrolment for crop insurance is increasing year by year indicate the scheme is very successful the compound annual growth rate (CAGR) of farmer enrolment for crop insurance over the period 2016-17 to 2023-24 is approximately 13.64% this indicates a strong and steady annual growth in enrolment.

Enrolment to claim paid ratio

This analysis examines the year-wise relationship between total farmer enrolment under crop insurance (reported in lakh, converted to crore) and the total claim payouts at the national level (reported in crore) from 2016–17 to 2023–24 The enrolment to claim paid ratio calculated as Enrolment to claim paid ratio = enrolment / claim paid The ratio initially declines over 2017-19 due to rising claim outpacing enrolment but rebounded after 2020-21 and by 2023-24 the ratio rose sharply to 0.00092 reflecting significant enrolment growth while total claim paid decline the rising ratio indicates expanding farmer participation relative to the claim paid signalling a need for further analysis on scheme.
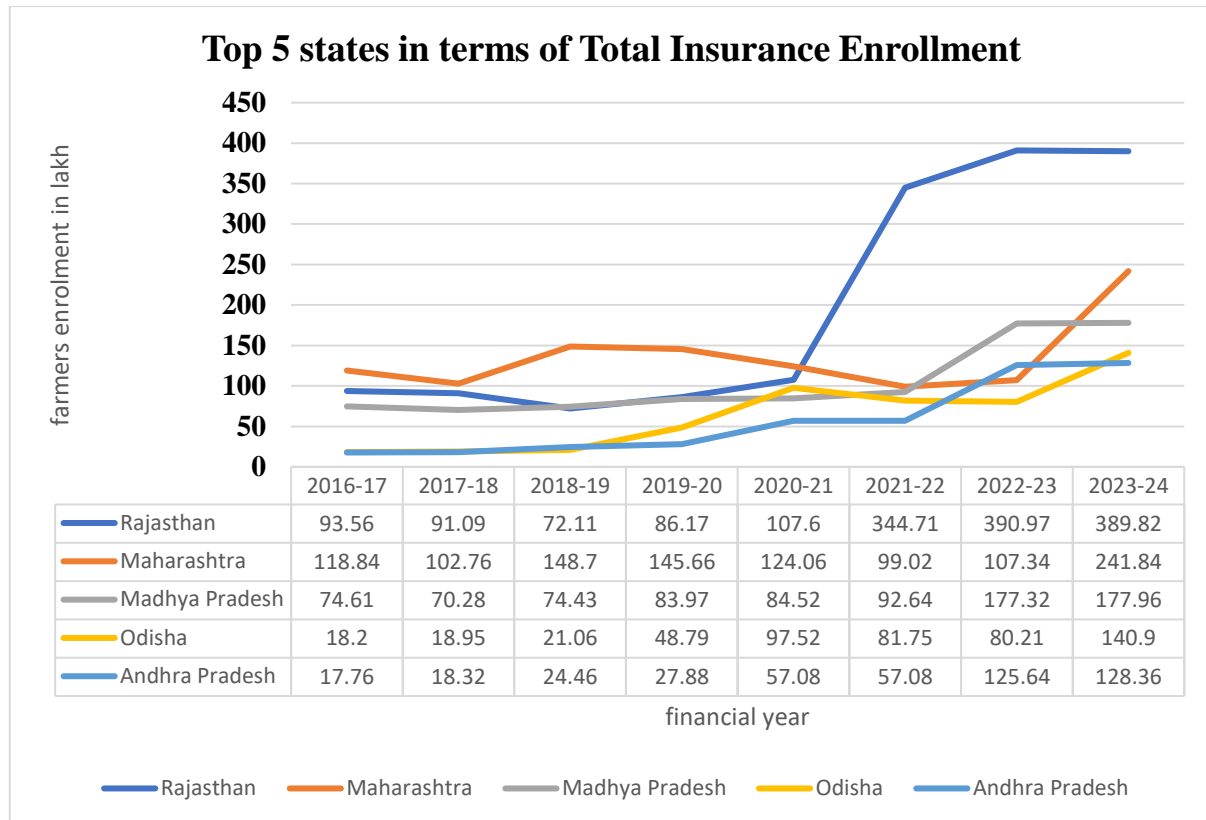
Top 5 states in terms of Total Insurance Enrollment

	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Rajasthan	93.56	91.09	72.11	86.17	107.6	344.71	390.97	389.82
Maharashtra	118.84	102.76	148.7	145.66	124.06	99.02	107.34	241.84
Madhya Pradesh	74.61	70.28	74.43	83.97	84.52	92.64	177.32	177.96
Odisha	18.2	18.95	21.06	48.79	97.52	81.75	80.21	140.9
Andhra Pradesh	17.76	18.32	24.46	27.88	57.08	57.08	125.64	128.36

Figure 3.0

(Figure 3.0) Compound annual growth rate CAGR analysis for each state(in % per year over 7 year) the data result for Odisha CAGR is 33.96% show rapid growth from low base especially after 2021-22, pushing it CAGR to the highest among the five states signal successful programme expansion in the state. CAGR for Andhra Pradesh is 32.65% it surged after 2021-22 transforming from a small player to a major contributor in enrolment number. Rajasthan show the most dramatic jump from 2020-21to 2021-22 jumping from 100 lakh to over 340 lakh enrolment the state CAGR is 22.61%. Madhya Pradesh CAGR is 13.22% show moderate growth with a clear rise after 2021-22 the data sowing consistent adoption and in Maharashtra high endowment in early year (picking in 2018-19) but declined then rebounded sharply in 2023-24 the state CAGR is 10.68%.
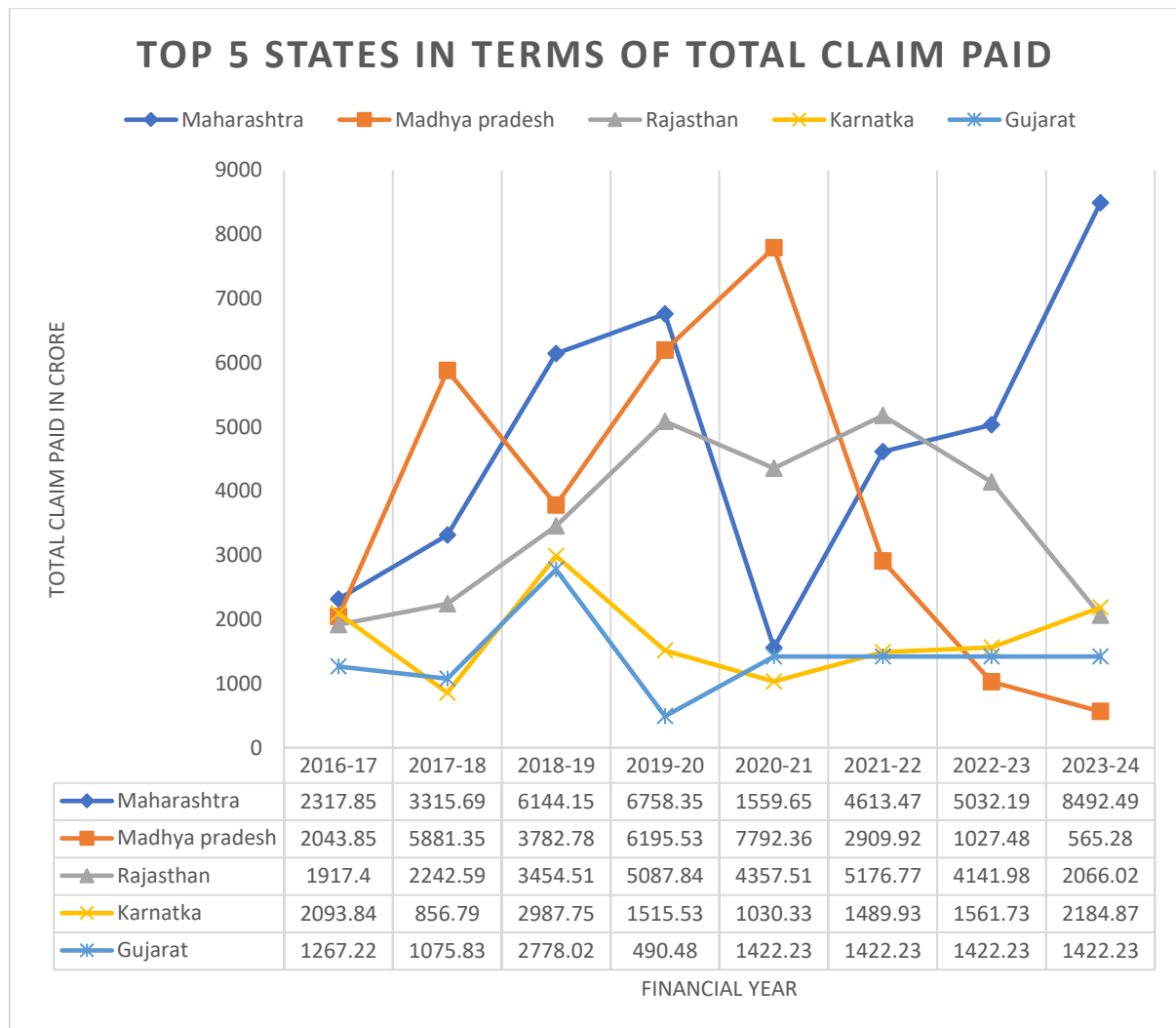
	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Maharashtra	2317.85	3315.69	6144.15	6758.35	1559.65	4613.47	5032.19	8492.49
Madhya pradesh	2043.85	5881.35	3782.78	6195.53	7792.36	2909.92	1027.48	565.28
Rajasthan	1917.4	2242.59	3454.51	5087.84	4357.51	5176.77	4141.98	2066.02
Karnatka	2093.84	856.79	2987.75	1515.53	1030.33	1489.93	1561.73	2184.87
Gujarat	1267.22	1075.83	2778.02	490.48	1422.23	1422.23	1422.23	1422.23

Figure 3.1

Analysis of (figure 3.1) CAGR analysis for (2016-17 to 2023-24) Maharashtra compound annual growth rate is highest among top five states CAGR is 20.38% indicating Strong growth in total claim paid Madhya Pradesh CAGR is -16.77% the negative CAGR sowing a steep decline in claim paid from 2043 crore in 2016-17 to 565 crore in 2023-24 the trend line of Madhya Pradesh so very high fluctuation. Rajasthan CAGR for total claim paid is +1.07% Karnataka CAGR is +0.61% and for Gujarat +1.66% these Three states CAGR indicate stable and slightly increasing claim over the period . the trend line of Gujarat shows very stable trend as compare to other.

Conclusion

The analysis of Pradhan Mantri Fasal Bima Yojana (PMFBY) from 2016–17 to 2023–24, supported by enrolment trends, claim payouts, and budget allocations, reveals both significant progress and persistent challenges. National enrolment rose from 583 lakh farmers in 2016–17 to an impressive 1,428 lakh in 2023–24, indicating nearly 2.5 times growth. States like Rajasthan and Andhra Pradesh stood out with compound annual growth rates (CAGR) above 22% and 32% respectively, while Odisha recorded the highest growth at ~34%. This rise reflects successful outreach, increasing farmer awareness, and improved insurance penetration.

Budget allocation trends show a steady increase from ₹5,501 crore in 2016–17, peaking at ₹16,000 crore by 2021–22, followed by slight reductions but still maintaining strong levels. Notably, considering PMFBY together with the Restructured Weather Based Crop Insurance Scheme (RWBCIS), allocations are projected to reach ₹69,515 crore by 2025–26 — a more than twelvefold increase over a decade, reflecting the government's strong fiscal commitment. national claim payout trends data show Total claims rose sharply, peaking at ₹29,445 crore in 2018–19, before gradually declining to ₹15,504 crore in 2023–24. State-level trends show Maharashtra as the clear leader, reaching ₹8,492 crore in 2023–24 with ~20% CAGR, while Madhya Pradesh saw a sharp fall from earlier peaks.

Despite impressive enrolment expansion and budget scaling, research highlights issues such as delayed settlements, exclusion of grazed or destroyed by domestic or wild animal, grazed by animal is big problem for state like Uttar Pradesh and Bihar it should be removed from exclusion . Future success depends on addressing these barriers through robust technological integration, region-specific customization, and stronger institutional mechanisms.

In conclusion, while PMFBY has emerged as a cornerstone for agricultural risk mitigation in India, its long-term sustainability requires continuous policy fine-tuning, enhanced transparency, and equitable benefit delivery across all farming communities.

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