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Evaluating the Impact and Risk Minimisation Ability of Rural Farmers under Pradhan Mantri Fasal Bima Yojana (PMFBY) in Coastal and Non-Coastal Regions of Odisha

Rishita Sen[1], Sarba Narayan Mishra[1], R.H. Ankhila[2], and Chinmayee Nayak[1]

This study examines the expansion and impact of the Pradhan Mantri Fasal Bima Yojana (PMFBY) in Odisha, with particular emphasis on coastal and non-coastal regions. The study employed primary data of 200 farmers gathered from 140 adopters and 60 non-adopters across two districts. The analysis was carried out using a combination of methods, including compound annual growth rate, Cuddy-Della Valle Index, probit regression, Inverse Probability Weighted Regression Adjustment (IPWRA), Garrett's ranking technique, and Likert scale. The number of beneficiaries rose substantially in both *kharif* (53.27%) and *rabi* (57.56%) seasons. However, claim disbursements declined and were marked as highly unstable. There is a significant increase in income for beneficiaries of PMFBY, with treated households in Kendrapara experiencing an increase of Rs. 22,094.31 and those in Bargarh seeing a higher growth of Rs. 56,897.15. Farmers were aware of the scheme's existence, the enrolment procedure, and the services provided by Mo Seva Kendra, though they were not very clear about the benefits offered by the scheme. Enhancing awareness through extension services, social media, and other communication channels, while tailoring insurance units to address farm-level risks, could improve risk coverage and increase the overall effectiveness of the scheme.

Value Chain Analysis of Kiwifruit: Unlocking Potential for Inclusive Development in Arunachal Pradesh

Tumdhwaj Mehta[3], L.D. Hatai[4], and A. K. Tripathi[5]

The present study analysed the existing marketing channels and value chain of kiwifruit in the lower Subansiri district of Arunachal Pradesh. The study is based on the data collected from a sample of 76 respondents, comprising kiwi farmers and market functionaries, who belonged to the selected villages and blocks within the district. The marketable surplus of Kiwifruit of small, medium and large categories of farmers was found to be 2802.66 kg/ha, 2773.8 kg/ha and 2725.7 kg/ha, respectively. The Marketing efficiency of channel A and channel B of kiwi farmers was found to be 17.32 per cent and 20.43 per cent, respectively. The producer's share in the consumer rupee of channel A and channel B was found to be 72 per cent and 95.33

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per cent respectively. Two distinct channels are identified, each characterised by varying levels of producer participation and marketing efficiency. Channel B, marked by direct producer-consumer transactions, emerges as the most efficient one, offering opportunities for enhanced producer income through bypassing traditional intermediaries. Initiatives are needed to improve access to agricultural inputs, facilitate market information dissemination, and foster collaborative partnerships across the value chain.

Crop Diversification in Udaipur and Bhilwara Districts of Rajasthan: An Economic Analysis

Hari Singh, Narendra Yadav, Hemant Kumar Lamba, and Gopal Nai[1]

The study was conducted in Udaipur and Bhilwara districts of Rajasthan as a benchmark survey of rice in the year 2023-24 and input interventions of crops, viz, maize, soybean and groundnut in *kharif* season 2024-25. For the study and input intervention distribution, a sample of 60 farmers was selected from Udaipur district, and 75 farmers from Bhilwara district. The finding revealed that the participation of farmers in FPOs and cooperative societies was high, and there was higher adoption of Government schemes like PDS and crop insurance. The total cost of cultivation was the highest for rice at ₹ 27640.77, while soybean and maize had lower total costs at ₹ 23168.31 and ₹ 22681.64, respectively, in the Udaipur district of Rajasthan. Net income (profit after deducting costs) from maize was the highest at ₹ 19080.96, followed by soybean at ₹ 16819.71 and rice at ₹ 10731.06. In Bhilwara district, the rice and groundnut costs were compared, and the total cost of cultivation was much higher for groundnut (₹ 59352.14) compared to rice (₹ 38772.74), primarily due to higher seed, rental, and fixed costs. Net income from groundnut was ₹ 59810.26, and that from rice was just ₹ 3016.06, indicating that rice barely covers its total cost. The findings suggest that maize, soybean, and groundnut were more profitable crops than rice in both districts. Therefore, crop diversification from rice to other crops (maize, soybean, and groundnut) was beneficial in the study or intervention area.

Status of Livestock Diversification in Rajasthan for the Period from 1997 to 2019

Narendra Yadav and Latika Sharma[1]

The present study is based on the Livestock Census 2024-25 and 33 districts of Rajasthan. The Herfindahl index was used to estimate the extent of livestock diversification. The analysis revealed that the index values declined steadily for

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Ajmer, Bhilwara, Churu, and Udaipur from 1997 to 2019. The Hanumangarh and Ganganagar districts experienced the highest levels of diversification. In the Hanumangarh district, the buffalo population declined, and crossbreed cattle and indigenous cattle increased during this period. Jaisalmer (0.89) and Dholpur (0.72) districts had higher diversification indices during 2019, highlighting lesser diversification. On the other hand, Jaisalmer district witnessed a decrease in indigenous cattle and an increase in crossbred and buffalo populations over time. The decline may be due to decreased production or a change in farmer preferences for buffaloes or crossbred types. On the other hand, the population of crossbred cattle has grown in most regions, indicating a rising preference for breeds that provide higher milk yields and more flexibility. Buffalo numbers have also improved in many areas, albeit regional expansion has been inconsistent. These changes indicate that cattle management practices are changing due to legislative, environmental, and economic concerns.

Economic Impact of Land Degradation on Crop Production in Haryana: A Cobb-Douglas Production Function Approach

Harshit Bansal[1], Ajay Singh[2], Neeraj Pawar[3], and D.P. Malik[3]

The study examined the economic impact of land degradation on crop production in Haryana, focusing on the comparative cost and return analysis between normal and problematic farms. Conducted in Karnal and Panipat districts, the research analysed data from 120 farmers (60 normal and 60 problematic farms) across four villages from 2023-24. The Cobb-Douglas production function and t-tests were employed to analyse input-output relationships and cost-return disparities. The results revealed significant differences: problematic farms incurred higher variable costs for seeds (₹4,693/ha vs. ₹2,952/ha), fertilisers (₹8,447/ha vs. ₹7,049/ha), and plant protection (₹12,264/ha vs. ₹10,265/ha) but lower irrigation and harvesting costs due to reduced water use and yield. Normal farms achieved higher gross returns (₹1,87,019/ha vs. ₹1,32,958/ha for basmati paddy) and net returns (₹43,175/ha vs. ₹17,311/ha), with superior benefit-cost ratios (1.30 vs. 1.15). The production function highlighted inefficient input use on degraded lands, with irrigation showing negative elasticity (-0.44) for paddy.

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Role of National Rural Livelihood Mission (NRLM) in Rural Development and Institutional Linkages in its Implementation in Uttarakhand

Komal Adhikari, Virendra Singh, and Ruchi Rani Gangwar[1]

This study assesses the impact of NRLM on rural development in Uttarakhand, focusing on changes in livelihood outcomes and the convergence of institutional support. A Livelihood Index comprising five components-human, physical, financial, and social capital, along with food security-was developed using pre- and post-mission data from participant-beneficiaries. Results indicate a significant improvement across all components, with the overall index rising from 37.27 to 45.95. While the mission enhanced participants' income, asset base, decision-making, and financial literacy, institutional linkages varied. Banks showed strong engagement with beneficiaries, whereas other institutions, such as Gram Panchayats, Community Development Blocks, RSETIs, KVKs, and UIRD, had weaker and inconsistent connections. The findings underscore NRLM's positive impact on rural livelihoods but highlight the need for stronger institutional convergence to maximise developmental outcomes.

High Value Agriculture: A Pathway for Transforming the Indian Rural Economy

Raj Kishore Panda[2]

The study used secondary data to analyse the extent and pattern of high-value agriculture (HVA) growth at the all-India and state levels from 2011-12 to 2019-20. The output value of HVA measured in terms of absolute value and proportion to gross agricultural output demonstrates wide and increasing inter-state disparity between 2011-12 and 2019-20. The annual compound growth rate of HVA output varied widely across states. Contrary to the common perception, while better-off states have recorded a lower growth rate in HVA production than the all-India average, relatively poorer states have exhibited higher growth performance. The sub-sector-wise growth rate also reveals wide inter-state variation. Except for Madhya Pradesh, which records high growth performance (triple-digit growth) in all three sub-sectors, other states exhibit large inter-sectoral disparity in the HVA production growth rate. Regarding the association of small farm-holders in HVA production, the findings reveal varying results across regions, indicating regional constraints beyond the farmers' control that affect HVA production. The study suggests identifying state-specific constraints and addressing the issues to bridge the gap in HVA production

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across states and segments. Since the HVA cultivation by the small farmers is influenced mainly by regional constraints, which are both physical and policy related, the primary focus should be given by the government in promoting institutions to develop infrastructure, particularly market and storage structures to ensure remunerative prices to these households on a sustainable basis. Switching to HVA production can be a catalyst for transforming the rural economy as it positively impacts income, employment, and resource utilisation, ultimately contributing to social equity and sustainability.

Understanding Income Diversification among Farmer Households across Indian States: A Herfindahl Index Analysis over Three Survey Rounds

A. Narayanamoorthy[1], K. S. Sujitha[1], R. Suresh[1], and N. Devika[2]

This paper investigates the patterns of income diversification among farmer households across 18 Indian States using the Herfindahl Index (HI). Utilising data from three rounds of the Situation Assessment Survey (2002-03, 2012-13 and 2018-19), the study analyses farm household income from four main sources: crop cultivation, animal farming, non-farm business and wage labour. The HI is calculated with and without wage income to distinguish structural diversification from distress-driven shifts. The study addresses key questions: How has the HI evolved across States over time? Has income diversification improved? Which States have performed well? Is there any association between the HI and the annual income of households? The findings show a gradual decline in HI at the national level over time, suggesting modest improvements in income diversification. State-level trends reveal considerable disparities in HI, with States like Gujarat, Rajasthan and Haryana showing significant and sustained diversification driven by increased contributions from livestock and non-farm activities. Conversely, States such as Madhya Pradesh, Chhattisgarh and Bihar exhibit high or fluctuating HI values, reflecting ongoing dependence on cultivation income. The analysis also highlights the importance of wage income in reducing HI, implying a distress-induced form of income diversification.

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Informing Agriculture: Who Do Indian Farmers Trust and Where Do They Sell? Evidence from the National Sample Survey

Vandana Sehgal[1] and Jivan Pandharinath Biradar[2]

This study aims to understand the relationship between extension services, types of crops, and farmers' market participation. It also attempts to explain the factors associated with farmers' choice of market and the role of extension services and types of crops. The multivariate logistic regression and probit models are used to understand factors influencing the farmers' choice of market participation. The study shows that Indian farmers sell approximately 90 per cent of their produce to non-regulated markets and mainly have access to private extension services for agriculture-related advice. The logistic regression shows that gender, social group status, monthly expenditure, availability of irrigation, types of crops grown by farmers, and price received are positively significant factors, whereas education level, access to extension services (private and Public), and access to credit are negatively significant factors influencing participation of farmers in regulated markets. The results highlight the need to strengthen regulated markets, reassess the working of public extension services, and increase the cohesiveness of non-regulated markets with private extension services sources to benefit the farmers.

A Decade of Change in India's Consumption Patterns

Anukriti Negi and Priyabrata Sahoo[3]

The study investigates the shift in consumption patterns across nineteen major Indian states from 2011-12 to 2022-23. The research focuses on changes in commodity-wise and income-wise expenditures, analysing the relationship between Per Capita Income (PCI) and Monthly Per Capita Expenditure (MPCE) to highlight regional disparities in income and consumption behaviours. The analysis utilises data from the National Sample Survey (NSS) Household Consumption Expenditure Survey (CES) to assess changes in spending patterns over the study period. It evaluates the expenditure composition on food and non-food items in rural and urban areas. The Growth Incidence Curve (GIC) approach is employed to assess the inclusivity of MPCE growth across income deciles. The analysis reveals a decrease in the share of spending on food items and a rise in non-food expenditures in both rural and urban areas. In rural India, the highest growth in food expenditure is on fruits, while conveyance leads to non-food spending. In urban India, beverages show the

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largest increase in food expenditure, while pan, tobacco, and intoxicants lead to non-food spending. Jharkhand and Uttarakhand demonstrate the highest growth in non-food expenditures in rural and urban regions, respectively. GIC analysis indicates faster MPCE growth for higher-income deciles, suggesting increasing economic inequality.

Rural Transformation and Its Determinants in India

Radhmi Tanwar[1]

The present study investigates the factors responsible for rural transformation in India and the linkages among urbanisation, industrialisation, rural-industrialisation and the livelihoods of rural people in Haryana. The study is based on secondary data. The secondary data on rural non-farm employment (RNFE), urbanisation, unorganised manufacturing (rural & total), rural roads, rural literacy, and agricultural and allied sector GDP had been collected from various published sources and unit-level data to study the determinants of rural transformation. The secondary data were used to examine the linkages between urbanisation, industrialisation, rural-industrialisation, and the livelihoods of rural people in Haryana. The panel data regression model and Pearson correlation analysis were administered to achieve the objectives. The study revealed that rural unorganised manufacturing industries, urbanisation, literacy, agricultural & allied sector GDP per hectare of net sown area, had contributed significantly to the transformation of rural areas. On the other hand, rural roads are not found to be significant in the study, showing that there are chances that instead of creating jobs in rural nonfarm employment in villages, roads are helping in the migration of the rural population to urban areas. The proportion of rural transformation explained by all these four factors varies from 67 per cent to 75 per cent. The significance of these factors in all panel regression models indicates the robustness of these factors in transforming rural areas. Positive and significant association between industrialisation and rural industrialisation has been observed for 2000-01 and 2004-05. Rural industrialisation and rural non-farm employment are positively and significantly associated with each other during 2004-05 to 2010-11. A positive and significant association was found between urbanisation and industrialisation between 2004-05 and 2010-11.

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Role of Vegetable Contract Farming in Crop Diversification and Rural Employment in Punjab: Evidence from Amritsar District

Navbir Batth and Sanjeev Kumar[1]

The study was conducted in the Amritsar district, with the primary data collected from 180 farmers. The study employed Simpson and Herfindahl indices to measure diversification and used a beta regression model to identify its key determinants. The results revealed that contract farmers had the highest level of diversification and cropping intensity, which was supported by better education, larger landholdings, and leased-in land. Vegetable contract farming also created significantly more employment (45 man-days per acre annually) than non-contract vegetable farms (33 man-days) and conventional farming (10 man-days). The findings highlighted that contract farming supports rural livelihoods by creating more stable, year-round employment. The study concluded that with proper institutional support, such as market access and technical assistance, contract farming can be an effective tool for reversing monoculture trends in Punjab and making agriculture more sustainable, profitable, and inclusive.

Scope of Rural Transformation in the Northeastern States towards an Inclusive Growth Process

Kamal Kumar Datta[2]

In the Northeastern states of India, the traditional form of agriculture is often considered to be an ideal situation to develop a balance between meeting our present needs, conserving natural resources, and protecting the environment for the benefit of future generations, which provides communities with their required levels of food. Traditional agricultural approaches are often not practical for mass food production, but they account for a substantial amount of local food production. Agro-climatic diversity enables the region to produce a variety of high-value crops, including spices (ginger, turmeric, and large cardamom), fruits (pineapple, oranges, and kiwi), tea, bamboo, medicinal plants, flowers, and ornamental fish, which are often highly price elastic. The Northeastern region produces many high-value crops (other than paddy) such as potato, fruits, and vegetables. Even though opportunities for farming and horticulture are being created in the Northeastern states, new markets for organic, bamboo, and other tribal products are being opened. The States will also benefit from a cluster-based approach for local products. New products should be identified at each block and district level for better processing and more effective marketing. The

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needs and aspirations of small and marginal farmers might be fulfilled by creating innovations in vertical farming to produce more from less space and energy. To standardise and validate convergence-led business models, thereby tracing out location and context specificity to enhance household-level farm income and ensure livelihood security.

Assessing the Impact of Kisan Credit Card on Crop and Livestock Farming in Maharashtra

Vishwanath[1], P. Anbukkani[1], Pramod Kumar[1], Praveen KV[1], Sitaram Bishnoi[1], and Ranjit Kumar Paul[2]

Based on primary data from 180 farmers (90 KCC beneficiaries and 90 non-beneficiaries) in two taluks of Latur district, Maharashtra, this study evaluates the impact of KCC on farm income from soybean cultivation and livestock farming. A regression adjustment model was used to assess this impact. Results show that KCC significantly reduces transaction costs, increases input use, and enhances income levels. Loans under the scheme are provided at concessional interest rates, encouraging responsible usage and reducing the likelihood of loan diversion. Beneficiaries of KCC report higher yields, increased investments in productive assets, and improved net returns, demonstrating a clear advantage over non-beneficiaries. KCC users enjoy better financial stability and agricultural productivity in soybean and livestock farming. Increasing loan limits to reflect rising input costs is essential to strengthen the scheme further. Additionally, introducing an inflation-linked mechanism for adjusting loan ceilings would help maintain the scheme's relevance and effectiveness over time. Overall, the KCC scheme is critical in enhancing farm profitability and ensuring the long-term sustainability of rural livelihoods.

Economic Growth and Rural Transformation in Haryana

D.P. Malik, Mafi, and Yashpal[3]

This paper explores the rural transformation of Haryana's economy from a predominantly agrarian base at the time of the state's inception to a more industrialised and service-oriented structure between 1991 and 2023. The results revealed a significant decline in agriculture's share in GSDP, from over 50 per cent in the 1970s to 15.80 per cent in 2022-23, accompanied by tremendous growth in the

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industrial (29.06%) and service sectors (53.00%). The proportion of the workforce engaged in agriculture dropped from 66.65 per cent in 1971 to 44.96 per cent in 2011 as per the census, while employment in tertiary sectors increased from 21.36 per cent to 52.10 per cent. Transformation in rural Haryana was gauged by substantial increase literacy rate (61.20%) in rural areas up to 2011, connectivity of each village to towns or regulated markets with metalled road, increased cropping (191%) and irrigation intensities (193%), concentration of area towards profitable crop enterprises, increased area under high value crops, quantum jump in food grain production (47.98 lakh tonnes in 2022-23) and manifold increase in crop productivity and milk production (2088 lakh litres). The total cropped area in 1970-71 was 49.57 lakh ha, and increased to 65.00 lakh ha in 2022-23**.** Despite this progress, the state continued to face challenges, including rural-urban inequality, agrarian distress due to low profitability and the small size of farm holdings, price volatility, and high input costs, as well as threats to environmental sustainability owing to the over-exploitation of groundwater, excessive usage of chemical fertilisers, and the continuous adoption of the same cropping systems. The various policy initiatives are needed to be taken, like establishment of agro-processing industries in cluster mode in rural area to create employment opportunities, promote to target barren, uncultivable waste land and low fertile land for establishment of industries and non-farm activities, motivate farmers for rain water harvesting and adoption of micro irrigation and solar powered pumps, encourage diversion of area towards high value crops to enhanced farm income per unit of land, investment in agricultural research for development of high-yielding and climate-resilient crop varieties to boost crop productivity, promotion of FPOs for taking benefit collective bargaining, primary processing of farm produce.

Impact of Krishi Vigyan Kendra (KVK) on Farm Management Practices, Crop Productivity, and Income in Nainital District of Uttarakhand

Karishma Panwar, Ruchi Rani Gangwar , and Anil Kumar[1]

This study assesses the impact of KVK Jeolikote on adopting improved farm management practices, crop productivity, and farm income among beneficiary and non-beneficiary farmers in Nainital district, Uttarakhand. Using regression analysis, the study identifies significant factors influencing technology adoption and productivity, and quantifies the role of KVK interventions. Results indicate that education, farming experience, and participation in KVK programs significantly influence management practices and farm outcomes. Beneficiary farmers exhibited higher productivity and income levels than non-beneficiaries, confirming the positive role of KVKs in hill agriculture.

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Impact of Organic Orange Production Technology on Rural Household Income in Arunachal Pradesh: A Comparative Analysis

S. S. Sahoo[1], L. D. Hatai[2], and R. Singh[1]

This study evaluates the impact of organic orange production technology on rural household income in Arunachal Pradesh through a comparative analysis of adopters and non-adopters. A total of 120 farmers, comprising 60 adopters and 60 non-adopters, were selected from two major orange-producing districts, East Siang and Lower Dibang Valley, using a multi-stage sampling technique. Primary data were collected through structured interviews and analysed using descriptive statistics, the Shapiro–Wilk test, the Mann–Whitney U test, the Gini coefficient, and the Lorenz curve. Results indicate that adopters of organic orange technology had significantly higher household income, with lower income variability and more equitable income distribution than non-adopters. Orange cultivation contributed a greater share to household income among adopters, emphasising its role in economic empowerment. The findings highlight the potential of organic orange production as a viable strategy for rural income enhancement and inclusive development in hilly regions. Policy support is recommended in training, certification access, market linkages, and youth engagement to scale organic adoption and its benefits.

Assessing Rice Productivity and GHG Emission Efficiency: Global and Country-Level Dynamics in Major Rice Producers

Ankita Rajput[3] and Poonam Chaturvedi[4]

Rice is a staple food for the majority of the population in the world. Rice fields emit greenhouse gases, including CO2, CH4, and N2O. The present study is based on secondary data collected from FAOSTAT. The data was collected from 2020 to 2022. The production, CO2, and CH4 emissions data were collected for China, India, Bangladesh, Indonesia, and Vietnam, the major rice producers. The statistical tools included absolute change, relative change, growth rate, and instability index. The results showed that emission intensity has decreased in all major rice producers. While rice production has significantly increased globally, emissions from rice fields have increased moderately. Vietnam and China exhibited moderate production gains, with Vietnam achieving reductions in CO_2 and CH_4 emissions,

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while China's emissions saw minor increases. Emission intensity has reduced in all major rice-producing regions.

Impact of Urban Proximity on Rural Farm Households in Punjab

Harsh Dagar[1], Jatinder Sachdeva[2], and Priya Brata Bhoi[2]

This study examined the effect of urban proximity on rural development for farm households in Punjab, India. Using a comparative approach, surveys were conducted in six villages in the Ludhiana district, three near and three distant from the city. Ninety households were interviewed, and descriptive statistics and regression models were applied. The analysis found that villages near Ludhiana had larger families, improved education, and more non-farm income, while those farther away held larger land and greater crop diversity. The findings highlight the dual role of urbanisation in shaping rural opportunities and risks, calling for policies that foster resilience as cities grow.

Seeds of Resilience: Women, Agritech, and the Future for Inclusive Rural Development in India

Yogesh Khandre and Mahesh Wakodkar[3]

This study categorises these challenges into structural, economic, and personal constraints. This study illustrates how women navigate systemic exclusions while innovating within their respective contexts by drawing on real-life case studies from across India, including Haryana, Maharashtra, Tamil Nadu, and West Bengal. It also highlights the resilience and innovation of women redefining rural entrepreneurship. For example, women-led farmer producer organisations (FPOs) in Maharashtra have successfully leveraged collective power to access credit and markets, while women in Tamil Nadu have adopted digital tools for organic farming and supply chain management (Desai et al., 2015; Rao, 2017). Despite these achievements, women in agritech continue to be underrepresented in policy design and startup ecosystems. The chapter calls for gender-responsive reforms, including inclusive financing mechanisms, digital literacy programs, mentor-ship platforms, and policy frameworks that recognise and support women's contributions to agritech. These interventions are not only crucial for promoting gender equity but also essential for achieving long-term agricultural sustainability and economic resilience in rural India.

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Tracking Agricultural Sustainability for Rural Transformation in India: A State-Wise Composite SDG Index

Harish B.[1], Praveen K. V.[1], Jamaludheen A.[2], and Gaurav Mattoo[1]

This study develops a state-wise Composite Sustainable Development Goal (SDG) Index using economic, social, and environmental indicators to assess agricultural sustainability across 28 states. Principal Component Analysis (PCA) was employed to aggregate the indicators into a single composite score based on the latest data (2017–2023). The results highlight significant regional disparities, with states such as Kerala, Tamil Nadu, and Maharashtra performing better on sustainability outcomes, while eastern and central states continue to lag on indicators related to resource efficiency, livelihood security, and ecological balance. Higher sustainability scores were strongly associated with improved rural poverty reduction and resilience to climate variability. The study demonstrates that such a composite index can help policymakers identify priority areas for investment and intervention, particularly in water-use efficiency, diversification, climate-resilient practices, and social inclusion. By tracking progress towards SDGs at the sub-national level, the index provides an evidence-based framework to guide rural development programs and promote long-term sustainability in Indian agriculture.

Impact of Resource Conserving Technology on Livestock Numbers in Punjab and Haryana

Rana Rohit[3]

India has the world's largest livestock population, accounting for over 37.28 per cent of cattle, 21.23 per cent of buffalo, 26.40 per cent of goats and 12.17 per cent of sheep. The study examined the growth and export dimension of the livestock sector in India, the factors affecting livestock output and the trends, performance and determinants of the livestock sector in India. Resource Conserving Technology Adopter Cattle Adult, cattle milch, cattle dry and others are less than buffalo adult, buffalo milch, buffalo dry, and others are higher than comparatively in numbers. resource conserving technology non adopter cattle adult, cattle milch, cattle dry and others is higher than buffalo adult, buffalo milch, buffalo dry and others is lesser than comparatively in numbers.

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Effect of Cluster Frontline Demonstrations on Greengram Yield in Bhiwani District, Haryana

Gulab Singh, Meenu, Murari Lal, Kapil Dev, Mamta Phogat, Krishma Nanda, and Sintu Malik[1]

Krishi Vigyan Kendra Bhiwani conducted cluster frontline demonstrations (CFLDs) on Green gram in 2019 and 2020 in eight and five villages of Bhiwani district, respectively. It was found that there was a 42.27 per cent and 29.41 per cent increase in yield during 2019 and 2020, respectively. The average grain yield recorded during the demonstration in 2019 and 2020 was 11.00 and 10.47q/ha, respectively. The average grain yield in the check during 2019 and 2020 was recorded at 8.50 and 8.02q/ha, respectively. A gap analysis study revealed a 75 per cent gap in adopting improved variety MH-421, a 95 per cent gap in seed treatment, a 98 per cent gap in fertiliser application, and an 80 per cent gap in proper and timely weed management.

Evaluation of Crop Diversification in India

Aakashdeep, D. P. Malik, and Vinay Mehla[2]

The study analyses both the patterns and determinants of diversification in Indian agriculture over the period 1993-94 to 2022-23, using secondary data on gross cropped area and employing diversity indices (Simpson Index, Entropy Index, and Herfindahl-Hirschman Index), as well as ridge regression techniques. The results reveal a significant decline in the share of coarse cereals in the gross cropped area, accompanied by the continued dominance of fine cereals such as rice and wheat. At the same time, there has been a notable expansion in the area under fruits, vegetables, spices, fibres, and commercial crops such as sugarcane and cotton, indicating a clear shift towards high-value agricultural production. The SID in gross cropped area increased from 0.66 in 1993-94 to 0.71 in 2022-23, and the EI rose from 1.51 to 1.67, signalling greater crop diversification over time. Conversely, the HHI declined from 0.34 to 0.29. However, within food crops alone, diversification remained modest, with SID values of 0.64 (1993-94) and 0.62 (2022-23). Ridge regression analysis identified rural literacy (coefficient 0.86) and urban population growth (0.66) as major positive determinants of diversification towards horticulture, while rainfall (-0.14) and profitability from conventional crops (-0.17) negatively influenced diversification decisions.

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The Efficacy of Integrated Farming Systems in Promoting Rural Livelihoods: Evidence from Meghalaya

Madhumita Naskar[1] and Anju Choudhury[2]

This study evaluates the impact of Integrated Farming Systems (IFS) on income and employment generation among farming households in Ri-Bhoi district, Meghalaya. Employing a multi-stage sampling technique, data were collected from 100 respondents comprising equal numbers of IFS adopters and non-adopters. The study examines income inequality, income levels, and employment patterns using tools such as the Gini coefficient, Lorenz curve, and multiple linear regression analysis. Findings reveal that although IFS farmers experience moderate income inequality compared to non-adopters, they have significantly higher average household and per capita incomes. Employment generation is positively influenced by the number of IFS components, landholding size, and farmer experience, while household size negatively impacts employment. The results suggest that IFS adoption enhances economic well-being and creates greater employment opportunities, highlighting its potential as a sustainable strategy for rural livelihood improvement in hilly agro-ecosystems like Meghalaya.

Instability in Agricultural Price Support: Evaluating the MSP–FHP Gap and Price Instability for Ragi in Odisha

Chetti Praveen Kumar[3]

This study investigates the trends and instability in MSP and FHP for Ragi in Odisha from 2014–15 to 2023–24 to evaluate the effectiveness of price support mechanisms. Using secondary data from the CACP and the Directorate of Economics and Statistics (DES), the study employs statistical tools, including CAGR and the Cuddy-Della Valle Index. Results reveal that while MSP has increased significantly (CAGR: 10.62%), FHP has lagged (8.59%) and remains consistently below MSP, with a widening gap over time. The instability in MSP (CDVI: 8.29%) is also higher than in FHP (CDVI: 4.46%). The findings underscore the need for improved procurement systems, better market access, and localised support for Ragi growers. Policy recommendations include decentralised procurement, price deficiency payments, and millet-based value addition to ensure fair returns. The study concludes that bridging the MSP–FHP gap is essential for achieving income security and sustainable agriculture in Odisha.

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Socio-Economic Assessment of PM-KUSUM Scheme (Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan) with Reference to Haryana State

Rijul Sihag, Sumit, Neeraj Pawar, Jatesh Kathpalia, and Monika Devi[1]

This study presents a socio-economic assessment of the PM-KUSUM scheme among farmers in the Hisar and Bhiwani districts of Haryana state. With a sample of 80 respondents (40 beneficiaries and 40 non-beneficiaries), the research aims to understand the impact of solar pump adoption on agricultural productivity, income generation, energy savings, and rural development. The findings suggest that beneficiaries of the scheme enjoy improved irrigation efficiency, enhanced crop productivity, and reduced input costs, particularly related to electricity and diesel consumption. Environmental benefits are also evident, with zero carbon emissions and reduced noise and pollution levels. Despite these advantages, the study identifies several critical challenges, including procedural delays in registration and implementation, technical failures during cloudy weather, high initial installation costs, and insufficient advisory support. Awareness levels average 64.16 per cent, with significant gaps in understanding procedural aspects such as the nodal agency, grievance redressal mechanisms, and helpline services. These findings emphasise the need for enhanced awareness campaigns, streamlined implementation procedures, and strengthened institutional support. The PM-KUSUM scheme promises to promote inclusive rural development and energy security; however, its potential can only be fully realised through targeted policy interventions addressing the prevailing barriers to adoption.

Women Empowerment through Self-Help Groups: A Case Study of Mahasamund District of Chhattisgarh

A. K. Gauraha and Jagriti Dubey[2]

The present study examines the business performance of selected food-based microenterprises managed by women-led Self-Help Groups (SHGs) in the Mahasamund district of Chhattisgarh. The study focuses on three prominent and active SHGs: Jai Maa Durga, Jan Jagriti, and Radhe Krishna, each engaged in the processing of products such as Til Laddu, Lemon Pickle, Moong Papad, and Badi. Primary data were collected from 47 SHG members through structured interviews and field-level observations. Key economic indicators were analysed to determine enterprise viability, including the cost of production, selling price, gross returns, net returns, input-output ratio, benefit-cost ratio, and marketing pattern. The findings

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revealed that Moong Papad emerged as the most economically efficient product with the highest input-output ratio (1:2.21). At the same time, SHG III reported the highest per-member annual income (₹3,258), reflecting effective group-level management and product choice. Across all SHGs, products demonstrated positive net returns, highlighting the income-generating potential of food-based microenterprises in rural contexts. Despite its profitability, the study identifies critical areas for improvement, including cost optimisation, market access, price realisation, and training in business planning. The results underscore that SHGs can significantly contribute to rural livelihoods and women's empowerment with appropriate institutional support, marketing linkages, and capacity-building. Additionally, improving marketing infrastructure and expanding access to organised retail and e-commerce platforms will be critical to boosting income. Targeted financial literacy, branding, and packaging support will empower SHGs to scale effectively.

Agrarian Indebtedness in India: Structural Vulnerabilities, Social Inequalities, and the Crisis of Landless Labourers: A Survey of Literature

Shaharshad C. T. and K. Manikandan[1]

This paper examines the persistent crisis of agrarian indebtedness in India, specifically focusing on the socio-economic vulnerabilities of landless agricultural labourers. Despite decades of economic reforms and rural development programs, structural inequalities persist, disproportionately affecting marginal farmers and labourers from the Scheduled Castes (SCs) and the Scheduled Tribes (STs). Drawing on a vast body of literature, this study highlights how neoliberal policies, rising input costs, land fragmentation, and limited access to credit have exacerbated rural distress. The paper also examines how caste, class, and gender intersect to shape labour exploitation and debt dependency in rural India. While schemes like MGNREGA provide short-term relief, they fail to address deeper issues of land inequality and exclusion from institutional credit systems. The findings highlight the need for more inclusive rural policies that focus not only on productivity and growth but also on social justice and equitable access to resources. This paper contributes to a deeper understanding of India's rural landless labour crisis by situating agrarian indebtedness within broader structural and historical contexts.

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Economic Analysis of HDP Apple Cultivation in the Mid and High Hills of Himachal Pradesh

Shilpa Rani and Subhash Sharma[1]

The present study has attempted topic entitled "Economic Analysis of HDP Apple Cultivation in Mid and High Hills of Himachal Pradesh" by selecting a sample of 200 HDP apple growers from mid and high hills, by selecting three districts of Himachal Pradesh i.e. Mandi (60), Kullu (70) and Shimla (70) where HDP in apple is prevalent and by analysing the results, it was obtained that NPW (₹56.08 lakh), BCR (1.31), IRR (27.32%), MIRR (19.79%) in overall, and these values were again highest in Shimla district followed by Mandi and Kullu districts, respectively. The value of returns to scale was more than one in all selected districts (1.240, 1.210, 1.122) in the overall age groups of 3-10 years (Partial and potential bearing stage), meaning that the HDP apple generated increasing returns to scale. Thus, the HDP apple is the gateway to enhancing production and the quality of fruits in Himachal Pradesh, which will help attain higher returns and act as a booster to the state's economy.

Inclusive Growth and Elements of Transformation in Rural India

Nisha[2] and D. P. Malik[3]

This review study examines the trajectory of inclusive growth and rural transformation in India, focusing on evaluating the effectiveness of key public policies and schemes to promote social and economic equity. Drawing from a wide range of national and international data sources, including government reports, economic surveys, and development indices, the study analyses how rural development programs have influenced income distribution, employment, and access to essential services. While India has made notable progress in poverty reduction and agricultural support, significant challenges remain, as reflected in its Human Development Index ranking of 130. Flagship schemes like MGNREGA and PM-KISAN have played a crucial role in cushioning vulnerable rural households and enhancing livelihoods. However, the extent of impact varies across states and population groups. The paper underscores the need for a more integrated policy framework beyond income support to include education, healthcare, skill development, and social empowerment. It argues that broad-based and sustainable

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rural development is essential for ensuring social stability, economic resilience, and democratic integrity.

Understanding Crop Insurance Decisions in the Context of Climatic Risks: Evidence from Central India

Ashish Chouhan and Mrinal Kanti Dutta[1]

Using a double hurdle model approach, this study analyses the determinants of crop insurance adoption in soybean-producing regions of Madhya Pradesh using survey data of 396 farmers. Our main finding is the role of socio-economic indicators such as age, education, social status, land size and financial factors such as credit, and informal risk management strategies such as income from off-farm activities and livestock rearing, in the decision towards adoption of crop insurance and area under insurance by farmers. Our findings indicate that age, education and credit increase the likelihood of adoption and area under insurance, highlighting the importance of financial inclusion and understanding crop insurance. Conversely, the availability of alternative income sources, such as livestock rearing and off-farm income, does not affect the adoption of crop insurance; however, it discourages farmers from insuring larger areas. Furthermore, social hierarchies continue to affect access to insurance and coverage, with farmers from marginalised communities insuring significantly less, reflecting inequities in access to crop insurance.

Determinants of Participation in Farmer Producer Organisations and Their Impact on Grape Farmers' Income in Maharashtra, India: A New Institutional Economics Approach

Deshmukh Akshay Subhashrao, and Parmod Kumar[2]

This study applies the New Institutional Economics (NIE) framework to examine the determinants and income effects of farmers' participation in Farmer Producer Organisations (FPOs) in India's grape value chain. Using logistic regression and instrumental variable (2SLS) regression models on primary data from 220 farmers, we analyse how institutional, economic, and socio-demographic factors shape participation decisions and farm income outcomes. The logistic model reveals that access to training, crop diversification, distance to market, farm size, and education significantly influence farmers' participation in FPO. Incorporating NIE principles, we emphasise the role of institutional arrangements-such as access to

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training cum extension services, capacity building, and collective action-in reducing transaction costs and improving market coordination. The 2SLS model confirms a significant positive impact of farmers' participation in FPO on farm income, indicating that participation enhances farmers' bargaining power, input access, and market linkages. Notably, this study introduces crop diversification and access to institutional support as novel variables in the participation-income nexus. Our findings underscore the importance of strengthening institutional mechanisms to enhance smallholder integration into value chains. The study provides policy insights to improve the design of inclusive and sustainable FPO models that can address rural market failures, reduce risk, and enhance agricultural incomes through collective action and capacity development.

Inclusive Dairy Development: Lessons from Income and Expenditure Patterns in Madhya Pradesh

Udita Chaudhary, Gunjan Bhandari and Subhasis Mandal[1]

This study analyses the levels and trends in dairy income and expenses of agricultural households in the state between 2013 and 2019 based on the unit-level data from the NSSO 70th and 77th rounds of Situation Assessment Surveys. The intra-state analysis reveals striking disparities in dairy incomes (nominal and real) across regions, social groups and land size categories. The real dairy income increased overall by 26.9 per cent in the state. While the increase was fourfold in the southern region, there was a 27.4 per cent decline in the south-western region. Although the Scheduled Tribes (STs) and Scheduled Castes (SCs) households witnessed an increase (49.2% and 196.2%, respectively) in their real dairy income, both the scheduled groups still earned well below the state average. The overall decline in real dairy expenses over time suggests efficiency gains, but the rising input cost (by 26%) for small farmers is a cause of concern. The findings highlight the need for inclusive policies for marginalised regions, social groups, and small landholders to increase dairy incomes and sustain dairy development in the state.

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Technical Efficiency in Potato Cultivation and Market Structure among Smallholder Farmers in the Tribal Areas of Himachal Pradesh

Parul Barwal[1], Subhash Sharma[2], Chinglembi Laishram[2], Diksha Bali[2], and Shilpa Rani[2]

The present research focused on the technical efficiency in potato cultivation and market structure in the tribal area of Himachal Pradesh. This data analysis was based on a primary survey of 120 randomly selected potato growers from the tribal areas of Himachal Pradesh. Potato cultivation was identified as highly capital and labour-intensive, primarily due to significant expenses on seed, Farm Yard Manure (FYM), and human labour. Among the total costs of Rs. 142454.39, FYM comprised approximately 30 per cent, followed by seed (7.20%) and human labour (5.78%). The output-input ratio of 2.00 for potato cultivation suggests that farmers in the study area are realising a substantial return on their investments. The maximum likelihood estimates of the stochastic production function revealed that fertiliser and manure negatively and significantly affected potato production. The mean technical efficiency was 78 per cent, indicating that there is still scope for potato growers to increase efficiency by operating at a fully efficient level of proper resource utilisation and technology. The Gini coefficient for wholesalers in the Bhuntar and Dhali markets was 0.51 and 0.48, respectively, indicating competitive market conditions. They recommended several interventions, including training programs, improved storage facilities, and enhanced access to credit, to boost farmers' incomes and formulate effective measures for achieving the sustainability of the potato crop in the tribal region. Consequently, it advocated for promoting policies enabling efficient and cost-effective potato marketing in the study area, encouraging potential investors to engage in the potato marketing chain.

Evaluating the Viability and Efficiency of Mechanised Paddy Cultivation: Evidence from Power Tiller Use in Sikkim

P. Lather[3], A. A. Devi[4], and R. Singh[3]

Farm mechanisation improves agricultural productivity by optimising input use and reducing labour dependency. In hilly regions like Sikkim, the adoption of power tillers remains limited due to terrain and small landholdings. This study examines the resource use efficiency (RUE) of paddy cultivation and identifies key

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drivers of power tiller adoption at the farm level in Sikkim. Using primary data from 60 farmers, analytical tools such as the Cobb-Douglas production function were used. Results indicated that adopters utilised inputs like seed, FYM, and tillage more efficiently (RUE > 1), while non-adopters exhibited inefficiencies. The study recommends promoting group ownership and machinery banks to support smallholders and enhance mechanisation in hill agriculture.

Profitability and Resource-Use Efficiency of Foxtail and Kodo Millet in Cuddalore District of Tamil Nadu

L.T. Thirumarudhan[1], N. Swaminathan[2], A. Pouchepparadjou[4], S. Parthasarathi[4], and G. Harshavardhini[3]

This study assesses the resource use efficiency of minor millets in the Cuddalore district of Tamil Nadu, utilising primary data collected from 80 farmers. Employing the Cobb-Douglas production function and marginal value productivity analysis, the study identifies underutilization and overutilization of key inputs. The Results reveal that while foxtail millet offers higher profitability (net income: Rs. 14,206/ha, input-output ratio: 1.48), Kodo millet also remains viable (net income: Rs. 9,575/ha, input-output ratio: 1.32). Fertilisers and seeds were significantly underused, whereas human and machine labour were often overused, especially in Kodo millet cultivation. The study highlights the need for improved input management, access to high-quality seeds, enhanced mechanisation, and improved market infrastructure. Policy recommendations include targeted subsidies, farmer training, and millet promotion programs to optimise resource use and improve livelihoods. The findings highlight that minor millets can significantly ensure nutritional security, increase farm profitability, and promote climate-resilient agriculture in semi-arid regions with strategic interventions.

Socio-Demographic Inequalities among Rural Labour and Marginal Farmer Households in the Border Areas of Punjab: An Empirical Evidence

Skattar Singh[3] and Kuldip Kaur[4]

The study reveals the inequalities in the socio-demographic profiles of 657 sampled rural labour and marginal farmer households in the border area of Punjab, comprising 357 rural labour households and 300 marginal farmer households. The study reveals that most sampled respondents were illiterate, with the maximum level

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of their education being only primary, middle, and metric levels. This is a major constraint to rational decision-making, generating new sources of income, and a lack of awareness of different government schemes. Most respondents belonged to the scheduled caste and other backward caste, living in small houses with one or two living rooms. Moreover, the sex ratio is better for rural labourers than marginal farmers. The illiteracy level was 19.37 per cent among sampled rural labour households compared to 12.61 per cent among sampled marginal farmer households in all six border area districts of Punjab. The study recommended multiple suggestions for rural transformation and inclusive development, such as providing adequate housing areas, improving education levels, and generating employment opportunities to improve social and economic conditions.

Impact of KVK on Farm Productivity and Income of Farmers

Bharti and K.D. Sharma[1]

The present study was undertaken in the Kangra block of Kangra district of Himachal Pradesh, where KVK is located. A stratified two-stage random sampling design was employed to select 60 sample farmers (30 beneficiary farmers and 30 non-beneficiary farmers) from the study area. Data were collected using a survey method from sample farmers and the office of KVK Kangra. The regression analysis was carried out to find the impact of various factors on the productivity of crops and livestock. Factors were selected to analyse their impact on better management practices, which were reflected in the high productivity of crops. Improved management practices like proper irrigation, diversification of farm, and KVK patronage were the most significant factors in the higher farm income of beneficiary farmers. It is suggested that extension agencies like KVKs should understand the loopholes in management practices used by farmers and increase their outreach to non-beneficiary farmers so that farm income can be increased in our country.

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Nudging the Fields: A Review of Behavioural Economics Applications in Agricultural Decision-Making and Rural Policy Design

Pratyush Kumari Rath[1], Ankita Sahu[2], Vijay Kumar Saran[3], and Aditya Singh[4]

This review synthesises key concepts, bounded rationality, nudges, social norms, mental accounting, and cognitive biases and explores their relevance to farming practices and rural policy design. Drawing on empirical evidence from South Asia, particularly drought-prone regions like Marathwada in India, the paper examines how interventions such as commitment savings, simplified choice architecture, goal-setting, and norm-based messaging influence the adoption of beneficial practices, including water conservation, soil health management, and crop insurance. Policy implications emphasise integrating behavioural tools with conventional agricultural programs to enhance uptake, reduce cognitive burdens, and build trust among farming communities. Ethical considerations and implementation challenges are discussed, advocating for context-specific, transparent, and farmer-centric strategies. By aligning interventions with farmers' real-world decision processes, behavioural economics offers promising pathways for advancing sustainable agriculture, climate resilience, and rural development.

Effect of Industrialisation on Income Sources and Food Consumption of Farm Households in Vemgal Industrial Area of Karnataka

S. Likhitha[5], M.N. Venkataramana[5], Mahin Sharif[5], K. B. Vedamurthy[6], and M. S. Ganapathy[5]

The study assessed the impact of industrialisation on household income and food expenditure in Kurugal village, which is 5 km from Vemgal Industrial Area, through a comparative analysis with Kurubur, located 22km away. Advanced models like PSM, Gini index, and PCA were used to find income, income inequality and dietary pattern. Kurugal households earned ₹38624 per year more than Kurubur households, with a higher inequality index (0.31). PCA revealed a balanced and pulse-based diet in Kurugal, while Kurubur showed a cereal-dominant pattern. Results highlighted significant socio-economic and dietary changes near industrial villages.

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Commercialisation and Resilience to Shocks: Evidence on Farm Productivity and Household Income in India

Mulla Areef[1]

This study investigates how agricultural commercialisation moderates these shocks' adverse effects on farm productivity and household income. Using nationally representative panel data from the 2012–13 and 2018–19 Situation Assessment Surveys, a two-stage least squares (2SLS) model is employed to address endogeneity and identify the impact of commercialisation in the presence of price, yield, and climate shocks. The results reveal that crop commercialisation increases productivity by 2 per cent and raises adult per capita income by 7 per cent during yield shocks, highlighting its dual role in boosting productivity and providing income resilience. Empirical evidence indicating that commercialisation improves productivity and income highlights the importance of policies promoting market access and participation in modern value chains to enhance smallholder welfare.

Rural Transformation and Inclusive Development in Gujarat: Evidence from Longitudinal Village Survey Reports

Shrikant S. Kalamkar[2], **Kalpana Kapadia**[1], **T.B. Parihar**[1], **and Ganesh Narkulwad**[3]

The study assessed the pace, process, and pattern of rural change and identified key drivers of such changes in Moti Khadol village of Gujarat state by comparing the data sets of the benchmark survey (1964) and recent resurvey (2020) for suitable interventions. Study results indicated that the village has developed over the period. Some households have migrated outside for children's education and jobs. The livelihood of the village is mainly based on agriculture and allied activities. The rearing of livestock is being done on a large scale. The milch animal population has increased significantly. Farmers primarily cultivate a single crop in a year, i.e. tobacco, which fetches them good returns due to high level of productivity, along with growing paddy and bajra on a small area. The main problem of high total dissolved solids in water forces villagers to fetch drinking water from outside the village area. About 83 per cent of households opined that the economic conditions of the villagers have improved, while about 68 per cent of respondents indicated the improvement in village infrastructure. About 58 per cent had opined that the

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agricultural situation has improved. Study suggested few urgent interventions in the village.

Enhancing Crop Production Efficiency through PMKSY: A Study from Kalyana Karnataka Region

Shreekanthareddy, Suresh K, Amrutha T Joshi, Prabhuling Tevari, Kapil Patil, and, Jagruti B Deshmanya[1]

This study explores the impact of Pradhan Mantri Krishi Sinchai Yojana (PMKSY) on water-use efficiency in major and horticultural crops among beneficiary and non-beneficiary farmers. The results revealed that beneficiary farmers achieved higher technical and economic efficiency than non-beneficiaries. For maize, beneficiaries produced 31.07 per cent more yield with 45.40 per cent less water use, resulting in 140.07 per cent higher water-use efficiency and 129.72 per cent higher net returns. Jowar cultivation also saw a 25.96 per cent increase in output and a 35.65 per cent reduction in water use among beneficiaries. In horticultural crops, banana beneficiaries produced 14.71 per cent more yield while using 39.39 per cent less water, and pomegranate beneficiaries had 5.83 per cent higher output with 7.50 per cent less water use. Data Envelopment Analysis (DEA) indicated superior technical efficiency for beneficiaries, with higher proportions of beneficiaries achieving 90-100 per cent efficiency across crops. Economic efficiency was also higher for beneficiaries, with maize farmers achieving an average of 93.03 per cent efficiency, compared to 92.88 per cent for non-beneficiaries. These findings highlight the positive effects of PMKSY in improving water-use efficiency, enhancing productivity, and optimising resource management, thus promoting sustainable agricultural practices.

Economic Analysis of Livelihood Diversification in Tribal and Non-Tribal Areas of Chhattisgarh

Reshma Kaushal and H.K. Patra[2]

The research intended to examine the dynamics of livelihood diversification and food security over time, investigate the determinants of participation rate among household heads in livelihood diversification and examine its effect on food security. This paper aims to measure livelihood diversification for a uniform data set of 21 years in tribal and non-tribal areas, which includes eight districts of Chhattisgarh state of India, namely Bastar, Kondagaon, Balrampur and Surguja (In tribal region) and

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Raipur, Rajnandgaon, Durg and Dhamtari (in Non-tribal region). At the same time, it focuses on status and the changing pattern of crop diversification in the districts with a comparative outlook of both. Data used for the study were collected from 2001 to 2024; the whole study was divided into seven periods, and a separate analysis was done for each period. Simpson's index was used to measure the crop diversification in the districts for comparative study. A result of the study show complete diversification was found in the tribal area in all periods through all indices. Likewise, crop specialisation in Surguja and Balrampur districts was more than in Durg and Raipur districts of the non-tribal area. The index values were higher in the tribal area than in the non-tribal area.

Effectiveness of NRLM in Enhancing Women's Economic Participation in the North Eastern States of India

K. Ophelia Dkhar, L D Hatai, Anju Choudhury, and Singyala Chiphang[1]

The National Rural Livelihood Mission (NRLM) has emerged as a transformative effort to boost women's economic participation in India's North-eastern states, a region characterised by ethnic diversity, socio-economic challenges, and limited employment opportunities. The mission operates through an extensive network of self-help groups (SHGs); nationally, India has approximately 12 million SHGs, of which 88 per cent are all-women groups serving over 142 million families. The program has successfully integrated more than 10 crore women into the formal financial system via over 90 lakh SHGs. In the Northeast, where female workforce participation is notably high in states like Nagaland (56.5%) and Meghalaya (51.4%), NRLM and state-specific initiatives have significantly increased women's income and financial independence. Evidence shows that SHG participation raised household income by 19 per cent and savings by 28 per cent within a short period. Additionally, the incomes of female SHG members across India more than tripled between FY 19 and FY 24. This achievement aligns with the rise in the rural female Labour Force Participation Rate from 21.7 per cent in 2017–18 to 34.6 per cent in 2022– 23. Beyond purely economic benefits, studies in states like Assam indicate that the scheme has promoted significant development for women in political, social, and technological domains, empowering them to contribute more effectively to social processes. Women also report increased involvement in small businesses, skill development, and community leadership. However, on-going challenges such as limited digital literacy, weak market linkages, and gaps in training for scaling entrepreneurial activities persist. NRLM catalyses poverty reduction, but its long-

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term success depends on sustained investment in capacity building, financial education, and adaptive policies tailored to the region's unique socio-cultural landscape.

Agricultural Market Infrastructure in Punjab: Challenges, Policy and Way Forward

Baldev Singh Shergill[1] and Deepak Kumar[2]

The study examined the region's existing structure of agricultural marketing institutions at the district level. PSAMB's expenditure pattern is lopsided as a lion's share is allocated to the repair/construction of roads, and a very small share is kept for capital investment. There has been no increase in the number of regulated markets; the number of sub-yards decreased, and the regulated markets served to the villages per square km have been scanty over time. The number of cold storage facilities and their capacity remained at the lower end. The share of the private sector in the warehousing capacity has been more than fifty per cent and has been increasing over time. The central government introduced e-NAM, a pan-India portal that has not been properly functioning due to the lack of infrastructural facilities in the APMCs. There is a lack of core facilities, service facilities, and support and maintenance facilities at the mandi level. In the above context, it is argued that PSAMB should improve the agri-marketing infrastructure. PSAMB and other related institutions should allocate grants for research and development for market innovations and empirical research studies in the area.

Assessment of Progress and Implementation of MGNREGA in Northern India

Yashpal, D.P. Malik, and Amit Yadav[3]

This study explores the implementation of MGNREGA during the last decade (2015-16 to 2024-25) in Haryana and compares it with neighbouring states such as Punjab, Himachal Pradesh, Rajasthan and Uttar Pradesh. Haryana achieved a strong annual growth rate in employment generation (CAGR 10.87%), surpassing the national average (4.74%) and also recorded a substantial growth in the number of households employed (13.56%). Haryana offered the highest wage to unskilled labour (₹362.83) in 2024-25, but its wage growth was slower than that of Rajasthan. Haryana demonstrated a 488 per cent increase in total area coverage under MGNREGA. The state showed a balanced distribution of work in the area covered

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across public and rural infrastructure and asset creation, indicating a more integrated development strategy for rural development. However, serious challenges persist, such as women's participation in supervisory roles as mates and the recent issue of delayed wage payments. Overall, the findings suggest that MGNREGA has positively contributed to rural employment and asset creation in Haryana, and what is now required is to focus on the quality aspects that lead to women empowerment, reinforce institutions and sustainable rural prosperity.

Trends and Patterns of Agricultural Labourers in India

Apsara K. P. and Mahantesh R. Nayak[1]

This paper examines the evolving trends and characteristics of agricultural labourers in India, focusing on Karnataka. Using historical census data, wage statistics, and labour reports, the study highlights a declining trend in agricultural labour in several states, including Karnataka, driven by urban migration and sectoral shifts. It also explores gender-based wage gaps, dependency on non-institutional credit, and the marginalisation of this workforce. The role of government schemes, particularly MGNREGA, is critically analysed in terms of employment support and policy effectiveness. A SWOC (Strengths, Weaknesses, Opportunities, and Challenges) analysis provides strategic insights into improving labour welfare. The findings underscore the need for comprehensive reforms in rural employment, credit access, and skill development to ensure sustainable livelihoods for agricultural labourers.

Structural Shifts in the Feminisation of Farm Operations in India

Shweta Laura, D.P. Malik, Sumit, Shubham, and Avishi[2]

This study was designed to analyse the trends of male and female workforce engagement in agriculture through the Compound Annual Growth Rate (CAGR) and Gross Value Added by agricultural economic activities. It also studies the possible reasons behind the rise in female participation in agricultural activities and discusses the constraints which limit their potential contribution. The analytical tools, like mean and CAGR, were computed. Women's participation rate in agriculture has increased over the years. The highest share of average female involvement in agricultural activities was found in the western states (42.70%), followed by the North-eastern states (42.4%). However, the average participation rate of women was lower in the

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northern states, except Himachal Pradesh, which had the highest participation rate (54.90%) of women in agricultural activities. Nagaland was next to Himachal Pradesh, with 51.50 per cent of the women's agricultural workforce, followed by Arunachal Pradesh (49.50%). Compared to the rest of the nation, male out-migration is most likely a more prominent reason in the North-eastern states, with an average male out-migration of 45.01 per cent. Also, special attention must be given to constraints like small land holding, less knowledge about mechanisation of farm operations and poor involvement in credit-related activities. Small machinery suitable for women working on hilly terrains should be developed to reduce drudgery.

Self-Help Groups as Catalysts for Women's Empowerment in Rural India: An Empirical Analysis of Ri-Bhoi District of Meghalaya

V. Mehta[1], Lalrinsangpuii[2], R. Singh[1], and Laldinmawii[1]

Women empowerment is a key unit of sustainable development and social progress. Rural India is one of the regions that contain traditional norms and restrictions of socio-economic life of women and as a result women have a need to be empowered with opportunities. Actually, Self-Help Groups (SHGs) have been proved as a strategy of empowering financially and socially skilled women environmentally, particularly villagers. However, the success and influence of SHGs may differ significantly regarding the local culture, resources and difficulties. The paper is on the impacts of Self-Help Groups (SHGs) on empowerment of rural women in the Ri-Bhoi district of Meghalaya. It measures empowerment by conducting an analysis of information gathered by 80-member SHGs on psychological, sociological, economic, and political dimensions. The results indicate that the majority of the participants are greatly satisfied with the moderate or strong feeling of empowerment, especially in self-confidence, social life, and monetary independence. Political empowerment is relatively less, indicating continued obstacles in this area. The study generally agrees that SHGs are the most important tools of holistic empowerment and has suggested capacity building, better access to finances, and enhanced engagement of women in local governance, to scale up the benefits.

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Cooperative-Led Viticulture in Mizoram: A Vehicle for Rural Transformation and Inclusive Agro-Enterprise Development

Laldinmawii[1], Lalrinsangpuii[2], Binodini Sethi[1], and Vipin Mehta[1]

This study examines the role of cooperative-led viticulture in Mizoram as a vehicle for rural transformation amid the decline of traditional jhum cultivation. Despite government policy shifts favouring high-value horticulture, particularly grape farming, there remains limited empirical analysis of the long-term viability and market competitiveness of local wineries operating within cooperative structures. The study applies a mixed-method, ex-post facto research design to address this gap. Qualitative data from interviews with cooperative leaders and winery managers were combined with quantitative consumer surveys across five districts. Market competitiveness was assessed using SWOT and Porter's Five Forces frameworks, while the market potential for local wine was estimated through the Chain Ratio Method. Findings reveal that Champhai and Hnahlan's cooperative wineries operate within a low-competition duopoly supported by regulatory protection and strong vertical linkages with member-growers. However, challenges persist in infrastructure gaps, financial strain and regulatory volatility. Consumer analysis indicates a growing young, urban, educated and high-income demographic driving demand, with estimated annual market potential reaching ₹46.32 crore. Despite a favourable policy environment, including the 2025 amendment allowing fruit-based wines, sustainability depends on policy consistency, innovation and improved governance within cooperatives. The study concludes that Mizoram's viticulture sector, if strategically supported, offers a scalable model for decentralised agro-enterprise and inclusive rural development.

Economic Analysis of Basmati Paddy (PB-1121) Seed Production in Eastern Haryana

Sumit, Neeraj Pawar, and D.P. Malik[1]

The study examines the economics of basmati paddy (PB-1121) seed production in Kurukshetra, Karnal, and Kaithal districts of Eastern Haryana during 2024-25. The average cost of seed production was estimated at Rs 160660 per hectare, generating a gross return of Rs 195688 per hectare and a net return of Rs 35027 per hectare, resulting in a benefit-cost ratio of 1.22, indicating the economic viability of seed production in the region. The operational processing cost was Rs 1019.9 per quintal, with processors earning a net profit margin of Rs 2408 per

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quintal. Major production constraints included a lack of technical guidance (73.3%), inadequate skilled manpower (66.6%), and high input requirements. Marketing challenges such as delayed payments by processors (76.6%) and poor processing facilities were also significant. The study recommends farmer-friendly policies to provide technical training, ensure timely payments, strengthen skilled manpower, and modernise seed processing infrastructure to sustain and enhance the profitability of basmati paddy seed production. The findings can help policymakers and stakeholders design supportive interventions to improve farm income and boost the certified seed sector in Haryana.

Agricultural Development, Land and Water Degradation in Haryana

Neeraj Pawar, Sumit, Harshit Bansal, and D.P. Malik[1]

The present study examines the trends in agricultural growth, crop instability, groundwater depletion, and land degradation in Haryana using time-series data from 1966-67 to 2023-24. Major crops were analysed across four periods using compound annual growth rates (CAGR) and the Cuddy-Della Valle Index (CDVI) to measure performance and variability. The findings reveal that crops like paddy, bajra, rapeseed & mustard showed positive growth in both production and productivity in recent decades. In contrast, others like wheat, barley, and gram have experienced stagnation or decline. Cotton, notably, has witnessed a significant drop in both area and yield due to pest infestation. Instability analysis indicates that crops such as gram, barley, and cotton are particularly vulnerable to external factors. Simultaneously, groundwater levels across Haryana have declined alarmingly, with average depth increasing from 8.92m (1974-83) to 20.23m (2014-23). Districts like Kurukshetra, Gurugram, and Fatehabad exhibit over 200 per cent groundwater development, indicating acute over-extraction. Furthermore, land degradation expanded in most districts between 2011 and 2019, particularly in urban and agriculturally intensive regions. These results underscore the urgent need for integrated policies promoting sustainable agriculture, groundwater conservation, and land restoration in the state.

The Economics of Production and Marketing of Sapota in the Northern Zone of Haryana

Vinay Mehala, Sumit, Janailin S. Papang, Sushil, and Aakshdeep[1]

The present study investigates the economics of production and marketing of sapota (Manilkara achras) in the northern zone of Haryana, where the crop is

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emerging as a viable alternative under horticultural diversification. Data were collected from 30 sapota growers selected purposively from Yamunanagar and Panchkula districts using a structured schedule during 2023-24. Analytical tools such as Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period, and Benefit-Cost Ratio (B:C) were used to assess the economic feasibility of sapota cultivation. Marketing efficiency was evaluated using the Conventional Method, Acharya's approach, and Shepherd's Index across different marketing channels. The results from the study revealed that the average establishment cost of sapota orchards was ₹70,465 per hectare, while the gross returns amounted to ₹3,78,805 per hectare in the seventh year. The investment was economically viable, with a Net Present Value of ₹4,52,967, an IRR of 23.69 per cent, a B:C ratio of 1:2.70, and a payback period extending to the seventh year. Among the three marketing channels observed, direct sale to consumers (Channel-I) was the most efficient per Acharya's and Shepherd's methods, while Channel-III (with pre-harvest contractors and intermediaries) showed slightly higher efficiency under the conventional approach. Key constraints faced by growers included pest incidence during the rainy season, lack of quality saplings, and market information gaps.

From Growth Trends to Global Trade: Time Series Forecasting and Competitiveness of Major Fruits in India and Haryana

Monika Devi, D.P. Malik, and Rijul Sihag[1]

This study presents a comprehensive analysis of the growth trends, variability, and export competitiveness of major fruits in Haryana and India from 2000–01 to 2023–24. Utilising statistical tools such as Compound Annual Growth Rate (CAGR), Coefficient of Variation (CV), Cuddy-Della Valle Instability Index (CDVI), and Revealed Comparative Advantage (RCA), the study evaluates temporal patterns in area, production, and productivity of key fruits—mango, citrus, guava, banana, and papaya. The results show a significant structural shift in Haryana's fruit cultivation, with citrus emerging as the dominant fruit in both area and production, while mango declined notably. Guava maintained moderate and stable growth. At the national level, banana and papaya showed strong early growth that stabilised in recent years. Export performance of fruits remained modest, with RCA values below 1 for most crops, indicating limited global competitiveness. Forecasting using ARIMA and NNAR models demonstrated reasonable accuracy for predicting future production, with citrus having the most reliable forecast. The study underscores the need for

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crop-specific policy interventions, improved infrastructure, and export-oriented strategies to enhance India's fruit sector's sustainability and global positioning.

Evaluating the Impact of E-NAM on Farmers' Price Realisation: A Comparative Analysis

Neha Thakur and Sanjeet Singh[1]

This study examines whether farmers in selected APMCs, Shimla & Kinnaur, Kullu & Lahaul-Spiti, and Solan receive better prices through e-NAM than physical auctions held in the same mandis. Using secondary data from 2017 to 2024, collected from e-NAM and Agmarknet portals, the study analyses price trends and differences using paired t-tests. The study's findings show that farmers in Solan APMC experienced the highest price gains, with e-NAM prices averaging ₹1283.87 more than physical auctions, significant at the 1 per cent level. In Kullu & Lahaul-Spiti APMC, the average gain was ₹203.89, significant at the 5 per cent level. However, in Shimla & Kinnaur APMC, the price difference was negative and statistically insignificant. Discussions with mandi officials suggest this may be because farmers with better quality produce often prefer to sell outside the mandi for immediate cash. Additionally, since e-NAM determines prices based on quality grading, farmers bringing ungraded or lower-quality produce may not receive competitive rates. To improve the effectiveness of e-NAM, there is a need to ensure quicker payments to address farmers' immediate cash requirements. In addition, regular training and awareness programs should be conducted to help farmers understand how to use the platform effectively and benefit from quality-based pricing.

Navigating Barriers to Climate Adaptation in Asia: A Comprehensive Systematic Review and Bibliometric Analysis

Neelam Singh and Dibakar Sahoo[2]

This study examines constraints to adopting and implementing climate adaptation strategies in Asia through a systematic review of 99 peer-reviewed articles from Scopus and Web of Science. Using bibliometric analysis and thematic exploration, it identifies trends, collaborative networks, and factors influencing the adopting of these strategies, shedding light on regional dynamics and persistent barriers. Findings show a surge in climate adaptation research post-2015, especially following the COVID-19 pandemic, focusing on sustainable agriculture and technological innovation. Smaller farms in Nepal adapt more effectively due to their

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flexibility, while Pakistan and China face severe institutional and water-related challenges. Economic sustainability is a key issue in Sri Lanka's arid regions, and Bangladesh and Nepal struggle with technological deficiencies. Financial constraints and socio-cultural barriers, including gender norms, are prevalent in Turkey, Pakistan, and India, disproportionately affecting women and exacerbating their vulnerability. Farmers often grapple with balancing short-term economic gains with long-term sustainability, as seen in decisions around zero-tillage and agroforestry practices. This study highlights the urgent need for targeted, inclusive interventions to address region-specific barriers.

Economic Impact of Farmer Producer Organisations (FPOs) on Farm Profitability in Madurai District

Yogitha P.[1]

This study was conducted on the members and non-members of FPOs in Madurai district to study the economic impact of FPOs on farm profitability. The main methodology used in this study to examine the economic implications of FPOs on farm profitability was the Difference in Difference model. In the case of FPO members of paddy crop, the average annual income before the operational period was Rs 29328.07. It was Rs 34747.67 after the implementation period. The difference was Rs. 5419.6. The FPO's average annual income difference between the two periods of the coconut crop, before and after the implementation period, was Rs. 51050.73. It is concluded that FPO members could get a higher income than non-members due to the provision of input availability at a lower price than the market price.

Evaluating the Role of PM-KISAN in Driving Rural Transformation and Inclusive Development in India

P. Balamurugan and K. Sitadevi[1]

This study uses Cragg's Double Hurdle Model to evaluate the scheme's role in promoting rural transformation and inclusive development by analysing the participation decision and the intensity of benefit utilisation. The first hurdle identifies factors influencing enrollment, revealing that education, farm size, and awareness significantly affect participation. The second hurdle examines benefit intensity, showing that banking access, fund utilisation for inputs, and cropping intensity are key determinants, while rainfall variability negatively impacts benefit use. The findings underscore the importance of improving financial infrastructure,

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enhancing awareness, and addressing climatic vulnerabilities to ensure broader and more effective inclusion. Policy suggestions include digitisation of land records, integration with input subsidy programs, and targeted outreach to marginalised groups like tenant farmers and women. The study concludes that while PM-KISAN has the potential to act as a catalyst for rural transformation, its impact depends on addressing systemic barriers and tailoring delivery to local needs. The evidence supports refining the scheme to better align with the broader goals of Viksit Bharat 2047 and SDGs.

Multidimensional Impacts of Floods on Human Development in South Asia: A Systematic Review

Swati Sneha and Dibakar Sahoo[1]

This study presents a systematic review of 53 peer-reviewed studies published between 2010 and 2024, examining the multifaceted consequences of flooding on health, education, livelihoods, and infrastructure, with particular emphasis on South Asia, a region increasingly vulnerable to climate-induced hazards. The review adhered to the PRISMA framework, wherein an initial corpus of 467,000 records identified through Web of Science and Scopus databases was methodically screened and analysed according to rigorous inclusion and exclusion criteria. The findings reveal that floods are not merely natural or environmental events but complex social phenomena with profound implications for human development. Their impacts intersect with existing social inequalities, disproportionately affecting marginalised populations, including women, Dalits, informal sector workers, and landless communities due to their restricted access to resources, essential services, and institutional support mechanisms. The study documents the increasing utilisation of technological interventions, Geographic Information Systems (GIS), remote sensing, and artificial intelligence, for flood prediction and risk management, while noting that weak governance structures and inadequate community engagement often constrain their effectiveness. The review identifies critical research gaps, including limited longitudinal studies examining long-term impacts and insufficient attention to equity-focused approaches in addressing flood-induced displacement and adaptation.

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Enhancing Rural Livelihoods through Crop Diversification in India: A Systematic Review

Smriti and A K Basantaray[1]

This paper presents a systematic literature review (SLR) of empirical and theoretical research on crop diversification in India, from 1976 to 2025. Anchored in the PRISMA framework, the study synthesises findings from a wide range of peer-reviewed articles, working papers, and institutional reports to examine the determinants, livelihood outcomes, and policy implications of crop diversification. The review highlights that diversification decisions are shaped by a complex interplay of household-level factors (e.g., farm size, irrigation access, education), economic drivers (e.g., net returns, credit access), and structural conditions (e.g., climate vulnerability, institutional support). Empirical evidence demonstrates that crop diversification contributes significantly to rural livelihoods by enhancing income stability, employment, food and nutritional security, and resilience to climate and market risks. However, challenges such as high input costs, perishability of high-value crops, and infrastructural constraints limit its potential, especially for smallholders. The review emphasises the need for integrated policy support, including investment in infrastructure, credit access, extension services, and capacity building. Aligning crop diversification with broader development programs can foster sustainable and inclusive agricultural growth in India. This review identifies critical knowledge gaps and provides a foundation for future research and evidence-based policymaking.

Flood Recession, Agriculture and Diversification towards Short Duration High-Yielding Varieties of Crop: Insights from Different Agro-Climatic Regions of Assam

Md. Aktar Hussain[2] and Pradyut Guha[3]

The present study examines the diversification towards short-duration high-yielding varieties (HYV) of crop in different degrees of flood hazard and its determinants using farm-level data collected from different agroclimatic regions of Assam. The findings reveal that agricultural diversification towards short-duration HYV crops was higher in very high and highly flood-hazard regions of the state. Factors like access to irrigation, flood exposure, institutional credit, extension services and size of operational landholdings significantly influence the decision to

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adopt and the extent of adoption of HYV crops in the study area. Policy interventions to strengthen irrigation infrastructure and improve extension outreach and inclusiveness in institutional credit delivery would enhance farmers' capacity to diversify toward flood-resilient HYV crops in Assam.

Study of Determinants of Performance of Farmer Producer Organisation in India

Swati Singh[1], Aakriti Sharma[2], Nitin Sharma[4], and Pavan Kumawat[4]

Farmer Producer Organisations (FPOs) in India are still questionable despite large government investment in these organisations. Integrating Collective Action, Institutional, and Stakeholder theories into a multi-level analytical framework, this study investigates the factors influencing performance in high-functioning FPOs. Using 25 in-depth interviews with CEOs, board members, and farmers, document analysis and field observations, the study uses qualitative data from five high-performing FPOs chosen using snowball sampling and participatory performance criteria. The study's conclusions highlight policy suggestions that promote open communication, attend to members' needs, and utilise technology-driven platforms. Policymakers may enable FPOs to have an even more revolutionary impact on India's agricultural environment by fostering these factors, encouraging economic empowerment and advancement among farmer constituents.

Farming for a Sustainable Future: Need of the Hour

Supreet Kaur and Skattar Singh[3]

The current study examines the structural changes in the proportions of various crops in the gross cultivated area and in the total yield of food and non-food crops, and the development of contract farming in Punjab state throughout the post-reform era (1990-1991 to 2019-20). The study's conclusions indicated that rice and wheat were the two main crops planted during the study period, indicating the state's predominance of traditional farming patterns, which is cause for grave concern. The findings also showed that Punjab state’s percentage of contract farming has been falling, indicating that the program hasn't had much impact on the state's agricultural situation. This could be because certain policy factors support the wheat and rice cycles. To transform the state's agrarian economy, coordinated efforts must be made so that it doesn’t threaten its sustainability.

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Rural Transformation through Displacement: Push-Pull Dynamics, Slum Settlement, and the Paradox of Migration in India

Ayushee Gautam[1] and Gulshan Kumar[2]

This study investigates the complex interplay between rural-to-urban migration, urbanisation, and slum proliferation across 30 Indian states using Census 2011 data. Despite internal migrants comprising 37 per cent of India's population and over 65 million urban residents living in slums, the correlation between slum share and migration intensity is weak ($r = –0.15$). Through a novel Migration–Slum Ratio (MSR) and quadrant typology, we uncover stark inter-state disparities: states like Delhi and Kerala demonstrate effective absorption, while Andhra Pradesh and Odisha exhibit high slum burdens despite modest migration. Findings underscore that slum formation is shaped less by migration volume and more by urban governance capacity.

Exploring Greenwashing in the Global Agricultural Sector: A Mixed-Methods Analysis of Misleading Sustainability Narratives and Country-Level Regulations

Priya Karna[3]

The present study examines how greenwashing shapes sustainability narratives, influences consumer trust, and escapes regulatory scrutiny across the agricultural sector. The objectives are to identify patterns of greenwashing, classify deceptive claims using the "Seven Sins of Greenwashing" framework, and assess how country-level regulations address these practices. A mixed-methods approach combining bibliometric analysis (via Bibliometrix in R) and text mining of global media and policy documents was performed to achieve this. The study also integrates in-depth case analysis of Mantria Corporation (USA), NeuRizer (Australia), and JBS (Brazil) to contextualise greenwashing practices across agri-food systems. Results reveal recurring patterns of unverifiable claims, vague certifications, and selective environmental messaging, often enabled by weak or fragmented legal frameworks. Findings also show that such practices distort sustainable value chains, mislead stakeholders, and reduce the effectiveness of climate-resilient agricultural policies. This research contributes actionable insights for regulators, start-ups, and agri-exporters. It aligns with AERA's conference themes by recommending stronger policy tools, verification mechanisms, and transparent communication to build sustainable agricultural futures.

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Optimising the Onion Ring: A Conjoint Analysis for Market-Driven Production Efficiency

Dhivya R.[1]

The study explores the determinants of consumer preference and production efficiency in onion cultivation through a conjoint analysis conducted in Trichy district, Tamil Nadu. Data were collected from 60 farmers, 10 intermediaries, and 30 consumers to identify key factors influencing market-driven production decisions. The analysis considered four attributes—price, color, pungency, and size—and revealed that consumers prefer low-priced, dark pink, medium-pungency, and large-sized onions. Price emerged as the most influential factor (28.9%), followed by pungency (26.6%), size (23.6%), and color (20.8%). The Response Priority Index analysis indicated that the major constraints for farmers include limited knowledge of improved varieties, high labor costs, and lack of storage, while marketing agents face severe price fluctuations, high transportation costs, and seasonal supply issues. The study concludes that improving farmers' access to training, technology, and infrastructure, along with organized marketing systems, can enhance productivity and profitability. Policy recommendations include strengthening extension services, developing cold-chain and storage facilities, ensuring better market information, and supporting smallholders through institutional and financial linkages.

Knowledge of Bhavanter Bharpai Yojna (BBY): A Lead Towards Rural Transformation in Haryana

Jatesh Kathpalia, Rashmi Tyagi, D.K. Bishnoi, Rijul Sihag, and Arun Patter[2]

The present study was conducted to assess farmers' knowledge about BBY, examine the socio-economic variables influencing awareness, and identify the key constraints faced in accessing scheme benefits. A total of 120 beneficiary farmers from Mahendergarh and Bhiwani districts of Haryana were surveyed using a structured interview schedule. The findings revealed that 44.17 per cent of the respondents exhibited medium knowledge, while 40 per cent had high knowledge and 15.83 per cent had low knowledge about the scheme. Statistical analysis showed significant associations between knowledge levels and variables such as education, income, landholding, occupation, extension contact, and socio-economic status. Major constraints included delays in compensation, difficulties in digital registration, a lack of clarity on documentation, and limited inclusion of crops. The study suggests that BBY's effectiveness can be enhanced by simplifying administrative procedures,

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expanding the crop basket, and strengthening farmer awareness through targeted extension strategies.

Fertiliser Trends in India with Special Reference to Haryana: A Production, Consumption, and Import Analysis

Mohit Sehal and Satpal Singh[1]

The present study investigates the long-term trends in fertiliser production, consumption, and imports in India, with special emphasis on Haryana, from 1992–93 to 2021–22. Data were sourced from official government portals and analysed using descriptive statistics and graphical representations. The findings reveal a consistent increase in fertiliser production and consumption, rising by 1.91 times and 2.45 times respectively by 2021. Fertiliser imports grew dramatically, recording a 447 per cent increase from 1992 to 2011, declining to 270 per cent in 2016, then rising to 336 per cent in 2021. Per-hectare fertiliser consumption in India rose steadily until 2010-11, after which it declined to 137.15 kg/ha by 2021. Among states, Uttar Pradesh exhibited the highest fertiliser consumption, followed by Maharashtra and Madhya Pradesh. The study also notes a growing adoption of alternative nutrient sources such as farmyard manure, cow dung, and poultry litter, reflecting a shift towards integrated nutrient management practices. This approach is increasingly recognised as vital for maintaining soil health, enhancing long-term agricultural productivity, and supporting environmental sustainability. The results underline the importance of promoting balanced and judicious use of fertilisers through region-specific strategies and policy interventions.

Cotton Decline in Tamil Nadu (2016–2023): Exploring the Roles of FPOs, MSP & Production Costs

S. Harini Ramya, Aruna. R., Balaji Jeyakrishnan, Ram Prasath, and Priya Dharshini[2]

This Study empirically investigates the role of Farmer Producer Organisations (FPOs), Minimum Support Price (MSP), and production costs in shaping cotton output trends. This study uses secondary data from government sources and employs regression analysis. It states that the nuanced relationships of MSP and cost of production exhibit statistically significant impacts on output. The number of FPOs shows no direct correlation. The Findings suggest that Minimum Support Price

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procurement strength and escalating cultivation costs, especially wages and fertiliser, are key production determinants. In contrast, FPOs require stronger institutional frameworks to influence yield outcomes meaningfully. The study states a relationship between Farmer Producer Organisation and cotton production at a foundational level, as major studies were found on agricultural production and sources not found particularly for cotton production, which was the major research gap.

Transforming Rural Economies through Employment, Livelihood, and Food Security Interventions: Evidence from Chhattisgarh

Neelam Sinha and Vijay Choudhary[1]

Rural transformation in Chhattisgarh has been shaped by flagship government programs to improve livelihoods, social inclusion, and food security. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is crucial in generating wage employment, reducing distress migration, and creating rural assets such as water conservation structures and rural connectivity. These interventions have strengthened agricultural productivity and climate resilience. The National Rural Livelihoods Mission (NRLM) has empowered rural households, particularly women, by fostering Self-Help Groups (SHGs), entrepreneurship, and skill development, diversifying income sources and enhancing financial inclusion. Concurrently, the National Food Security Act (NFSA)-based Public Distribution System (PDS) in Chhattisgarh stands out for its efficiency and accessibility, ensuring food and nutritional security to a large rural population. The combined impact of these programs has contributed to poverty reduction, improved living standards, and greater participation of marginalised communities in development processes. The convergence of employment, livelihood, and food security interventions has advanced sustainable livelihoods and inclusive growth in rural areas. Despite these achievements, persistent challenges such as capacity building, monitoring, and timely fund allocation demand continuous attention. These policies collectively drive rural transformation, positioning Chhattisgarh as an example of integrated and inclusive rural development.

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Investigating Paddy Straw Burning in Punjab: Drivers, Information Gaps, and Economic Feasibility of Sustainable Alternatives

Gaurav Mattoo, Praveen K.V., and Harish Boraiah[1]

This paper explores why farmers resort to burning crop residue, what information shapes their decisions, and whether sustainable alternatives are economically viable. Through a survey of 150 rice farmers in Ludhiana district, this study identified the primary reasons for stubble burning: high machinery costs, limited access to rental equipment, and insufficient awareness of other options. To determine their affordability, the paper evaluates the costs of adopting sustainable Crop Residue Management (CRM) tools, such as the Super Seeder, MB Plough, Baler, and Rotavator. Findings suggest that adopting these tools may pose financial and logistical challenges for some farmers. Additionally, information about sustainable practices is not reaching farmers effectively, as extension services and digital platforms are inconsistent and underutilised. This paper recommends region-specific, farmer-focused policies to bridge knowledge gaps, improve access to machinery, and promote cost-effective CRM solutions to reduce stubble burning and safeguard the environment and public health.

Economic Evaluation of Cauliflower Cultivation in Hisar District of Haryana

Dalip Kumar Bishnoi, DP Malik, Monika Devi, and J.K. Bhatia[2]

The results of the study revealed that per acre, the total and variable cost of cultivation in normal sown cauliflower was found to be Rs 118169 and Rs. 81507, respectively. Meanwhile, in the case of mid-sown cauliflower, the total and variable cost of production per acre were found to be Rs. 91015 and Rs. 58346, respectively. Meanwhile, per-acre net returns were estimated to be Rs. 28065 and Rs. 12485 for normal and mid-sown cauliflower cultivation. Similarly, the benefit-cost ratio was higher in normal sown cauliflower (1.24) over mid sown cauliflower cultivation (1.14), indicating that cultivation of normal sown cauliflower is more beneficial in the study area. Therefore, it was concluded that there is a need to ensure the availability of quality seeds at affordable prices and encourage the formation of FPO to realise better prices.

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Socioeconomic Characteristics of PBNS-12 Growers and Non-Growers Parbhani District of Maharashtra

Sandeep K. Kayande, Digambar S. Perke, Pratyush Kumari Rath, Sachin S. More, Ranjit V. Chavan, Ramkishan F. Thombare, and Dheeraj T. Pathrikar[1]

This study examined the socioeconomic profile of farmers cultivating the improved safflower variety PBNS-12 in Parbhani district, Maharashtra, and compared it with that of non-growers. Using a multistage sampling design, data were collected from 60 growers and 60 non-growers, and analysed using descriptive statistics. Results showed that PBNS-12 growers were predominantly male (93.3%), with the majority falling in the 31-45 age group (48.3%) and having over 21 years of farming experience (56.6%). Secondary education was the most common level of education, and agriculture was the primary occupation for 81.67 per cent of growers. The annual family income of growers (₹307500) was significantly higher than that of non-growers (₹193866.7), with growers also holding slightly larger landholdings (3.05 ha vs. 2.60 ha). These findings indicate that PBNS-12 adoption is associated with higher incomes, better resource access, and greater social participation.

Do Self-Help Groups Catalyse Gender-Inclusive Climate-Smart Agriculture? Evidence from Bihar, India

Rosalin Geetha-Ingersal, and Mahin Sharif[2]

This study uses gender-disaggregated data to examine the role of Self-Help Groups (SHGs) in promoting Climate-Smart Agriculture (CSA) in Bihar. Heckman and negative binomial models reveal that SHG membership significantly enhances women's awareness and adoption of low-cost, knowledge-intensive practices like nutrient management, intercropping, and crop diversification, with spillover benefits to male counterparts. However, Scheduled Caste and Tribe (SC/ST) women remain structurally excluded, even within SHGs. Access to Krishi Vigyan Kendras (KVKs) strongly predicts awareness, adoption, and intensity. The study calls for equity-focused institutional linkages to build inclusive, climate-smart farming systems.

Renewable Energy as a Means for Rural Livelihood in Punjab

Arshdeep Singh and Sangeet Ranguwal[3]

Primary data were collected from 60 farmers (30 adopters and 30 non-

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adopters), 10 paddy residue collectors and two bioenergy power generation plants of different capacities of power generation from 2 different districts selected by using a multi-stage random sampling technique through personal interview method during the agricultural year 2023-24. Both adopter and non-adopter farms generated significant crop residue, producing an average of 18.62 quintals per acre and non-adopters 15.32 quintals per acre. Over 90 per cent of the residue remained surplus for both categories. Adopters primarily managed residues through removal, while non-adopters relied mainly on incorporation and partial burning. The paddy residue collectors across two selected districts, i.e. Sri Muktsar Sahib and Hoshiarpur, managed 993.17 acres of paddy area on average and baling operations averaged 390 hours over about 42 days, with a field capacity of 2.55 acres per hour, using square bales. Among different expenses, transportation had the largest share of total cost (27%). On average, the baling of paddy straw for power generation in Punjab demonstrated it as a profitable option, with net returns of Rs 651.98 per acre; BC ratio of 2.36; payback period of 2.59 years. However, realising the full potential of CRM faces several challenges that must be addressed systematically to ensure long-term success. There is an urgent need for a multi-faceted approach that includes technological investment, supply chain infrastructure, financial incentives, and awareness and regulatory support, which will unlock the potential of agricultural residues as a valuable resource, providing both environmental and economic benefits.

Rural Transformation through Agricultural Technology with Special Reference to Super Seeder

Rashmi Tyagi and Jatesh Kathpalia[1]

The Superseeder is an advanced agricultural implement designed to address the dual challenges of crop residue management and soil conservation. The analysis revealed that two-thirds of the farmers (65.00%) belonged to the age group of above 50 years, followed by 39.17 per cent of the farmers belonging to the age group of >35to 50 years, and the remaining 28.33 per cent of the respondents belonged to the age group of up to 35 years. In terms of respondents' caste, 61.67 per cent belonged to the general caste and 26.67 per cent belonged to the backward class. It was reported that 73.33 per cent of farmers knew that stubble burning contributes to pollution. Around two-thirds of farmers recognised that the super seeder is one of the best options for crop residue management. With regard to managing the paddy straw, 60 per cent of the farmers stated that the super seeder consists of a rotavator and a zero till drill. Results revealed that education, size of landholdings, annual income,

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social participation, mass media exposure and socio-economic status were significantly associated with the level of knowledge among respondents.

Economic Viability of Shrimp Farming in the Emerging Aquaculture Zones of Haryana, India

Dalip Kumar Bishnoi, Anupam Anand, and Sanjeev[1]

Shrimp aquaculture rapidly expands into non-coastal, inland regions of India, transforming saline-affected, marginal lands into economically productive assets. Haryana has emerged as a notable example of this shift, demonstrating significant potential in Litopenaeus vannamei cultivation. This study evaluates the economic viability of inland shrimp farming in Haryana's Sirsa and Fatehabad districts. Based on data from 50 shrimp farmers, the analysis reveals a high-cost, high-return system with net returns of Rs. 3.32 lakh per acre and a Benefit-Cost Ratio of 1.36. Despite profitability, systemic feed, seed, credit, and marketing infrastructure bottlenecks constrain scalability and demand urgent institutional redress.

Comparative Economic Analysis of Lilium Cultivation under Protected Structures in Haryana, India

Parveen Kumar Nimbrayan[1]

An economic analysis of Lilium production in Haryana under different protected structures has been done in the present study. In Haryana, the districts Sonepat, Kurukshetra, Karnal, Panipat, and Hisar were purposively selected because Lilium is cultivated in these districts under protected structures (i.e. naturally ventilated polyhouses, net houses and walk-in-tunnel). Results from the study revealed that the higher initial investment cost was found in the naturally ventilated polyhouse (₹8154040) compared to other structures. Also, the results obtained in this study indicated that the walk-in-tunnel (₹4222711) has the highest total cost (Cost C_2) incurred in the lilium production as compared to the naturally ventilated polyhouse (₹4170332) and net house (₹4060696). Gross returns were higher in naturally ventilated polyhouses (₹6086080) than in other structures. Net returns were found to be highest in net houses (₹2022164), followed by the naturally ventilated polyhouses (₹1915748) and walk-in-tunnel (₹1858189). Seedling cost was found to be the major cost in Lilium production. Higher stick production of the Lilium flower was found in a naturally ventilated polyhouse. The benefit-cost ratio was the highest in the net houses (1.50) among the three structures.

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Non-Farm Income and Inequalities among Agricultural Households in Punjab

Sukhdeep Singh, Arjinder Kaur, and H K Mavi[1]

The present study has assessed the inequality arising from different income sources across agroclimatic zones and farm categories of Punjab, India. The analysis indicates that the rural poor in the state tend to diversify their income portfolio towards non-farm and livestock income. Income from agriculture comprised the major source of total income among the agricultural households. In contrast, income from livestock and non-farm activities plays a major role in marginal and small farm categories. Agricultural income contributes the maximum (87%) to the total inequality and has a positive marginal effect on inequality. Meanwhile, livestock and non-farm income are potential sources of bridging the inequality gap across all agroclimatic zones of Punjab. The Theil index showed that within-zone inequality is the main contributor to the total inequality in the state. In contrast, in the case of agricultural income between farm categories, inequality is more than within-category inequality.

Sustainable Livelihood Security and Rural Transformation: A Comprehensive Empirical Analysis of Chhattisgarh

Pydi Anuhya and Praveen Kumar Verma[2]

The research evaluates the state's agricultural and economic development over a decade (2014 to 2024) through ecological, economic, and social indicators. A composite Sustainable Livelihood Security Index was developed to assess disparities and trends across 33 districts. The study reveals that high population density exerts pressure on natural resources, while forest coverage varies significantly, affecting biodiversity. Cropping intensity, net irrigated area, and livestock density influenced ecological sustainability. Effective water conservation practices in select districts serve as models for sustainable resource management. Economically, Raipur (0.751), Bemetara (0.814), and Balodabazar (0.71) showed strong infrastructure and resource efficiency, while disparities in food grain and milk production persist. Socially, higher female literacy, road connectivity, health centres, and commercial banks contributed to improved social equity, with Raipur (0.826) performing best. In 2024-25, 22 districts were moderately sustainable, and 11 districts were sustainable. Bemetara (ecological score 0.743) led in environmental performance. The study recommends integrated policies focused on balanced development, forest

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conservation, sustainable cropping and livestock practices, improved market linkages, and infrastructure enhancements to secure sustainable livelihoods for Chhattisgarh's future.

Transmission of Agricultural Labour Force towards Other Sectors- A Reform in Agriculture in the U.T. of Puducherry

Thanu Vaishnubharathi, E. T. Sivasakthi Devi, N. Swaminathan, A. Pouchepparadjou, and S. Saravanan[1]

The structural changes in the cropping pattern due to labour scarcity were examined using the Markov chain approach over 10 years. Among them, paddy has the highest retention probability at 64 per cent, followed by sugarcane, which has retained 54 per cent, and other crops. The study inferred that a change in cropping pattern was readily visible, and the transition trend was towards cultivating less labour-intensive crops. The results of the supply-demand gap of agricultural labour revealed that the demand exceeded labour supply during November and December, indicating the magnitude of labour scarcity prevailing in the study area during these months. Paddy and sugarcane demanded maximum labour in December and November, coinciding with groundnut crop harvesting and sowing operations. A spatial-temporal changes map is shown in agricultural labour in the distribution patterns of agricultural labourers in areas of high decrease (above 1 per cent) in the proportion of agricultural labour comprised of five villages of the state. Similarly, areas of low decrease (below 1 per cent) have occurred over three zones of the state and areas of increase (0.02 - 4 per cent) indicated that the proportion of agricultural labour has been witnessed in nine zones in the Union Territory of Puducherry.

Digital Divide and Rural Sustainable Development in India: Empirical Evidence from National-Level Data

Vinita Kanwal[2], Soumya Mohapatra[3], Sendhil Ramadas[4], and Jaspal Singh[5]

This study examines the impact of the digital divide (in terms of access and ability) on sustainable development outcomes. We used the 79th round of NSO's socio-economic survey. We constructed a sustainable development composite index (SDCI) using four indicators of SDGs, including safe water, better sanitation, health and clean energy. To address potential endogeneity among SDCI and digital ability,

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we employed a two-stage least squares (2SLS) regression model and complement our approach with a regression tree model to capture non-linear, intersectional patterns across social groups. Results indicate that both digital access and ability strongly determine sustainable development outcomes. While income is the prime driver of development outcomes, digital ability amplifies income benefits, particularly for lower- and middle-income households. Socially disadvantaged groups perform worse on sustainable development indicators even when controlling for digital interventions. The study emphasises that mere access to digital intervention and infrastructure is insufficient. The policy interventions must focus on digital literacy and inclusion strategies that address structural hierarchies and pose inequalities.

Women's Participation in the Labour Force and Its Emerging Trends

Isha, Mukesh, Parminder Singh, and Vijay Kumar[1]

This study explores working women in India and the northern states by analysing the Periodic Labour Force Survey (PLFS) data. Drawing on the Periodic Labour Force Survey (PLFS) data analysis, the present study discusses women working in India, emphasising the northern states. The article uses the Worker Population Ratio (WPR) and the Labour Force Participation Rate (LFPR) to examine the level and extent of women's labour force participation. It provides evidence of significant inter-state differences: Haryana and Uttar Pradesh have relatively lower participation rates. Himachal Pradesh steadily records the highest WPR for women owing to agricultural work and an extended social history of women's economic engagement. Rural–urban polarisation is evident with the employment of rural women mainly in agriculture and informal sectors, while urban women are deterred from getting fixed, formal sector employment. The discussion highlights that to stimulate women's working population, multi-pronged policy measures focused on skill upgradation, formal employment growth, gender friendly infrastructure, and curtailment of socio-cultural inhibitions are needed to unlock women's economic potential.

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Women Agri-Entrepreneurship: Transforming Rural India through Women-Led Agricultural Enterprises

Ritika Koundal, Induri Sujitha, Amanveer, D.P. Malik, and J.S. Papang[1]

Based on secondary data, this study analyses enabling factors, case evidence, and challenges affecting women's participation in agricultural enterprises. Female literacy has risen from 65.46 per cent in 2011 to 74.6 per cent in 2024, enhancing decision-making and enterprise participation. Institutional mechanisms such as Self-Help Groups and Krishi Vigyan Kendras have facilitated financial inclusion, skill development, and market integration. The case of Shreeja Mahila Milk Producer Company Limited demonstrates the transformative potential of collective models. Persistent challenges include limited access to credit, restrictive gender norms, and poor market access. Strengthening the ecosystem for women agri-entrepreneurs will not only promote gender equality but also accelerate sustainable rural transformation and contribute to national development goals.

Farmers' Adaptation Strategies and Determinants of Climate Resilience in Haryana Agriculture

Naseeb Choudhary, U. K. Sharma, and D. P. Malik[2]

This study examines farmers' adaptation mechanisms and the factors influencing their adoption of climate-resilient strategies in Hisar and Sonipat districts. Primary data were collected from 120 farmers through a structured interview schedule using a multi-stage random sampling technique. Descriptive statistics and a probit regression model were employed to analyse adaptation mechanisms and the determinants influencing their adoption. The findings reveal that the most frequently adopted adaptation measures include increased irrigation (65.83%), enhanced fertiliser application (63.33%), and adjustments in crop sowing time (60.83%). Other strategies, such as crop insurance (58.33%), soil and water conservation techniques (38.33%), and intercropping (36.67%), were also observed. Probit regression analysis identified key determinants influencing adaptation decisions. Age exhibited a negative impact, suggesting that older farmers are less likely to adopt adaptation strategies. Conversely, landholding size, education level, income level, and access to climate change information positively influenced adaptation decisions. However, family type and occupation type did not significantly impact adaptation choices. The study highlights the need for targeted policies to enhance climate adaptation, particularly through improved access to climate-related information, education, and

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financial resources. Strengthening extension services and promoting sustainable adaptation mechanisms can improve farmers' resilience and ensure agricultural sustainability in Haryana.

Farmer Producers Company in Transforming the Agricultural Landscape: Evidence from a tribal context of Odisha, India

Dinesh Kumar Chauhan and Saswat Kumar Pani[1]

The present study aims to answer the following questions: (1) How do the two extremes, better and poor performing FPCs, compare regarding agricultural sustainability and their role in transforming the agricultural landscape in the study area? (2) What are the unique characteristics of the better-performing FPCs, and what gaps exist in the poor-performing ones? This study was conducted in the tribal region of Odisha state, specifically in Koraput. It is based on survey data collected through a structured interview schedule. A total of 412 households from four FPCs across four districts-Semiliguda, Nandapur, Pottangi, and Borigumma-participated in the study. The findings reveal that technology adaptation and innovation, processing and value addition, convergence and collaboration, and institutional governance are key traits that distinguish better-performing FPCs from poorer ones and significantly contribute to agricultural sustainability. Controlling for these variables can influence performance. Additionally, strategic and efficient resource use, resilience building against climate change, developing an entrepreneurial ecosystem, and adopting a market-driven approach-while enhancing skills, capacity, and market access-have transformed the agricultural landscape, supporting sustainable livelihoods. The existing policies and schemes implemented by various government departments have effectively supported the FPCs in the study region. Understanding the growing potential of fruits and vegetables in the state and to strengthen the Value chain, the Department of Agriculture and Farmers' Empowerment-Government of Odisha, has brought the State Cold Storage Policy 2025.

Structural Break in Terms of Trade for Indian Agriculture in the Context of Prebisch-Singer Hypothesis

Anamika Verma and G.K. Vani[2]

The dynamics of agriculture necessitate farmers to continue to get relatively higher prices than they pay, including for their family consumption, which is

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reflected in trade for farmers. The Prebisch-Singer hypothesis postulated declining terms of trade for producers of primary commodities. The present study was conducted to find the structural breaks in the index of terms of trade and its components, as well as its trend and growth rate for 39 years (1982-2020). The results showed that the fluctuating but long-run increase in terms of trade was observed during the period of study, which undermined the Prebisch-Singer hypothesis. The structural breaks in the index of terms of trade and its components showed that both internal and external factors are responsible for its volatility.

Dynamics of Agricultural Labour Wages and Employment: A Study of Haryana and Kerala

Sradha Krishnan[1], Parveen Kumar Nimbrayan[2], Dalip Kumar Bishnoi[2], J. K. Bhatia[2], and Monika Devi[2]

Labour is a key factor of production, and agricultural labourers carry out various farming activities, ranging from land preparation to harvesting. By analysing the agricultural labour wages for various agricultural operations across India, Haryana and Kerala using secondary data, it was observed that wages for both male and female workers in all three regions have shown an upward movement from 2008–09 to 2023–24, although the rate of increase varied by region and activity. Kerala consistently offered the highest wages in all categories. In all operations, male workers were paid higher wages than female workers, highlighting a persistent gender wage gap in the agricultural labour market. The analysis of employment distribution revealed a clear shift away from agriculture and allied activities over the past three decades in all three regions. The rural employment trend in agriculture was analysed, showing a decline in the proportion of workers engaged in agriculture during the study period. In urban areas, the share of employment in agriculture and allied activities remains considerably low and shows greater fluctuations, particularly in Kerala.

Quality of Decentralised Extension Services and Farmers' Willingness to Pay: Evidence from Northeast India

Christopher Tirkey[3], Rajiv Gurung[4], and Manesh Choubey[3]

This study attempts to understand the farmers' perception of the quality of extension services and their willingness to pay for quality extension services. It also

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identifies the major determinants influencing farmers' willingness to pay for extension services in Northeast India. Primary data for this study were collected from 160 rice-growing farmers from the Golaghat district of Assam, India. The study used descriptive statistics to understand the socio-economic status of the farmers. The Likert Scale was used to understand the farmers' satisfaction with the extension services in four quality dimensions: timeliness, accuracy, relevance, and ease of understanding. The Contingent Valuation Method was used to measure the farmers' willingness to pay, and the binary logistic regression was used to identify the factors that influence the farmers' willingness to pay. The results show that most farmers were satisfied with the extension services and willing to pay for them. In terms of amount, the farmers were willing to pay an average of Rs 190. The logistic regression results showed that age, education, experience and total production were statistically significant determinants of willingness to pay.

A Comparative Analysis of Performance, Challenges, and Future Prospects: Punjab vs. Indian Agriculture

Sukhvir Singh, Amit Guleria, and Sanjay Kumar[1]

Punjab's journey from the success story of India's Green Revolution to an agriculture facing deep economic, environmental, and social challenges reflects a larger concern for the country's farm sector. Once celebrated for record yields, extensive irrigation, assured procurement, and strong institutional support, the state is experiencing stagnating growth, a shrinking resource base, rising input costs, mounting debt, and farmer distress. Using five decades of data, covering different time spans for various indicators, this paper examines why Punjab's agricultural growth has slowed, how its path has diverged from national trends, and what this means when viewed through India's broader agricultural experience. The analysis links the slowdown to structural imbalances ranging from skewed crop patterns and unsustainable resource use to market dependence and persistent socio-economic pressures, which have locked Punjab into a high-input and low-resilience model. To address these challenges, the study recommends a comprehensive set of policy pathways spanning crop and enterprise diversification, sustainable water and soil management, revised procurement and subsidy policies, stronger value chains, growth of allied sectors, and expanded rural employment opportunities, aimed at restoring economic viability, ensuring sustainable use of resources, and strengthening the resilience of rural livelihoods.

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Farming Systems Diversification-A Way Forward for Strengthening Rural Livelihood in the Sub-mountainous Region of Punjab

Simran Saini, Parminder Kaur, and Amit Guleria[1]

Four major integrated farming systems, Crops+ Dairy+ Agro-forestry, Crops+ Dairy, Crops+ Agro-forestry, and Crops+ Poultry, designated as IFS-I, IFS-II, IFS-III and IFS-IV, were identified in the study area. A sample of 100 farm households adopting different integrated farming systems and 30 non-adopter IFS farmers practising traditional cropping systems was selected as control, thus making the sample of 130 farmers for the study. The highest adoption per cent was for IFS-II (38.46%), followed by IFS-III (14.62%), IFS-I (12.30%) and IFS-IV (11.54%) respectively. IFS-IV (Rs 2105895.00) was the most remunerative farming system. The diversification index of farming systems ranged from 0.33 to 0.65, indicating a wide variation in the distribution of per-farm income. The highest remunerative component of the integrated farming systems was Agro-forestry for IFS-I. (Crops >Dairy) is the declining order of the remunerative components for IFS-II. (Crops > Agro-forestry) is the order for IFS-III and (Poultry> Crops) order for IFS-IV. The least remunerative was found in all crops across different size classes of farmers (small, medium and large). A consistent declining order of remunerative systems (FS-IV >-I > -II >-III >crops alone) for small farmers, medium farmers (FS-IV > -II >-I >-III >crops alone) and large farmers (FS-IV >-II > -I >crops alone). IFS reaped higher returns than the crop system alone. In each farming system, dairy, agroforestry, and poultry components added additional weight to the income generated. By conducting front-line demonstrations and training sessions, it is desirable to encourage farmers to adopt an ideal diversified farming system with all conceivable components. Farmers can effectively reduce farm-related difficulties and hence lessen distress by doing this.

Economic and Profitability Insights into High-Tech Cabbage Farming in Chhattisgarh

Bhashkar Sahu and Hulas Pathak[2]

The present study investigates the economics and profitability insights into high-tech cabbage farming in Chhattisgarh. Using data from 240 sample farms across varying farm sizes, a detailed cost and return analysis was conducted to assess economic viability. The overall cost of cultivation per hectare was estimated at Rs. 226162.33, with variable costs comprising around 61.65 per cent, mainly

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contributed by manures and fertilisers, plant protection, and labour inputs. Fixed costs accounted for 38.35 per cent, including depreciation and rental value of owned land. Among labour inputs, hired labour formed the major cost component. The total cost of cultivation varied slightly across farm sizes, with large farms incurring Rs. 227557.31per hectare and small farms Rs. 224371.27 per hectare. Gross returns from Cabbage cultivation under high-tech conditions were calculated at Rs. 525000.89 per hectare, resulting in a net return of Rs. 354580.91 per hectare and an output–input ratio of 3.17. Break-even analysis revealed that the required yield to cover total cost was 113.63 quintals per hectare, while actual yields averaged 350.23 quintals per hectare. Offering a significant margin of safety at 67.54 per cent. Profitability improved with scale, as larger polyhouses demonstrated higher economic efficiency. The study concludes that Cabbage cultivation under protected structures, such as polyhouses and using high technologies in farming, is highly profitable and economically sustainable, particularly when supported with proper input management and scale optimisation.

Oil Palm Cultivation in Mizoram: Growth Performance, Instability and Prospects

Lalrinsangpuii[1] and Ningombam Nita Devi [2]

The study examines oil palm cultivation's sustainability and growth dynamics in Mizoram between 2009 and 2024. Using time series data, compound growth rates, instability indices, and decomposition analysis were applied to assess trends in area, production, and productivity. Results revealed a decline in the area and production of oil palm over the study period, primarily due to low fresh fruit bunch (FFB) prices, high labour and transportation costs, and limited market access. However, productivity showed significant positive growth, indicating improved yield performance despite declining acreage. Instability analysis highlighted high fluctuations in production and productivity during later years. Decomposition analysis demonstrated that the yield effect was the most important factor contributing to the growth of oil palm production (48.03%), followed by area effect (44.33%) and interaction effect (7.64%). The findings suggest that while yield improvements have driven production growth, long-term sustainability of oil palm cultivation in Mizoram requires addressing area contraction, stabilising prices, and strengthening market and processing infrastructure.

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Rural Transformation and Income Inequality in India: Insights from Agricultural Household Surveys

Utkarsh Tiwari[1], Alka Singh[1], Pramod Kumar[1], Venkatesh P[1], Jaiprakash Bisen[2], Harish Kumar H.V.[3], Chiranjit Mazumder[3], and Anand Pratap Singh[4]

This study examines the evolving income structure of agricultural households in India using unit-level data from the National Sample Survey's Situation Assessment Surveys (70th round, 2012-13; 77th round, 2018-19). An agricultural household's total nominal farm income increased at an annual rate of 9.61%, while real income increased at an annual rate of 3.42%, reflecting inflationary pressures. Disaggregated analysis reveals stagnation in crop income alongside significant gains in wages, livestock, and non-farm enterprises, underscoring a structural reallocation of livelihoods beyond cultivation. Regional disparities are pronounced: The Northern region has the highest average incomes, while the North-Eastern region shows the fastest growth. Inequality remains high (Gini = 0.56), with decomposition analysis indicating that crop, livestock, and wages mitigate disparities, whereas non-farm income exacerbates them. The findings highlight both the opportunities and challenges of rural income diversification. Policies that foster the balanced integration of farm and non-farm activities, while addressing regional disparities, are crucial to ensuring inclusive and sustainable rural transformation.

Economic Analysis of Consumption Patterns and Food Demand across Rural and Urban Households in Himachal Pradesh

Jyoti Chaudhary[5] and H.P. Singh[6]

The consumption pattern in India has undergone a remarkable transformation. The consumers in Himachal Pradesh have also experienced a change in consumption patterns. The NSSO consumer expenditure survey (unit-level data) 68th round (2011-12) was used to derive different demand elasticity for various food groups in Himachal Pradesh. The Quadratic Almost Ideal Demand System Model was used to derive the income elasticity, depicting that Milk and Milk Products, egg, fish, meat, fruits, and fruits in the rural sector and milk and milk products, egg, fish, meat, fruits and vegetables in the urban sector are luxury items for non-vegetarian households. Likewise, for vegetarian households, milk and milk products are luxury items in rural

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and urban sectors. Further, the compensated price elasticity of all the food groups is higher than the uncompensated price elasticity, depicting the favourable effect of income on food groups. The study suggested that to prevent the shift in the dietary pattern of households, the government must enhance the production and the availability of high-value commodities in the state to meet the nutrient requirements.

Linkages between Farm and Non-Farm Sectors in Rural India

Rohlupuii, Laishram Priscilla, Souradipta Das, and Baljinder Kaur Sidana[1]

This study examines farm–non-farm linkages in rural India using large-scale unit-level data from the NSSO 77th round (2018-19). Non-farm income exceeds farm income in most states, except Gujarat, Karnataka, Madhya Pradesh, Punjab, and Telangana. Across income quintiles, crop income shares decline while non-farm business, wages, and salaries rise. Multivariate probit estimates show that larger landholdings raise farm income dependence but reduce non-farm work, while education promotes salaried jobs and business over casual labour. Older household heads withdraw from wage work and livestock but are more likely to lease land. Credit access and cooperative membership enable non-farm enterprises. The negative and significant Spearman rank correlation coefficient between overall farm and non-farm income further reinforces this substitution effect, suggesting that households ranking higher in farm income tend to rank lower in non-farm income, and vice versa. The results indicate that expanding non-farm activities can boost household income and reduce poverty, provided financial and market barriers to entry are addressed.

Bridging the Knowledge-Practice Gap in Rural Transformation: Analysing Climate-Smart Agriculture as a Pathway to Sustainable Rural Development

B. Vetri Selvi[2] and S. Varadha Raj[3]

This study evaluates farmers' awareness and adoption of CSA practices in the western zone of Tamil Nadu, focusing on Coimbatore, Tiruppur and Karur districts and examines the key constraints hindering wider implementation. A field survey assessed awareness levels, adoption rates and perceived barriers across practices such as water management technologies, crop diversification and sustainable farming techniques. Findings reveal a pronounced awareness-adoption gap. While awareness levels are high (88-95%), adoption remains comparatively low (28-40%). Capital-

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intensive practices exhibit the widest gaps, with farm ponds showing 100 per cent awareness but only 5.67 per cent adoption and solar pumps 90.33 per cent awareness against 6.67 per cent adoption. In contrast, practices supported by government schemes and subsidies, such as micro-irrigation (81.33% adoption) and those requiring minimal technical skills, such as mulching (81% adoption), demonstrate higher uptake. Adoption barriers span multiple dimensions, including socio-behavioural factors (labour shortage with higher wage rates, youth migration), technical limitations (inadequate training, lack of demonstrable CSA models), financial constraints (delayed returns on investment, absence of premium pricing) and institutional weaknesses (insufficient support mechanisms and limited policy frameworks). The study concludes that, despite widespread awareness, CSA adoption remains constrained by interconnected challenges. It recommends region-specific demonstration models through research institutions, targeted financial mechanisms such as eco-loans and subsidies for capital-intensive practices and stronger institutional support to narrow the awareness-adoption divide.

Economic Assessment of Drumstick Tree (Moringa Oleifera) Plantation in Haryana: A Sustainable Alternative and Profitable Agro-Forestry Crop

Janailin S. Papang[1], Sumit Mahajan[2], Vinay Mehala[1], Sanjay[1], and Sandeep Arya[1]

Moringa is known as a superfood. The tree is well adapted to droughts and is suitable for cultivation in arid and semi-arid regions of Haryana. Due to its fast-growing potential and low establishment and maintenance costs, drumstick cultivation has attracted many farmers in Haryana in recent years. The commercially grown varieties are P.K.M. -1, P.K.M. -2 and ODC-3. The study was conducted across eight districts of Haryana during 2024-25. The total establishment cost was estimated at ₹157259/ha for leaf purpose and ₹1,14,37/ha for pod production. The rental value of land accounts for the highest share of total production cost, which is 26-29 per cent for leaves and 41-59 per cent for pods. Leaf production starts at around 61 kg/ha of dry powder in 1st year and increases gradually to 1358 kg/ha by the 5th year. Pods production ranges from 74 kg/ha in the 1st year to 12350 kg/ha by the 5th year. The payback period was achieved within the 2nd year of cultivation. The major constraints farmers face includes the unavailability of labour during the peak harvest season, poor seed germination rate and lack of local market, especially in the marketing of pods.

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A Regional Analysis of Crop Specialisation and Diversification in Indian Agriculture: Insights for Sustainable Development

Nidhi Bagaria[1]

India's agricultural sector, deeply rooted in history, continues to be a vital contributor to the nation's economy, employing over 60 per cent of the workforce and accounting for more than 18 per cent of GDP. This study evaluates crop specialisation and diversification patterns across 25 states and one Union Territory, using three analytical tools, namely Location Quotient, the Crop Versatility Index, and the State Versatility Index. The analysis reveals distinct regional trends, with some states demonstrating a high degree of specialisation in particular crops, while others maintain diverse cropping systems. The study highlights the widespread cultivation of staple crops like rice, wheat, and maize, contrasted by the niche distribution of crops such as small millet, gram, and pulses. The findings provide valuable insights for policymakers to foster balanced agricultural growth, promote diversification, and enhance resilience to climate variability and economic challenges.

Public investment in irrigation across North Indian states: A Comparative Study

Shubham, Shweta Laura and Dinesh[2]

This study investigates public investment in irrigation across North Indian states, focusing on Haryana, Punjab, Himachal Pradesh, and Uttarakhand, highlighting its pivotal role in enhancing agricultural productivity and ensuring food security. However, issues like groundwater depletion in Punjab and over-extraction in Haryana have raised sustainability concerns. With their rich river networks, Himachal Pradesh and Uttarakhand face challenges due to mountainous terrains, limiting large-scale irrigation and making watershed management critical. Data from 2017 to 2023 shows Haryana's gross irrigated area increased from 5,831 to 6,319 thousand hectares, while Punjab's figures grew modestly from 7,714 to 7,775 thousand hectares. In contrast, Himachal Pradesh experienced a slight decline, reflecting the constraints of its terrain. The study evaluates landmark initiatives, including the Accelerated Irrigation Benefits Programme (AIBP) and the National Mission on Micro Irrigation (NMMI), which have enhanced irrigation infrastructure and efficiency, contributing to a 4.29 per cent compound annual growth in India's

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irrigated area. Programs like PMKSY (Pradhan Mantri Krishi Sinchayee Yojana) have created over 20 million hectares of irrigation potential and improved water use efficiency by 30–50 per cent. Micro-irrigation schemes have covered over 13 million hectares nationwide, with Haryana leading in adopting sprinkler systems. Despite these achievements, challenges persist. Punjab's wheat-paddy cropping cycle exacerbates water stress, while Uttarakhand and Himachal Pradesh require targeted investments.

Land and Socio-Economic Deprivation of Scheduled Castes in Tamil Nadu

S. Yogeshwari[1]

This paper draws on longitudinal evidence from the Population Census, Agricultural Census, National Sample Survey Organisation (NSSO) rounds, and the All-India Debt and Investment Survey (AIDIS) from the 1970s onwards to investigate patterns of land access, asset accumulation, and credit dependence among SCs. The analysis reveals a pronounced trend of landlessness and depeasantisation, indicating a progressive withdrawal of SC households from cultivation as a viable livelihood activity. Among those retaining small and marginal holdings, restricted access to institutional credit perpetuates reliance on informal lending, constraining capital formation and reinforcing cycles of indebtedness. Further, asset growth has remained stagnant, while SC participation in land markets has mainly been skewed towards leasing out land, underscoring this group's declining economic relevance of land ownership. These findings highlight how unequal land distribution, compounded by marginalisation of holdings, reproduces economic vulnerability. The paper argues for reorienting agrarian policy, integrating redistributive justice with institutional support, to mitigate the compounded risks confronting SC farmers amid the contemporary agrarian crisis.

Pesticide Use in Agriculture: A Meta-Analysis of Farmer Knowledge, Behaviour, and Safety Outcomes

Pranjal Sharma, Sonal Dhiman, and Shaikh Mohd Mouzam[2]

The current study presents a meta-analysis of 35 studies from 2000 to 2024, focusing on understanding how farmers perceive and handle pesticides and their use regularly. Data were combined across five key domains: Awareness, Attitude, Training Received, Health Impacts, and PPE Usage, and pooled estimates for each were calculated using a random-effects model. Findings of the study revealed that

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while 53 per cent of farmers had a basic level of Awareness regarding pesticide risks and 50 per cent had a generally optimistic attitude towards pesticide use, only 37 per cent had received any form of safety training for their proper handling. Around 45 per cent of the farmers acknowledged having faced health issues related to pesticide use and misuse. PPE usage among farmers also averaged around 45 per cent, with high variability across studies. Heterogeneity and publication bias assessments confirmed the robustness of the results. The study draws attention to the serious gaps between knowledge and practice among the farmers of various regions, pointing to the need for more region-specific interventions, including hands-on Training, affordable PPE availability, and more frequent and apt risk communication. Pesticide safety is not just about awareness campaigns, but also about addressing the real-world constraints farmers face in adopting safer behaviours regularly.

Perceptions and Information Networks Shaping Fertiliser Use Dynamics in the Indo-Gangetic Plains

Praveen K V[1], Girish Kumar Jha[2], Sreeram Vishnu[3], and Deepak Kumar[4]

This study examines farmers' perceptions and attitudes towards fertilisers, their information networks, and the system dynamics influencing the adoption of sustainable fertiliser practices in the IGP. Primary data were collected from 906 farm households across five major rice-growing states using a stratified multi-stage random sampling approach. A state-level nitrogen budget was estimated to assess nutrient surpluses. At the same time, descriptive statistics, social network analysis, and causal loop diagramming were employed to capture farm-level behaviour and institutional linkages. Results show substantial nitrogen surpluses at the state level, sustained by farmer perceptions favouring high fertiliser use, reliance on traders and family networks for advice, and limited awareness of environmental risks. The findings underline the importance of strengthening extension services, diversifying information channels, and designing region-specific fertiliser policies. The study contributes to a better understanding fertiliser use's socio-behavioural and institutional dimensions and offers insights for promoting balanced nutrient management in the IGP.

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Assessing the Socioeconomic Impact of Climate Resilient Infrastructure and Green Technology Adoption in Rural Communities of Haryana, India: A Multi-District Microanalysis

Garba A. D. and Pooja[1]

This study evaluates the socioeconomic benefits and adoption challenges of integrating climate-resilient infrastructure and green technologies, specifically solar-powered irrigation systems and biodigesters, across four agro-climatically diverse districts of Haryana. Using a mixed methods approach, primary data were collected from 200 households selected through a stratified random sampling technique. A double hurdle model analysed adoption determinants, while a difference in difference estimator quantified the impact on key outcome variables. Results indicate that adoption is significantly influenced by technical awareness, access to subsidies, and social capital. Major barriers include high initial investment and technical skill gaps. The analysis revealed that adopting households increased their annual income by an average of ₹42,380, reduced irrigation costs by 32 per cent, and enhanced crop yield stability by 25 per cent compared to non-adopting control groups. Furthermore, biodigester adoption contributed to a 38 per cent reduction in household fuelwood consumption. The study concludes with a policy framework advocating for integrated technology packages, innovative financing, and localised institutional support to accelerate climate-resilient agricultural transformation across diverse agro-ecological zones.

Bioeconomy in Rural India: Transforming Agricultural Waste into Biofuels for Inclusive Growth

Pooja and Garba, A. D.[1]

This study explores whether linking crop residues to biofuel markets reduces burning and improves rural livelihoods. Primary data were collected in 2023–24 from 180 households across 12 villages in four drought-prone districts of Haryana (Sirsa, Hisar, Bhiwani, Mahendragarh). Three potential pathways were examined: briquetting for thermal power plants, decentralised compressed biogas (CBG) hubs, and straw aggregation for second-generation (2G) ethanol. The analysis focused on factors shaping household participation, intensity of supply, and labour outcomes. Assured demand and access to logistics emerged as the strongest drivers of adoption. Higher prices and awareness encouraged participation, while greater distance to plants discouraged it. Supply intensity rose with better contract prices, credit availability, and lower moisture content. For landless households, involvement in

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these value chains increased annual income by ₹23,000–26,000 and generated 36–44 additional paid workdays. Among adopters, reported burning declined by 41–49 per cent, corresponding to 1.1–1.4 tCO_2e of avoided emissions per household annually. The findings highlight biofuel pathways as a dual solution for sustainability and livelihoods.

Effects of Direct Cash Transfers on Paddy Productivity: Evidence from Panel Data Analysis of Indian States

H. R. Prajapati[1]

This paper examines the impact of agricultural inputs and the direct cash transfers on paddy yield, using data from 2004 to 2023 from 27 Indian states collected from the RBI. This study provides a macro-level assessment of the impact of direct cash transfers on paddy crop productivity at the state level. This macro-level study helps academics and policymakers reform existing policies to increase crop productivity. This study used static and dynamic panel data regression models to assess the impact of agricultural inputs and DCT on paddy productivity. The study's findings indicate that the DCT schemes had a negligible effect on paddy productivity in static panel regression and no effect with the dynamic panel regression model. The robust test results of the two-step system GMM confirm that the lag of paddy productivity significantly influences the current year yield.

A study on livelihood diversification in Kargil district, UT of Ladakh

Mansoor Hussain and Nazir Hussain[2]

The present study was undertaken in the Kargil district to analyse the income sources and livelihood diversification in the study area. Multistage sampling has been used to select 140 respondents. Descriptive statistics, Simpson Diversity Index and Garett ranking methods are employed for analysis. Results indicate that the average household income was ₹3,37,105, with salaried employment (37.4%) and business activities (28.3%) constituting the major share. Casual labour contributed 14.5 per cent, while agriculture (10.12%) and livestock rearing (9.08%) together accounted for 19.2 per cent of the total income. These findings highlight the predominance of tertiary sector activities in household earnings, reflecting a gradual shift from traditional agriculture and allied sectors. The study underscores the significance of livelihood diversification as a critical mechanism for enhancing rural resilience and

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ensuring sustainable income generation. The study examines the livelihood diversification of rural households across selected blocks of the study area using the Simpson Diversification Index (SDI). The SDI values, ranging from 0.4 to 0.8, highlight the varying extent of household income diversification. Results indicate that most rural households relied on multiple sources of income to sustain their livelihoods. Medium diversification was observed in the Sodh, Drass, and Chiktan blocks. In contrast, higher levels of diversification were recorded in Kargil, Pushkum, and Lotsum blocks, with the highest diversification noted in the TSG block. The findings further suggest that livelihood diversification increases with distance from the main city, reflecting the adaptive strategies of households to overcome limited local opportunities. The Garrett ranking analysis identified a lack of marketing facilities (mean score 67.8) as the most critical constraint to livelihood diversification, indicating that the absence of reliable markets restricts households from deriving sustainable income despite diversifying activities. Lack of awareness about government schemes (63.7) was the second major barrier, reflecting limited access to institutional support. Other notable constraints included lack of training opportunities (46.7), weak asset base (44.2), poor road and transport facilities (36.6), and inadequate credit access (36.2). Low risk-taking ability (29.4) was ranked lowest, suggesting that structural and institutional barriers exert a stronger influence than individual factors. The findings highlight the need to strengthen market linkages, improve awareness of government programs, and enhance training, credit, and infrastructure support to promote adequate livelihood diversification.

Assessment of resource use and technical efficiency of pomegranate in the Mid Hill Zone of Himachal Pradesh, India

Divyanshu[1], Subhash Sharma[2], Chandresh Guleria[2], and Rohit Kumar Vashishat[2]

Climate change and global warming adversely impact fruit cultivation in the Himalayan region, including Himachal Pradesh. In the Kullu district, a notable shift from apple to pomegranate cultivation has been observed, prompting the need to assess the financial viability and production efficiency of pomegranate orchards. A study based on a multistage random sample of 120 pomegranate growers revealed encouraging economic indicators. At a 9 per cent discount rate, the internal rate of return was 42.9 per cent, the benefit-cost ratio was 2.12, and the payback period was five years. On average, pomegranate cultivation yielded an annual net income of Rs. 72,087.09 after maintenance costs. Fertiliser and plant protection emerged as

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significant but underutilised inputs, suggesting that optimising their use could enhance yields. The average technical efficiency was 74 per cent, indicating a 26 per cent gap between current and potential performance. Socioeconomic factors, including family size, number of farm workers, and literacy rate, significantly influenced technical efficiency. The findings emphasise the importance of optimal resource utilisation to improve productivity, ensure economic viability, and support a strategic shift in cropping patterns in response to changing climatic conditions.

Natural Farming in the Sub-Tropical Region of Himachal Pradesh: A Comparative Economic Evaluation and Market Dependency Analysis

Chinglembi Laishram, Subhash Sharma, Rajeshwar Singh Chandel, Manoj Gupta, RK Gupta, Chandresh Guleria, Nisha Thakur, Amit Guleria, Parul Bharwal, Rohit Kumar Vashishat, Bhavna Rajkumari, Neha Mishra, Shilpa Rani, and Riya Thakur[1]

SPNF (Subhash Palekar Natural Farming), a sustainable agriculture method in India, addresses resource scarcity and economic inequity. It empowers smallholder farmers, especially women and marginalised groups, to achieve local self-sufficiency through modern science and traditional knowledge. Its significance, economic benefits, and decreased dependency on external sources are all examined in this study. Studies show that compared to the CF system, SPNF farming has a lower market dependency ratio and a higher crop equivalent yield (CEY), which results in a percentage decrease in costs. The study shows that SPNF can transform agriculture and boost resilience and prosperity in developing nations like India.

Assessment of Agricultural Sustainability in the North-Eastern Region of India: A Composite Agricultural Sustainability Approach

D. Das, N. A. Singh, and R. Singh[1]

This study evaluates agricultural sustainability across the eight NE states through a composite index based on three dimensions: Economic Efficiency, Ecological Security, and Social Security. The results reveal wide inter-state variations, with Assam showing strong economic and social performance but weak ecological outcomes. Arunachal Pradesh exhibited high ecological strength but poor social and economic indicators. Meghalaya and Mizoram displayed moderate performance across dimensions, whereas Manipur, Nagaland, Sikkim, and Tripura lagged due to weak economic efficiency and inadequate social infrastructure. Overall,

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the findings highlight that strengthening water resources, irrigation, livestock integration, and rural infrastructure while reducing input-intensive practices is crucial for enhancing agricultural sustainability in the NER.

Agricultural Credit and Rural Non-Farm Diversification: A Cross-Country Comparative Study of India, Brazil and Mexico

Meenakshi Mritunjay and Ranjit Singh[1]

This paper investigates the relationship between agricultural credit and rural non-farm employment (NFE) diversification in India, Brazil, and Mexico from 1996 to 2023. It explores how rural credit access influences the shift from farm-based to non-farm employment, a key aspect of agrarian transition and rural transformation. The study finds a strong positive association between agricultural credit and rising non-farm employment in rural areas using fixed-effects panel regression and country-specific OLS models. However, the effects of agriculture's GDP share and rural demographic pressures differ across countries, shaped by unique development trajectories and financial systems. In India, institutional credit drives livelihood diversification, supporting multiple income sources for rural households. Brazil demonstrates agro-industrial complementarity, where credit aids farming and integrated off-farm activities. Mexico reflects a classical sectoral shift, with NFE growth linked to liberalisation and trade policies. The paper emphasises reimagining agricultural credit not just as farm support, but as a catalyst for broader rural development and livelihood security. It calls for credit policies that align with regional economic dynamics, strengthen rural financial infrastructure, and foster inclusive growth. The study contributes to development economics by linking rural finance to structural change and highlighting its role in enabling resilient, diversified rural economies.

Demand for crop insurance to manage climate risks: A systematic literature review and bibliometric analysis

Dibakar Sahoo[2], Neelam Singh[1], and Prasanta Moharaj[3]

This article aims to enhance understanding of the dynamics surrounding the demand for crop insurance, address existing challenges, and explore future research avenues in climate change adaptation strategies. Employing a systematic literature review and bibliometric analysis, we identified 187 relevant studies on crop insurance

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demand. These studies were meticulously analysed to uncover the domain's patterns, challenges, and opportunities. Our findings highlight a significant concentration of research from the United States and a notable market incompleteness for crop insurance in developing countries. The analysis also reveals a persistently low demand for crop insurance, characterised by spatial and temporal variability. Recent trends in research indicate a growing emphasis on behavioural aspects influencing crop insurance demand. Nevertheless, the exploration of behavioural biases and risk factors driving adoption in developing nations remains underexplored. The insights from this study emphasise the need for targeted policy interventions. Policymakers are urged to address the unique market dynamics of crop insurance in developing countries and enhance awareness and understanding, particularly in regions with limited adoption. Such strategies are crucial for strengthening the agricultural sector's resilience against climate change.

Alternative Marketing Channels and Their Impact on the Marketing of Apple in Himachal Pradesh, India

Chander Mohan Negi[1]

Apple is one of the most important commercial crops produced in the world. India is the fifth-largest producer of apples in the world. In India, Himachal Pradesh is the second largest producer of apples, next only to the union territory of Jammu and Kashmir. Apple is the dominant crop in Himachal Pradesh, generating significant revenue and employment. Traditionally, the *Arthiyas* (the commission agents) and Local Traders were the sole sources of marketing of Apples. The entry of new channels, especially the corporates in the Apple business, has significantly changed the dynamics of the Apple crop marketing. This paper applies the Multinomial Endogenous Treatment Model to assess the impact of marketing channels on the farm revenue and productivity of the apple crop. For this purpose, we collected 297 samples from the three prominent Apple-producing districts of the state. The price of the crop and the bulk selling come to the core concern of the orchardists while opting for the channels. Price is positive and significantly associated with *Arthiyas* and modern channels compared to local traders. Among others, the age of the household head has a positive and significant impact on the apple productivity.

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Bridging the Market Divide: Rethinking Commons and Farmer Agency in India's Paddy Economy

Jyoti Kumari Jyotshna[1]

This study examines the social and economic factors affecting farmers' market channel selections in India, specifically targeting paddy planters. Employing a multinomial logistic regression model on survey data from more than 13,000 farmers, we analyse the influence of variables such as landholding size, religion, crop prices, bank account ownership, and social interaction on the probability of choosing different market outlets, including local markets, input dealers, APMC markets, cooperatives, private processors, and government agencies. Findings indicate that larger landowners and those obtaining elevated crop prices are more predisposed to formal and organised market channels, including APMCs and cooperatives. Ownership of a bank account is inversely correlated with formal market utilisation, indicating that welfare programs may be effectively reaching unbanked farmers. Furthermore, religious affiliation influences market preferences, as Sikh farmers demonstrate greater participation in formal markets, whilst Muslim and Christian farmers seem to be underrepresented. The interplay between social networks and landholding size further improves access to organised marketplaces. These findings emphasise the intricate relationship between economic ability, institutional access, and social identity, influencing market behaviour. The study offers valuable insights for designing inclusive agricultural marketing policies and reimagining governance models to improve institutional linkages for marginalised farmers.

Tiered Electricity Pricing for Irrigation for Long-term Sustainability of Groundwater Resources: A Case of Uttar Pradesh

S.K. Srivastava[2], **P. Kishore**[2], **P. S. Birthal**[2], **J. Singh**[3], **and R. R. Sethi**[4]

Most states provide heavily subsidised or free electricity for groundwater irrigation, which ensures farmers' affordable access and leads to inefficient groundwater use due to zero or near-zero marginal cost of water extraction. This paper evaluates the prospects of tiered electricity pricing, which involves a graduated pricing structure in which the price of electricity increases when its consumption crosses the established thresholds. Policy inputs are based on the scheme introduced by Uttar Pradesh in March 2024, in which electricity is free till 1045 units and at full tariff after this threshold. It estimates and compares the energy required to meet the

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peak season irrigation demand of the existing cropping pattern with freely available electricity in Sitapur district in the Central region, Baghpat district in the Western region, and Jalaun district in the Bundelkhand region. The evidence reveals that all smallholders can meet their peak season irrigation demand at established thresholds of free electricity. This indicates that the scheme effectively covers all smallholders who need policy support. However, it does not reflect the scarcity value of groundwater and potentially undermines the objective of changing farmers' behaviour towards its efficient use. The paper provides policy inputs to recalibrate subsidy thresholds for different regions, considering hydrological differences, synchronise the free electricity supply with the crop growth period, and limit the subsidised electricity only to the required quantity. Considering the increasing use of electricity, limiting financial benefits to its required consumption is rational and politically less contentious, particularly in a scenario where populist measures are becoming prevalent.

Custom Hiring Centres (CHCs) as a Common Resource Pool System: An Empirical Economic Analysis in Meghalaya

Ipshita Bhuyan[1], Ningombam Anandkumar Singh[2], Ram Singh[3], Nivedita Deka[1], and Bhaskar J Bhuyan[1]

Indian agriculture is gradually shifting from dependence on human and animal power to mechanical power. However, the majority of the farmers, being poor and marginal farmers, cannot bear the huge purchasing cost of the machinery, which is why the concept of Custom Hiring Centres (CHCs) came into being. CHC is a unit consisting of farm machinery, implements, and equipment provided to the farmers at affordable prices on a hiring basis. A CHC can be conceptualised as a common-pool resource as it is managed by a group or community that makes machinery available to all farmers, who cannot afford expensive machinery, for use without specific restrictions. Meghalaya is an agrarian state where 81 per cent of the population depends on agriculture for their livelihood (GoM, 2018). To make machinery available for the farmers, the Meghalaya Basin Development Agency (MBDA) and the ICAR Research Complex for NEH Region have established CHCs across the state. The aim of the study was (1) to study the economic feasibility of the Custom Hiring Centre in Meghalaya, (2) to assess the impact of the Custom Hiring Centre on farm profitability and (3) to analyse the constraints faced by different stakeholders of

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the Custom Hiring Centre. Various methods utilised for the study were: financial methods, cost concepts recommended by the Commission on Agricultural Costs and Prices (CACP) and descriptive statistics like frequency and percentage.

Strengthening Climate-Resilient Root Crop Systems in Himachal Pradesh: Economic, Ecological, and Policy Perspectives

Pardeep Singh[1], Manoj Kumar Vaidya[2], Divyanshu[2], and Subhash Sharma[2]

The study evaluates the ecological and economic implications of climate change on root crops across regions with varying vulnerability levels. Primary data were collected from 480 farmers through a multistage stratified random sampling technique. Farmers in the low-vulnerable group demonstrated superior economic performance and sustainability of root crops, attributed to better resource access and adaptive capacity. However, the highly vulnerable group revealed less viability of the crops from the low and moderate vulnerable groups. Climatic stresses, particularly rising maximum temperatures and erratic rainfall, have negatively impacted the profitability of the ginger crop in the moderately vulnerable group and potato in the highly vulnerable group, whereas garlic remains a relatively climate-resilient crop across all vulnerability groups. Adaptation strategies such as crop diversification, organic amendments (e.g., farmyard manure), irrigation, balanced fertilisation, and integrated pest management enhanced the resilience and profitability of the root crops. However, their effectiveness varied by crop type and regional vulnerability. Potato emerged as the most carbon-intensive crop, while garlic showed the highest sustainability index. The findings highlight the need to develop crop and region-specific adaptation frameworks. Climate-smart agricultural practices, targeted policy interventions, and robust value chain support are essential to strengthen the resilience and sustainability of root crop farming in Himachal Pradesh.

Reassessing Policy Implications of Agricultural Subsidies in India

Deepak Shah[3]

The study showed a steady rise in India's agricultural subsidy over the last four decades, which was also seen to be accompanied by a substantial increase in production due to higher capacity utilisation of existing units or by creating new capacities. In the case of inputs, the subsidy outgo rise is matched with a significant increase in indigenous fertiliser production and stimulating fertiliser consumption.

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However, the increased use of fertiliser in India is accompanied by disproportionate use of indigenously produced urea since other fertilisers are mainly imported. It is well known that while the government fixes the market price for urea, the sale to farmers is at a subsidised price under the floating subsidy scheme, and fertiliser manufacturers are compensated for the loss. Despite the facility to process other fertilisers, fertiliser companies concentrate on urea manufacturing, which does not benefit farmers from the fertiliser subsidy. This leads farmers to use urea, which is manufactured mainly by Indian companies. Another issue is that the rapid increase in food subsidy in recent years is attributable to the 'economic costs' of foodgrains. There has also been a growing trend in economic and buffer carrying costs of rice and wheat, as well as consumer subsidies. Not only this, but the existing food subsidy programme in India is marked with administrative inefficiency, corruption, and wastage since only 42 per cent of the subsidised foodgrains released for the poor actually reach them due to errors in their identification. Since the outreach of food subsidy in India has been highly inadequate and concentrated more in the relatively developed and less poverty-stricken states, there is a need to improve the outreach of these subsidies. There is also a need to raise subsidies on investment categories and make the subsidies transparent, targeted, and short-term.

Farmers' Climate Change Perceptions and Adaptation Strategies: Impact Assessment of Climate Resilient Technologies in Semi-Arid Marathwada Using Double Difference Approach

Vasant G. Jadhav, Sachin S. More, R.V. Chavan, D.S. Perke, R. F. Thombre, and R. P. Kadam[1]

This study examines the impact of Climate-Resilient Agricultural Technologies (CRTs) introduced under the National Innovations in Climate Resilient Agriculture (NICRA) project in the drought-prone Marathwada region of Maharashtra, India. Using a quasi-experimental design and the double-difference (Difference-in-Differences) estimation method, data were collected from 240 farmers—120 NICRA beneficiaries and 120 non-beneficiaries—across six villages in Parbhani, Jalna, and Chhatrapati Sambhajinagar districts. The results reveal significant benefits for NICRA beneficiaries, cropping intensity increased from 132 per cent to 179 per cent, irrigated area rose from 20.9 per cent to 37.3 per cent, and net income grew by over 200 per cent (₹31,975 to ₹95,913), compared to a 103 per cent increase for non-beneficiaries. Crop-wise yield improvements were notable: cotton (40.8%), soybean (43.1%), chickpea (40.9%), maize (23%), and sugarcane

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(31.2%). Crop diversification index increasing from 0.59 to 0.81. Perception analysis indicated that farmers recognise key climate risks such as erratic rainfall (83%), declining rainy days (92%), extreme heat (91%), and resource degradation (70%). The findings underscore the potential of CRTs to enhance resilience, productivity, and income in climate-vulnerable farming systems. Expanding such interventions through supportive policy frameworks, localised extension services, and investment in climate-smart infrastructure is critical for sustainable agricultural transformation in India.

Groundwater Sustainability-Economic Welfare Trade-offs of Electricity Pricing Policy for Irrigation in India

Anukriti Raj[1], Shivendra Kumar Srivastava[2], Prabhat Kishore[2], Jaspal Singh[3], and Mrinmoy Ray[4]

This study analyses evolving trends in groundwater irrigation and quantifies the effects of free electricity policy on groundwater levels at the meso-level. Further, the price elasticity of groundwater irrigation has been estimated and used to simulate the likely impact of reducing the electricity subsidy on groundwater savings and irrigation cost in Punjab. The results show that eliminating the electricity subsidy is expected to reduce irrigation hours by up to 26 per cent, but would raise the irrigation cost by up to 291 per cent. A relatively higher rate of increase in irrigation cost than the reduction in irrigation hours highlights a policy dilemma of optimising the trade-off between improving farmers' welfare and ensuring groundwater sustainability. Alternatives to electricity subsidies include Direct Benefit Transfers to farmers' bank accounts or tiered electricity pricing that ensures farmers' affordability and promotes sustainable use.

Comparative analysis of Emission Efficiency and Growth Patterns in Buffalo Meat Production across Major Producers

Poonam Chaturvedi[5], G K Vani[5], and Ankita Rajput[6]

The present study analysed emissions' intensity, growth, and instability globally and from major buffalo-producing countries, including India, Pakistan, and China, from 2000 to 2022. The study used compound annual growth rate (CAGR),

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instability index and LMDI decomposition analysis to decompose the total emission into production, emission intensity and distribution effect. The findings showed that India led global buffalo meat production with the highest growth rate of 4.92 per cent, with a significant decline in emission intensity (-4.72%). In contrast, China showed rising emissions and stagnating efficiency. Pakistan showed a minor increase in production (1.25%) but a significant increase in emission growth (3.13%). Findings of LMDI decomposition showed that the production effect was the dominant contributor to the rise in CO_2-eq emissions from buffalo meat, with an average value of 54.83 per cent. In contrast, the emission intensity effect significantly offset this increase with an average reduction of -42.64 per cent, indicating improved efficiency over time. The distribution effect had a relatively minor and fluctuating impact with an average of -1.37 per cent, suggesting limited influence on total emissions compared to production and efficiency changes. These findings highlight the importance of adopting climate-smart livestock practices, policies to improve emission efficiency through feeding practices, manure emission and emission-efficient technologies to ensure sustainable meat production in major producing nations.

Crop Production Dynamics in North Eastern States of India: Pathways to Sustainability and Food Security

Bhaskar J Bhuyan[1], Ram Singh[2], Nivedita Deka[1], Horindra Gogoi[1], and Ipshita Bhuyan[1]

The present study has been undertaken to understand the dynamics of major food crops production in the North Eastern states of India with the following objectives: (1) Study the growth and instability in area, production and productivity of major food crops in North East India. (2) Estimate the contribution of area and productivity in enhancing the production of major food crops in North East India. Time series secondary data on the area, production, and productivity of food grains and oilseeds in North East India for the period of 2001-02 to 2020-21 have been collected from various published sources, which have been divided into two phases *i.e.* 2001-02 to 2010-11 as phase I and 2011-12 to 2020-21 as phase II. Compound annual growth rate (CAGR), Cuddy-Della Valle Index (CDVI), and decomposition analysis technique have been used to carry out the study. Regarding food grains, Manipur recorded the highest CAGR of 3.300 concerning area, whereas for production and yield, Arunachal Pradesh recorded the highest CAGR of 3.778 and

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3.109, respectively. Regarding oilseeds, Tripura recorded the highest CAGR concerning area and production, *i.e.,* 17.813 and 21.680, respectively, whereas Manipur recorded the highest CAGR of 5.310 for yield. High instability was observed in the states of Manipur, Mizoram, and Nagaland with respect to area, production, and yield of food grains and oilseeds. The yield effect contributed the highest in the production of food grains and oilseeds in the entire North East, with a value of 101.262 per cent and 324.464 per cent, respectively.

Economic Viability and Resource Use Efficiency of *Apatani* Paddy-Cum-Fish Farming in Arunachal Pradesh

Gelung Pertin[1], N. Anandkumar Singh[2], Ram Singh[2m] and Snehal Athawale[2]

The study was carried out in the Lower Subansiri District of Arunachal Pradesh. A sample of 100 respondents was selected using a random sampling technique. Primary data was collected through a pre-structured, standardised interview schedule. Analytical tools like Cost Concepts and Cobb-Douglas production function were applied. The study found that, per hectare, gross returns for paddy-cum-fish farming were ₹287,848.69 for small farms, ₹277,588.92 for medium farms, ₹273,756.96 for large farms, and ₹280,272.53 overall. The benefit-cost ratios were found to be 2.34 for small farms, 2.18 for medium and large farms, and 2.17 for overall. Resource-use efficiency analysis indicated underutilization of key inputs such as human labour, fertilisers, seeds, and fingerlings, while others were overutilized. The findings underlined that *Apatani* paddy-cum-fish farming is economically sustainable. The study contributes empirical evidence to support the conservation and promotion of this traditional yet economically promising farming system in Northeast India.

Edible Oil Production in India: A Strategic Perspective

Kalpana Kapadia[3]

Day to day, edible oil consumption has been growing steadily in India because, in the Indian diet, oilseeds are the main source of fat and protein after cereals and pulses. Aggregate consumption has increased. The per capita edible oil consumption has increased by more than 18.7 kg/year during the last two decades, making the country dependent on large edible oil imports to meet the domestic demand. Approximately 60 per cent of the edible oil needs are met through imports. In India, oilseed production is estimated to be 413.55 tonnes in the year 2022-23, which has

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increased from 108.30 lakh tonnes in 1985-86, almost by a 38 per cent increase over the base year. For the last five years, i.e., from 2015-16 to 2022-23, the production growth rate was 7.3 per cent per annum. In India, domestic edible oil production stood at 116.5 lakh tonnes and imports at 141.93 lakh tonnes, while the total consumption/ demand was 258.43 lakh tonnes. Oilseed crops are the second most important part of the agricultural economy in India, next only to cereals within the portion of field crops. The self-sufficiency in oilseeds achieved during the "Yellow Revolution" in the early 1990s was short-lived and could not be maintained for long. This research paper attempted to analyse the trends in production and changes in the consumption pattern of edible oilseed in India, and there is a discussion about which types of suggestions and improvements we should take to become self-sufficient in oilseed crops. The 1980s saw strong growth, with area, production, and yield rising by 2.85 per cent, 5.99 per cent, and 3.06 per cent. However, in the last decade from 2011 to 2023, the growth rates slowed, with area increasing by 0.57 per cent, production by 2.12 per cent, and yield by 1.53 per cent. Thus, from 1980 to 2023, the area and production of oilseed crops have been observed to decrease. Various government policies have been undertaken to meet the growing demand, but there have also been presented for achieving “Atmanirbharta” in the edible oil sector. If India is to become self-sufficient in oilseeds, some strategic policies will have to be made such as increasing the area under oilseed crops, the cluster's strengths, including horizontal and vertical expansion of edible oil cultivation, adopting improved and advanced crop-specific technologies (seeds, fertilisers, Micro Irrigation System etc.) for edible oil production, apart from this according to ICMR-National Institute of Nutrition (ICMR-NIN) a need for awareness regarding the optimum consumption of edible, to importance the Behavioristic Approach recognizes the potential for behavioral shifts in consumption patterns driven by increasing income levels, price fluctuations, evolving lifestyles, and changing dietary habits.

Potato Production in Sirmaur & Himachal Pradesh: Trends, Resource-Use Efficiency, and Socio-Economic Constraints in the Trans-Giri region of Himachal Pradesh

Sapna Bhardwaj[1] and Brij Bala[2]

Based on 60 farmers from Rajgarh and Sangrah blocks, this study analysed socio-economic profiles, trends in area, production, and productivity (CAGR), resource use

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efficiency, and constraints in cultivation. The average operational holding was 0.60 ha, with potato covering 14 per cent of the gross cropped area. Productivity averaged 225 q/ha, contributing 11 per cent to total household income. CAGRs (1994–2019) showed significant declines in area (-1.50% p.a.), production (-2.86% p.a.) in Sirmaur, as in Himachal Pradesh, the reduction in production (-1.39% p.a.) was greater than the reduction in area (-1.01% p.a.) under potato cultivation. MVP analysis revealed underutilisation of key resources, indicating scope for higher returns through increased human labour, seed, and area allocation. Major constraints included high seed cost, low prices, labour shortages, lack of irrigation, and inadequate quality seed. Policy measures should focus on affordable quality seed supply, training in recommended practices, and farmer cooperatives for improved market access.

Dynamics of Onion Cultivation in Haryana: A Study of Growth and Profitability

Rakesh Kumar[1], Parminder Singh[2], Dharampal Malik[1], Dalip Kumar Bishnoi[1], G Johns Tiyndel[1], and Sanjay Kumar[1]

This study analyses the growth trends, instability and profitability of onion cultivation in Haryana over three decades (1991–92 to 2020–21), focusing on the impact of the National Horticulture Mission (NHM). Using time-series data, compound annual growth rates (CAGR) and Cuddy-Della Valle Index (CDVI), results showed significant increases in area and production, particularly during the NHM period. However, productivity growth was more modest. Instability declined post-NHM, indicating improved production resilience. Primary data from 30 farmers in Nuh and Yamuna Nagar districts revealed that onion cultivation remains profitable, with an average gross return of ₹465,399/ha and a net return of ₹135,365/ha. Despite persistent challenges like price volatility and post-harvest losses, government interventions and improved practices have positively influenced onion cultivation and farmer income in Haryana.

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Farmers' Willingness to Pay for Eco-Friendly Agricultural Technologies in Haryana

Nilar Myat, Sanjay and Gelung Pertin[11]

The study investigated farmers' willingness to pay (WTP) for eco-friendly agricultural technologies in Haryana, focusing on selected bio-fertilisers. Despite Haryana's advanced agricultural base, declining soil fertility and excessive reliance on chemical fertilisers highlight the need for sustainable alternatives. Primary data from 280 adopters and non-adopters covering seven eco-friendly agricultural technologies, such as Azoteeka, Bioteeka, Mycorrhizae, Phosphoteeka, Pusa Decomposer, Rhizoteeka, and Zinc Solubiliser, were analysed using Probit regression. Findings revealed that non-adopters exhibited a higher mean WTP (₹589.79) than adopters (₹253.10), suggesting stronger expectations from bio-inputs among those yet to adopt. Awareness of Zinc Solubiliser significantly increased WTP (Odds Ratio = 7.41; $p<0.01$), indicating that knowledge of specific products enhances farmers' valuation. Conversely, familiarity with Bioteeka had an adverse effect, possibly due to limited field efficacy or unsatisfactory past experiences. Socio-economic factors such as caste category and income group were also significant determinants of WTP. The results underscore that product-specific awareness and social context shape farmers' willingness. Strengthening targeted training and awareness programs is essential to enhance demand for eco-friendly technologies and support sustainable agricultural practices in Haryana.

An Economy-wide Analysis of Repurposing Fertiliser Subsidies in India

Asha Devi[2], Praveen K V[2], Kriti Sharma[3], Barun Deb Pal[2], Alka Singh[2], Subrata Barman[2], K Ramanjaneya Reddy[2], and Shreya Hanji[2]

Fertiliser consumption in India has surged due to Green Revolution technologies and government subsidies. However, rising subsidy expenditures have created a heavy fiscal burden. Uneven subsidy allocation has kept urea prices artificially low compared to phosphorus and potassium fertilisers, leading to its overuse, soil nutrient imbalances, and diversion to non-agricultural uses. Recognising these challenges, the government has recently intended to curtail fertiliser subsidies. PM-PRANAM (Prime Minister Programme for Restoration, Awareness Generation, Nourishment, and Amelioration of Mother Earth) is the latest initiative in this direction. This study examines the economy-wide effects of reducing fertiliser

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subsidies and explores compensatory mechanisms to safeguard farmers' incomes. Results show that while subsidy cuts ease fiscal pressure, they negatively affect agriculture and spill over to other sectors, reducing Gross Value Added across the economy. Redirecting savings to rural farm households cushions income losses for farmers but lowers real incomes for rural non-farm and urban households. Hence, a blanket reduction in fertiliser subsidies is not a feasible solution.