

National Sectoral Paper

Agriculture and Crop Science

Farm Sector Development Department
National Bank for Agriculture and Rural Development
Mumbai





NABARD's Vision

Development Bank of the
Nation for fostering rural
prosperity

NABARD's Mission

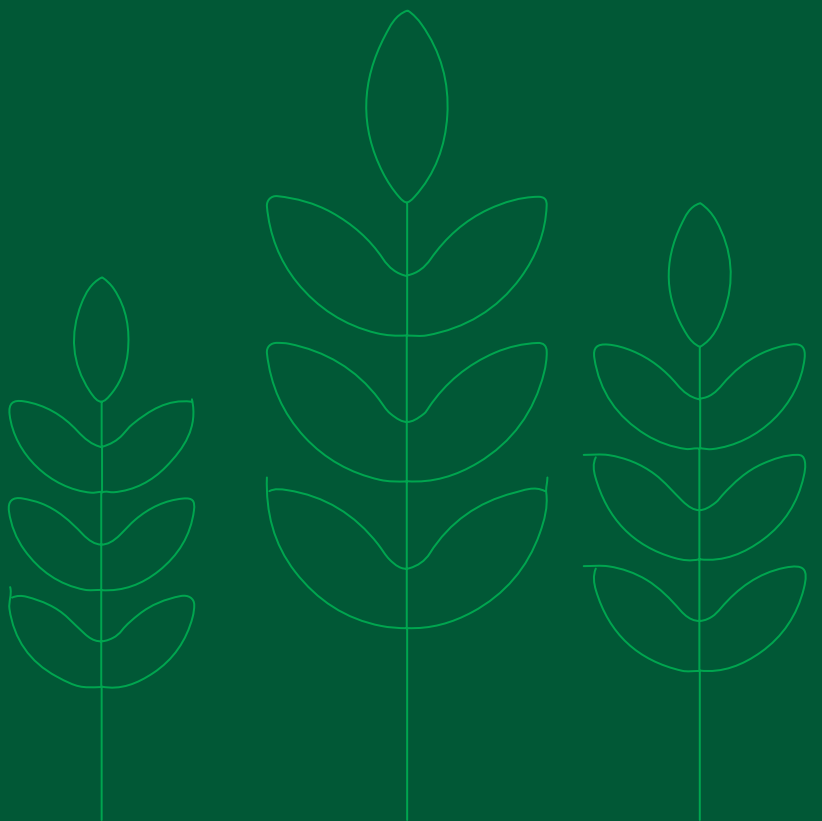
Promote sustainable and equitable
agriculture and rural development
through participative financial
and non-financial interventions,
innovations, technology and
institutional development for
securing prosperity

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Contact	:	Plot No. C-24, 'G' Block, Bandra Kurla Complex, Bandra East, Mumbai- 400 051, India.
Tel.	:	+91 22 2653 0094
E-mail	:	ctag@nabard.org; fsdd@nabard.org
Website	:	www.nabard.org , www.youtube.com/nabardonline

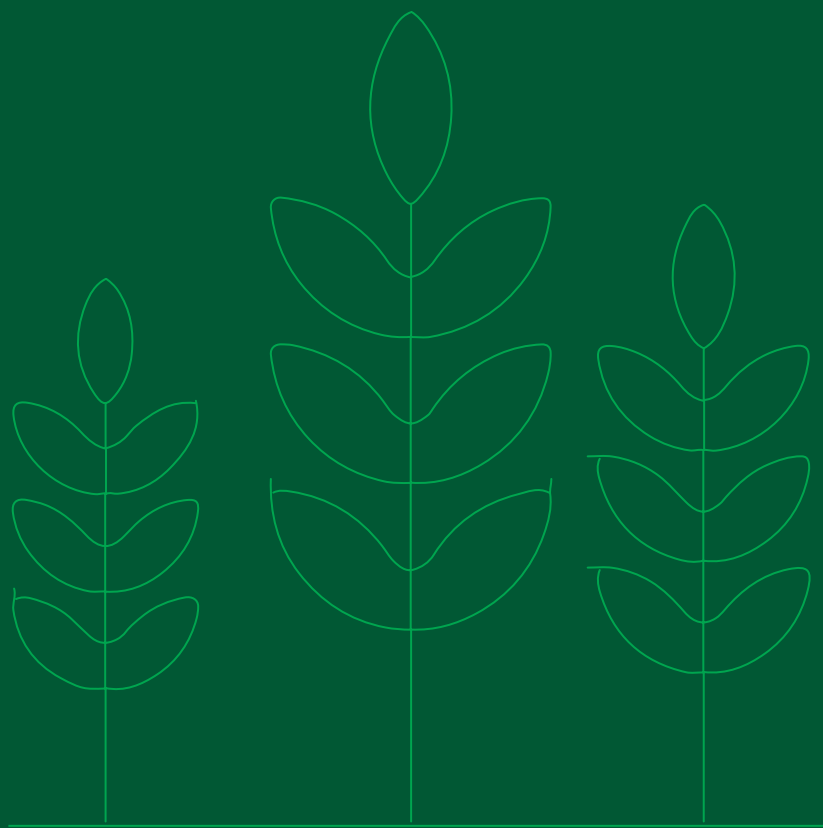


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Foreword

Agriculture in India is both the foundation and the lifeblood of our nation. With over half of the country's workforce dependent on agriculture, it remains central to our economic and social fabric. However, the sector faces unprecedented challenges, ranging from environmental stressors like climate change to outdated farming practices that limit growth potential. Yet, despite these challenges, agriculture also offers the brightest prospects for sustainable growth, rural development, and food security.

This paper aims to explore the present status of Indian agriculture, the challenges hindering its potential, and the transformative role of innovation and government policies in reshaping the sector. It delves into the impact of climate change on farming, the need for climate-resilient agriculture, and how new, sustainable farming practices are emerging as the key to securing the future of Indian agriculture. It also highlights the essential role played by agricultural research institutes, financial institutions like NABARD, and government schemes in enhancing productivity, improving soil health, and boosting farm incomes.

As the world's second-most populous country, India's agricultural transformation is not only crucial for its own food security and economic stability but also for the global agricultural landscape. While the path forward is fraught with challenges such as low credit penetration, inadequate infrastructure, and fragmented land

holdings, there are opportunities to leapfrog to a more sustainable and technology-driven agricultural system. The adoption of precision farming, integrated pest management, and other innovations is paving the way for a more resilient, efficient, and inclusive agriculture sector.

The PM Dhan Dhanya Krishi Yojana 2025 is a central government initiative aimed at enhancing agricultural productivity in 100 low-crop-intensity districts, benefiting around 1.7 crore farmers through financial aid, improved irrigation, and better storage infrastructure. It promotes sustainable farming practices, crop diversification, and increased credit access to boost rural prosperity and food security.

This reflects on the significant strides already made and the roadmap that lies ahead for Indian agriculture. By examining key government schemes, the critical role of research, and the rising prominence of sustainable farming practices, we hope to inspire further action, collaboration, and innovation to shape a more prosperous future for India's farmers and the agricultural economy.

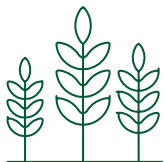
Shaji K V

Chairman

**National Bank for Agriculture and Rural
Development**

Mumbai

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Message

Agriculture remains the backbone of the Indian economy, employing nearly half of the workforce and contributing significantly to food security and rural livelihoods. As the sector evolves amidst climate change, technological disruption, and shifting market dynamics, the role of institutional support—particularly in the form of credit—becomes increasingly vital.

The agricultural sector today faces a multitude of challenges. Climate variability, land fragmentation, rising input costs and market access are few of the many challenges. To address these challenges, a multi-pronged approach leveraging technology, policy innovation, and institutional reform is essential. Some of the new age solutions like Digital Credit Platforms, Precision Agriculture, Climate-Smart Practices, Agri-Startups and FPOs a Crop Insurance and Risk Management are targeted towards making agriculture remunerative for the small and marginal farmers.

The National Bank for Agriculture and Rural Development (NABARD) plays a pivotal role in strengthening the rural credit structure. As an apex development financial institution, NABARD provides refinance support to banks for short-term crop loans and long-term investment credit. It also facilitates capacity building, infrastructure development, and financial inclusion initiatives. Additionally, NABARD supports innovative

models such as Farmer Producer Organizations (FPOs), watershed development projects, and climate-resilient agriculture, thereby promoting sustainable rural development.

Agriculture and crop science are at a critical juncture. While the sector grapples with structural and environmental challenges, the convergence of institutional credit, technological innovation, and policy support offers a pathway to sustainable and inclusive growth. Strengthening credit systems, empowering farmers with knowledge and tools, and fostering resilient ecosystems will be key to unlocking the full potential of Indian agriculture.

I commend the C-TAG Coordinator and team members for their dedicated efforts in preparing this insightful document. NABARD welcomes feedback and suggestions to further enrich this initiative and strengthen our collective commitment to sustainable land management and rural prosperity.

Dr A K Sood

Deputy Managing Director

National bank for Agriculture and Rural Development

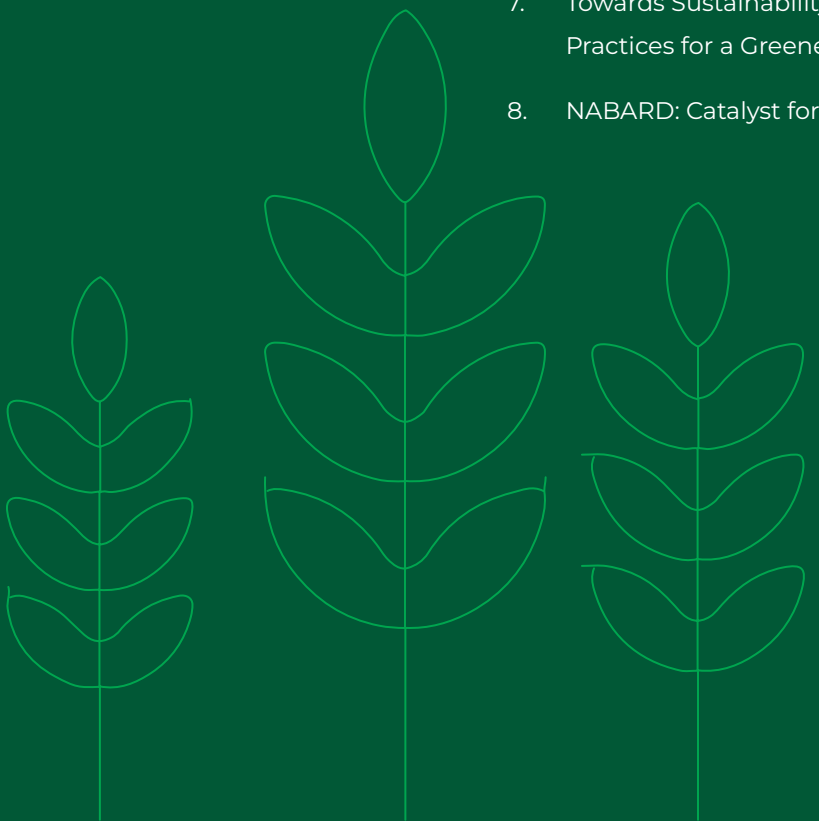
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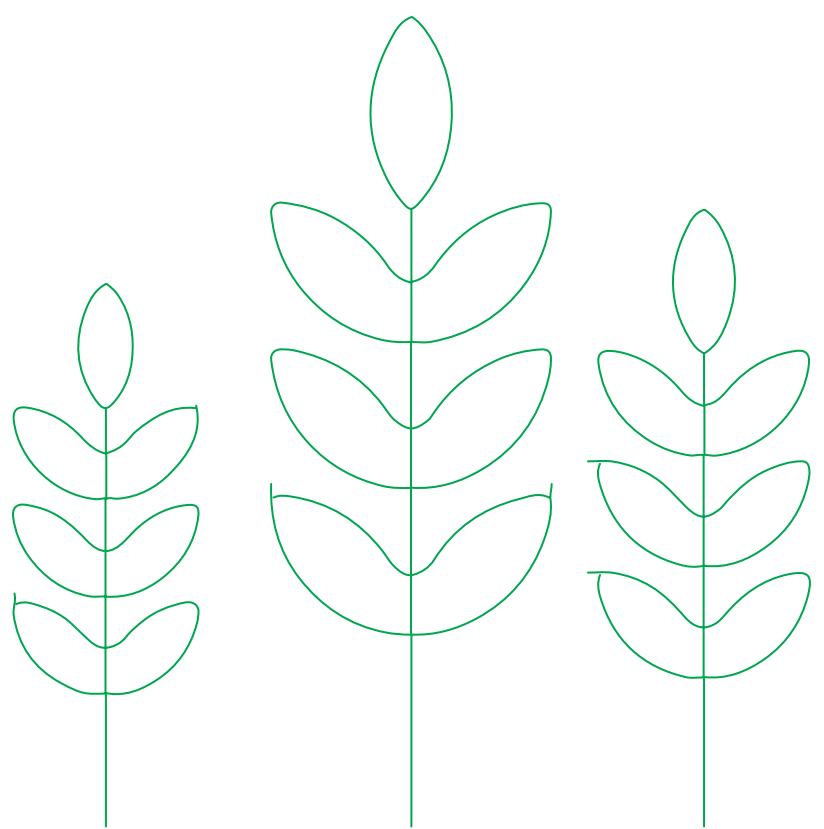
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01

Present Scenario of Agriculture in India



Agriculture plays a vital role in the Indian economy, employing around 42.3% of the workforce and contributing 18.2% to the country's GDP. India ranks as the second-largest producer of rice, wheat, and cotton, among other crops, and holds the position of the world's largest producer of milk, pulses, and spices. The agricultural landscape in India is highly diverse, incorporating a broad array of crops, livestock, and farming techniques.

Over the past five years, the agriculture sector has grown at an average annual rate of 4.18%. For 2023-24, provisional estimates indicate a more modest growth rate of 1.4%. In recent years, allied activities such as livestock and fisheries have outpaced traditional crop production. The share of livestock and fisheries in the Gross Value Added (GVA) from agriculture has increased significantly, from 24.38% and 4.44% in 2014-15 to 30.23% and 7.25% in 2022-23, respectively. Meanwhile, the crop sector's contribution to Agriculture GVA fell from 61.75% in 2014-15 to 55.28% in 2022-23.

India's annual agricultural exports during FY2024 at \$48.8 billion, The export basket, nevertheless, remains highly concentrated (with high shares of rice, including basmati rice, and sugar together accounting for more than one third of total exports).

For the year 2024, total foodgrain production (from both the kharif and rabi seasons) is 332.29 million tonnes, according to the final estimate. Pulses production for the year 2023-24 is 24.24

million tonnes, which marks a decrease of 0.42 million tonnes over the five-year average of 24.66 million tonnes. The production of oilseeds reached a record high of 39.67 million tonnes in 2023-24, showing reduction from the previous year's total by 1.69 million tonnes. In horticulture, output for FY2024 is estimated (as per 3rd advance estimates) at 353.18 million tonnes, a slight decrease from the 355.5 million tonnes produced in FY2023.

Productivity and Growth: India's agricultural sector has seen notable growth in recent decades, primarily driven by the Green Revolution in the 1960s and 1970s, which introduced high-yielding varieties (HYVs) of crops, increased use of fertilizers, and improved irrigation facilities. Major crops like rice, wheat, and pulses have seen significant production increases. As of 2023, India is the second-largest producer of rice and wheat globally, and it is a leading producer of pulses and several fruits and vegetables.

Despite these achievements, productivity

remains inconsistent across different regions and crops. The disparity can be attributed to factors such as uneven access to technology, infrastructure, fragmented land holdings, low farm investment, lack of farm mechanization, insufficient access to quality inputs, and

inadequate marketing infrastructure leading to post-harvest losses, dependency on rains and short growing seasons are a few reasons for the low yields and credit facilities.

1.1. Area under cultivation

During the year 2022-23, the total reported area (for all India classification of land) by all States/UTs is 306.65 million hectares which is about 93.28 per cent against the total geographical area of 328.75 million hectares. The total agricultural land, that includes land under miscellaneous tree crops, culturable wasteland, fallow land other than current fallow, current fallow and net area sown, is 179.98 million

hectares. This is more than 58 percent of reported area.

Area of agriculture land during 1950-51 was 66.70% of the reporting area, which is reduced to 58.69% during 2022-23. This decrease in agriculture land may be attributed to growing demand for increasing population, urbanization, industrialization.

1.2. Land Use Pattern in India is as under:

(million hectares)

Area reported for land utilization classification		306.65
Sr. No.	Classification	
1	Forests	72.02
2	Area put to non-agricultural uses	27.85
3	Barren & unculturable land	16.55
4	Permanent pastures & other grazing lands	10.25
5	Land under Misc. tree Crops	2.99
6	Culturable Wasteland	11.66
7	Fallow Land Other than Current Fallows	11.12
8	Current Fallow	13.49
9	Net Area Sown	140.70
10	Agricultural Land (5+6+7+8+9)	179.98

(source: LAND USE STATISTICS AT A GLANCE: 2022-23)



1.3. Land Holding Pattern

As per Agri census 2015-16, total no. of agriculture holdings in India was 1,46,454 and total area operated was 157.83 million hectares with average holding size was of 1.08 ha.

The details of number and area of operational holdings in India is as under:

(Number in thousands, area in million hectares, average size hectare, marginal<1 ha, Small -1-2 ha, Semi medium 2.0-4.0 ha, Medium 4.0-10 ha, Large 10 ha and above)

Category of farmers	Number	Area	Average holding	% of total number	% of total area
Marginal	1,00,251	37.92	0.38	68.45	24.03
Small	25,809	36.15	1.40	17.62	22.91
Semi-Medium	13,993	37.62	2.69	9.55	23.84
Medium	5,561	31.81	5.72	3.80	20.016
Large	8,38	14.31	17.07	0.57	9.07
All holdings	1,46,454	157.82	1.08	100	100

(Source: Agriculture Census 2015-16)

It can be inferred from above table that 86 % of Indian farmers are marginal and farmers and owns 47% of the area.

Cropping Intensity is the ratio (%) of Total Cropped Area to Net Area Sown. The cropping Intensity is 155.9 with the Net Sown Area in the country of 140.70 million hectares and the Gross Cropped area (2022-23) of 219.69 million hectares.

1.4. Production

Food Grains: As per final estimates for production of food grains during 2023-24, the total food grain production in the country stood at 332.29 million tonnes registering a slight increase of 0.79% over the food grain production of 329.68 million tonnes recorded during 2022-23.

The status of food grain production in the country during last three year is as under:

Production in Lakh Tonnes

Sr. No	Crop	2021-22	2022-23	2023-24	Change (%) in 23-24 over 22-23
I	Cereals	2883.14	3036.28	3080.52	1.46
1	Rice	1294.71	1357.55	1378.25	1.52
2	Wheat	1077.42	1105.54	1132.92	2.48
3	Maize	337.3	380.85	376.65	-1.10
4	Barley	13.71	19.13	16.99	-11.19
5	Jowar	41.51	38.14	47.37	24.20
6	Bajra	97.81	114.31	107.16	-6.25
7	Ragi	17.01	16.91	16.7	-1.24
8	Small Millets	3.67	3.84	4.49	16.93
II	Total Pulses	273.02	260.58	242.46	-6.95
1	Tur	42.2	33.12	34.17	3.17
2	Gram	135.44	122.67	110.39	-10.01
3	Urad	27.76	26.31	23.19	-11.86
4	Moong	31.66	36.76	31.03	-15.59
5	Lentil	12.69	15.59	17.91	14.88
6	Other Pulses	23.27	26.14	25.77	-1.42
Total Food Grains		3156.16	3296.87	3322.98	0.79

(Source: DA&FW)



1.5. Oilseed and Commercial Crops:

As per final estimates for production of oilseeds and commercial crops during 2023-24, the total oilseed production in the country stood at 39.67 million tonnes registering a decline of 4.08% over the oilseed production of 41.36 million tonnes recorded during 2022-23. Sugarcane production in the country during 2023-24 stood at 453.16 million tonnes. Cotton, Jute and Mesta production in the country during 2023-24 stood at 325.22, 92.52 and 4.41 lakh bales, respectively.

The status of Oilseed and Commercial crop production in the country during last three year is as under:

Production in Lakh Tonnes

S.No.	Crop	2021-22	2022-23	2023-24	Change (%) in 23-24 over 22-23
I	Total Oilseeds	379.6	413.6	396.7	-4.08
1	Groundnut	101.35	102.97	101.8	-1.14
2	Castor seed	16.19	19.8	19.59	-1.06
3	Sesamum	7.89	8.02	8.47	5.61
4	Niger seed	0.33	0.29	0.27	-6.90
5	Soybean	129.87	149.85	130.62	-12.83
6	Sunflower	2.5	3.63	1.73	-52.34
7	Rapeseed and Mustard	119.63	126.43	132.59	4.87
8	Linseed	1.26	1.67	1.13	-32.34
9	Safflower	0.61	0.9	0.5	-44.44
II	Cotton*	311.2	336.8	325.2	-3.44
III	Jute**	97.62	89.89	92.52	2.93
IV	Mesta**	3.87	4.03	4.41	9.43

* 1 bale=170 Kg **1 bale=180 Kg

(source: DA&FW)

1.6. Productivity

The estimates for Yield of major crops in the country during last three years is as under:

Yield (Kg/ha)

S.No	Crop	2021-22	2022-23	2023-24	Change (%) in 23-24 over 22-23
I	Cereals	2899	2939	2945	0.20
1	Rice	2798	2838	2882	1.55
2	Wheat	3537	3521	3559	1.08
3	Maize	3387	3545	3351	-5.47
4	Barley	3025	3044	3082	1.25
5	Jowar	1092	1079	1162	7.69
6	Bajra	1430	1510	1453	-3.77
7	Ragi	1396	1454	1375	-5.43
8	Small Millets	1093	1086	1165	7.27
II	Total Pulses	888	902	881	-2.33
1	Tur	861	814	827	1.60
2	Gram	1261	1172	1151	-1.79
3	Urad	599	657	656	-0.15
4	Moong	570	663	598	-9.80
5	Lentil	899	952	1028	7.98
6	Other Pulses	666	823	776	-5.71
	Total Food Grains	2425	2494	2515	0.84

(source: Agricultural Statistics at a Glance 2023)

The yield of rice, wheat, barley, jowar, small millets, tur and lentil registered an increase in yield in 2023-24 in comparison to 2022-23 while yield of maize, bajra, ragi, gram, moong, urad and other pulses registered decline in yield in 2023-24 in comparison to 2022-23.



1.7. Agro-Climatic Zones: The Key to Climate-Smart Agriculture

To facilitate planning and research for better agricultural practices, classification of available land has been attempted and one of the most accepted classifications is delineation of the country into 15 Agro-Climatic Regions by erstwhile Planning Commission of India in 1989 based on homogeneity in rainfall, temperature, topography, cropping and farming systems and water resources. The main objective was to integrate plans of the Agro-climatic regions with the state and national plans to enable policy development based on techno-agro-climatic considerations. These Regions are known as Agro Climatic Zones of India. The 15 regions are:

S. No.	Agro-climatic regions/zones	States represented
I	Western Himalayan region	Himachal Pradesh, Jammu & Kashmir, Uttarakhand
II	Eastern Himalayan region	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West Bengal
III	Lower Gangetic plain region	West Bengal
IV	Middle Gangetic plain region	Uttar Pradesh, Bihar
V	Upper Gangetic plain region	Uttar Pradesh
VI	Trans Gangetic plain region	Chandigarh, Delhi, Haryana, Punjab, Rajasthan
VII	Eastern plateau and hills region	Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, West Bengal
VIII	Central plateau and hills region	Madhya Pradesh, Rajasthan, Uttar Pradesh
IX	Western plateau and hills region	Madhya Pradesh, Maharashtra
X	Southern plateau and hills region	Andhra Pradesh, Karnataka, Tamil Nadu
XI	East coast plains and hills region	Andhra Pradesh, Odisha, Puducherry, Tamil Nadu
XII	West coast plains and ghat region	Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu
XIII	Gujarat plains and hills region	Gujarat, Dadra & Nagar Haveli, Daman & Diu
XIV	Western dry region	Rajasthan
XV	Island region	Andaman & Nicobar Islands, Lakshadweep

The Agro-Climatic Regional Planning aims at a more scientific utilization of natural and manmade resources available in the country. An overall development profile of each region is formulated through an optimal mix of land stock management, crop production, animal husbandry, aquaculture, horticulture, forestry and agro-processing activities. At the disaggregated level, a farming system approach, rather than the traditional crop production approach, is attempted at. The objectives are to: (a) attempt a broad demand supply balance of major commodities at the national level based on an analysis of potential and prospects of the several regions; (b) maximize net income of producers; (c) generate additional employment for the benefit, particularly, of landless labourers; and (d) in the long-run, provide the framework for a scientific and sustainable use of natural resources particularly land, water, and forests.

1.8. Agri Export

India is a major global player in agricultural exports, with the sector contributing significantly to the country's economy. In 2023-24, India's agricultural exports were valued at US\$ 48.15 billion, although this represents a decline from the US\$ 52.50 billion in exports recorded in 2022-23. The country's agricultural exports primarily consist of agri and allied products, marine products, plantation goods, and textiles. Notably, agri and allied products alone accounted for US\$ 37.3 billion in exports, reflecting a robust 17% growth over the 2020-21 period.

Key agricultural commodities exported by India include tea, coffee, rice (both basmati and non-basmati varieties), spices, sugar, meat, and marine products. In the 2022-23 period, marine products emerged as the one of the

largest contributors to agricultural exports, accounting for 15.2% of the total, followed by rice at 20.9%, sugar at 10.8%, and spices at 7.1%.

The Indian government has shown a strong commitment to increasing farmers' incomes by enhancing agricultural exports. This is evident in the various initiatives led by the Agricultural and Processed Food Products Export Development Authority (APEDA), which has played a pivotal role in expanding export opportunities. Efforts such as organizing business-to-business (B2B) exhibitions in key global markets and launching targeted marketing campaigns for specific products have helped unlock new markets and boost India's agricultural export potential.

1.9. Budget 2024-25 for Agri and allied activities

In the Union Budget for 2024-25, enhancing productivity and resilience in agriculture has been identified as one of the top nine priorities of the Government of India. To strengthen the agricultural sector and make it more sustainable, several key initiatives have been outlined. These include: (a) transforming agricultural research to drive innovation, (b) the release of new crop varieties to improve yields and disease resistance, (c) promoting natural farming practices for sustainable growth, (d) a dedicated mission to boost pulses and oilseeds production, (e) improving vegetable production and strengthening supply chains, (f) developing digital public infrastructure to support the agricultural ecosystem, and (g) enhancing shrimp

production and export capabilities. To support these efforts, the government has allocated ₹ 1.52 lakh crore to the agriculture and allied sectors for the fiscal year 2024-25, signalling a strong commitment to revitalizing and modernizing India's agriculture.

The share of agriculture and allied activities in total budgeted expenditure has been retained at the last year's level (3.15 % in FY 25 versus 3.13 % in FY 24), and YoY growth in budgeted expenditure for the sector is pegged at about 8 per cent (as against 7.3% for total expenditure)



Budget Provisions for Agriculture and Allied Activities

(₹ Crore)

Particulars	2022-23 (Actuals)	2023-24 (Revised Estimates)	2024-25 (Budgeted)
Agriculture and Allied Activities	1,25,875	1,40,533	1,51,851
Of which: (a) Department of Agriculture and Farmers Welfare	99,877	1,16,788	1,22,528
(b) Department of Agricultural Research and Education	8,399	9,327	9,353
(c) Department Fisheries	1,294	1,701	2,616
(d) Department of Animal Husbandry and Dairying	2,315	3,913	4,521

(Source: Budget 2024-25)

The Government of India's proactive approach towards enhancing agricultural productivity and resilience signals a promising future for the sector. With a focus on transforming agricultural research, promoting sustainable practices like natural farming, and boosting production in key areas such as pulses, oilseeds, and shrimp, the initiatives outlined in the 2024-25 Budget demonstrate a comprehensive strategy for long-term growth. The allocation of ₹ 1.52 lakh crore to agriculture and allied sectors highlights the government's commitment to ensuring food security, improving farmers' incomes, and fostering innovation through digital infrastructure. As these measures take shape, India's agriculture sector is poised to not only meet domestic demands but also strengthen its position in the global market, ensuring a more resilient and sustainable agricultural landscape for future generations.

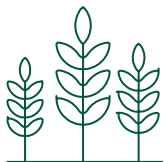
The present scenario of agriculture in India reflects a complex blend of progress and challenges. While the sector remains a cornerstone of the Indian economy, supporting millions of

livelihoods and contributing significantly to the GDP, it faces pressing issues such as climate change, water scarcity, and outdated farming practices. However, there are clear signs of transformation, with technological advancements, government initiatives, and a growing focus on sustainable practices offering new opportunities for growth. Efforts to enhance productivity through research, improve market access, and expand irrigation infrastructure are critical steps towards making agriculture more resilient and profitable. As India continues to evolve its agricultural policies and practices, the sector's future holds immense potential to drive economic growth, ensure food security, and uplift the livelihoods of millions of farmers across the country.



02

Key Challenges in Modern Agriculture



Agriculture in India, while experiencing significant advancements, faces a range of key challenges that hinder its full potential. These challenges are multifaceted, involving environmental, economic, and technological factors that impact productivity and sustainability. Climate change, with its erratic weather patterns and increasing frequency of droughts and floods, poses a major threat to crop yields and agricultural stability. Water scarcity, coupled with inefficient irrigation systems, exacerbates the pressure on farmers, particularly in rain-fed and semi-arid regions. The dependence on traditional farming practices, limited access to quality inputs, and fragmented landholdings further undermine the sector's growth. Addressing these challenges is crucial to ensuring that agriculture remains a viable and sustainable livelihood for millions of farmers and continues to contribute significantly to the Indian economy.

India's agriculture sector, despite being a crucial part of the economy as contributed approximately 18.2% of India's total GDP. While the contribution of agriculture to GDP has declined from over 50% at the time of independence in 1947 to around 18.2% today, it still plays a vital role in sustaining rural livelihoods and food security. The decreasing trend for the share in GDP is attributed to several key challenges that impact its efficiency, productivity, and sustainability. Here are the primary challenges:

2.1. Fragmented land holdings

Small and fragmented land holdings are a significant issue in Indian agriculture.

According to the agricultural census 2011, around 86% of farmers in India are small and marginal, owning less than 2 hectares of land.

Solution:

- Promote land pooling and consolidation to increase farm size, thereby enhancing economies of scale.
- Strengthen FPOs and cooperatives to enable small farmers to access inputs, technology, and markets collectively.
- Encourage models of contract farming that provide small farmers with assured markets, technology support, and credit.

2.2. Dependence on monsoon

Agriculture in India is highly dependent on the monsoon season, as more than 50% of cultivated land is rain-fed. Food grain production in the country accrues from approximately 139.18 million hectares of net area sown. Of this, 69.48 million hectares is net irrigated and the remaining area of about 69.70 million hectares is under rainfed conditions (as per Land Use Statistics at a Glance 2017-18).

Solution

- Expand irrigation coverage through schemes like micro-irrigation (e.g., drip and sprinkler systems) and better water storage facilities.
- Implement water conservation techniques like rainwater harvesting, watershed development, and the rejuvenation of traditional water bodies.
- Promote drought-resistant crop varieties and develop contingency plans for areas prone to drought.

2.3. Inadequate irrigation infrastructure

Despite significant investments in irrigation infrastructure, only around 55% of India's gross cropped area is irrigated. Out of the total cropped area of 219.36 million hectares, approximately 122.29 million hectares are irrigated, accounting for 55.8% of the gross cropped area. Further, the country has 79.31 million hectares of net irrigated area, compared to a total net sown area of 140.70 million hectares, accounting for 56.36% of the net sown area. This indicates a substantial potential to expand irrigation coverage,

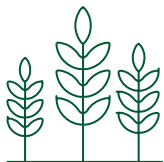
especially in unirrigated areas, which could significantly improve agricultural productivity and water-use efficiency.

Solutions:

- Promote drip and sprinkler irrigation to save water.
- Repair and desilt canals for better water delivery.
- Capture rainwater for irrigation in dry periods.
- Use solar pumps to ensure sustainable water access.
- Enforce limits on groundwater extraction for sustainability.

2.4. Post-Harvest losses and inadequate storage

India suffers from substantial post-harvest losses due to poor storage facilities, inadequate cold chains, and insufficient processing units. Post-harvest losses in India continue to be a significant challenge, impacting both the economy and food security. It is estimated that India loses 20-30% of its total agricultural production after harvest, with losses varying depending on the type of crop, region, and stage of the supply chain. According to the Ministry of Food Processing Industries, the estimated value of post-harvest losses in the country amounts to about ₹ 92,000 crores annually. These losses primarily occur in the form of spoilage, physical damage, poor handling practices, and inefficient storage and transportation systems. Fruits and vegetables, being perishable, face the highest levels of wastage, with losses reaching 35-40% for some crops like tomatoes, potatoes, and onions. Grains, on the other hand, generally experience



post-harvest losses of around 10-15% due to improper storage conditions, pest attacks, and moisture content variations.

Solution:

- Develop cold storage chains, efficient transport networks, and modernized processing units to reduce post-harvest losses.
- Enhance e-marketing platforms like e-NAM (Electronic National Agriculture Market) to connect farmers directly with buyers, eliminating intermediaries.
- Ensure timely procurement at MSP and expand coverage to more crops and regions.

2.5. Low adoption of technology

Despite the availability of modern farming technologies, including precision farming and digital tools, the adoption rate is low due to high costs, lack of awareness, and inadequate access.

Solutions

- Conduct extensive farmer education initiatives to demonstrate the benefits of modern technologies like precision farming, soil sensors, and drip irrigation.
- Provide government subsidies and financial incentives for adopting advanced tools like farm machinery, digital platforms, and smart irrigation systems.
- Encourage innovation in cost-effective technology solutions that are affordable for small and marginal farmers.
- Improve agricultural extension

services to help farmers understand and implement new technologies effectively.

- Foster collaboration between the government, private tech firms, and startups to create tailored solutions for Indian farmers.
- Enhance rural internet connectivity to enable farmers to use mobile apps, e-market platforms, and real-time weather or crop advisory services.

2.6. Soil degradation and overuse of chemicals

Excessive use of chemical fertilizers and pesticides has led to soil degradation and declining soil health. India is witnessing an alarming rise in soil degradation, threatening its agricultural productivity, food security, and environmental sustainability. Soil, a vital resource supporting the livelihoods of millions of farmers and maintaining ecosystem balance, is under siege from various forms of degradation. According to recent estimates, nearly 115 to 120 million hectares roughly 33% of the country's total geographic area are affected by soil degradation, including water erosion, wind erosion, salinity, and vegetation loss.

Solution:

- Promote organic and zero-budget natural farming practices to reduce reliance on chemicals and restore soil health.
- Encourage practices like crop diversification, mixed farming, and sustainable irrigation techniques to conserve water.
- Encourage agroforestry and afforestation projects to maintain ecological balance.

2.7. Access to credit and financial services

Farmers, especially smallholders, often lack access to formal credit, forcing them to rely on informal sources like moneylenders who charge exorbitant interest rates. According to the NABARD All India Financial Survey 2021-22, commercial banks (32%) and relatives & friends (23%) are the most preferred sources of loans for agricultural households, indicating a strong reliance on both formal and informal credit. Among institutional sources, scheduled commercial banks (32%), NBFCs (17%), and bank-linked SHGs (14%) are the most commonly accessed. Agricultural households exhibit greater preference for cooperative societies (7%) and regional rural banks (5%) compared to non-agricultural households, which rely more on NBFCs (18%) and SHGs (16%). Notably, only 3% of agricultural households depend on moneylenders or landlords, highlighting a significant reduction in the use of informal credit sources. This shift reflects increasing access to formal credit channels, although informal networks still play a key role in rural finance.

Solution:

- Improve access to institutional credit through expanding banking networks, promoting micro-finance institutions, and leveraging digital platforms.
- Simplify access to agricultural subsidies and ensure the effective implementation of crop insurance schemes like the Pradhan Mantri Fasal Bima Yojana (PMFBY) to reduce risk.

2.8. Market access and price volatility

Farmers frequently face difficulties accessing markets due to poor transportation, infrastructure, and limited information about prevailing market prices.

Solution:

- Implement mechanisms like buffer stock operations and Price Stabilization Funds to safeguard farmers against volatile prices.
- Promote agricultural future markets and contract farming to allow farmers to look in prices in advance.

2.9. Climate Change

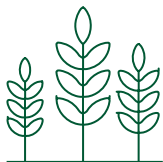
The effects of climate change, such as rising temperatures, changing rainfall patterns, and increasing frequency of extreme weather events, pose a severe threat to Indian agriculture.

Solution:

- Promote farming practices that increase resilience to climate change, such as intercropping, mulching, and mixed farming.
- Develop better early warning systems for extreme weather events and pest outbreaks to help farmers prepare and respond effectively.

2.10. Government policies and reforms

There are inconsistencies and delays in the implementation of government agricultural policies. Though several schemes have been launched, like the Minimum Support Price (MSP) system and PM-KISAN, the execution often lacks efficiency and reach.

**Solution:**

- Streamlining of policies related to land use, market access, and farm inputs to reduce bureaucracy and make it easier for farmers to navigate.
- Implement reforms in agricultural marketing, such as those suggested by various committees, to give farmers greater freedom to sell their produce.

2.11. Labour shortage

With increasing rural-to-urban migration, especially among younger populations, agriculture is facing labour shortages. Agriculture still employs around 46.1% of India's workforce, according to the Periodic Labour Force Survey (PLFS) 2023-24. However, this share has been declining over the years, reflecting a shift of labor from agriculture to non-farm sectors. The participation of youth (aged 15-29 years) in agriculture has decreased by around 10% over the past two decades. As per the Agriculture Census 2015-16, youth participation in agricultural work dropped from 42.6% in 2001 to 31.6% in 2016.

Solution:

- Promote the use of farm machinery to reduce dependency on labour.
- Create alternative employment

opportunities in rural areas to reduce migration pressures.

2.12. Agro-Ecological sustainability

Over-exploitation of natural resources like groundwater, deforestation, and loss of biodiversity are reducing the sustainability of agricultural practices in India.

Solutions

- Promote organic farming and Zero Budget Natural Farming (ZBNF) to reduce chemical usage, improve soil health, and enhance biodiversity.
- Use water-efficient techniques like drip irrigation, rainwater harvesting, and sustainable soil practices like mulching and contour ploughing.
- Encourage growing diverse crops (like millets, pulses) and integrating trees into farms to improve soil fertility, carbon sequestration, and resilience.
- Minimize chemical pesticides by adopting biological pest.

Tackling these challenges will require coordinated efforts from the government, private sector, and farming communities, alongside a focus on sustainable agricultural practices and modern technologies.



03

Impact of Climate Change on Agriculture



Present Status - Current impact of Climate Change on Agriculture

Agriculture has long been a cornerstone of the Indian economy, contributing significantly to GDP, employment, rural livelihoods, and food security. The growth and sustainability of the sector are vital for the nation's economic and social well-being. Overcoming challenges like low productivity, climate-related risks, and rural distress, while promoting sustainable agricultural practices, is essential for safeguarding the future of millions of farmers and the broader economy.

Indian agriculture faces heightened vulnerability due to climate change, with unpredictable monsoons, droughts, and floods leading to sharp declines in crop yields. These climate-induced challenges threaten the stability of the sector, with far-reaching economic, social, and environmental implications for the country.

The effects of Climate Change on Agriculture are observed in the following ways:

3.1. Change in Cropping Patterns

Rising temperatures, along with shifts in rainfall patterns—such as delayed or early onset and increased rainfall intensity—are significantly disrupting the sowing dynamics of major food crops in India. These changing climatic conditions have altered the growing seasons, making traditional crop varieties less suitable in some regions. This shift not only poses challenges for agricultural productivity but also threatens the country's food security.

3.2. Decline in Crop Yields

The crop yields are negatively affected due to erratic weather patterns like unseasonal rains, floods, and droughts. Rainfall during the harvest season, higher temperatures during critical growth stages declines the yield of major crops.

3.3. Water Stress

Rainfed agriculture occupies about 51% of country's Net Sown Area and accounts for nearly 40% of the total food production. Agriculture in India relies heavily on monsoon rains. Unpredictable rainfall patterns disrupt the water availability in their critical growing periods thus affecting the yield negatively. Further, excessive Groundwater exploitation, its extraction and resulting depletion will have long term effects on the irrigation water availability scenario of the country in the near term especially in water-scarce regions.

3.4. Soil Degradation

Climate change is causing soil degradation through extreme weather events like droughts, floods, landslides that damage soil and agricultural lands. Soil erosion and its degradation reduce the soil fertility and farmers cannot maintain productivity over the long term, increasing their reliance on external fertility inputs like fertilizers, thus also increasing their costs of production.

3.5. Pest and Disease Outbreaks

Warmer climates and altered humidity levels create favourable conditions for the spread of pests and plant diseases. This further threatens agricultural productivity and increases the need for

pesticide use, and this causes negative environmental and health issues. Pests and diseases can spread to new areas that were previously inhabitable. Warmer winters can help pests and pathogens survive over winter as also help in their multiplication. Climate change can reduce the effectiveness of biological control, especially natural enemies.

3.6. Impact on Livestock

Heat stress due to rising temperatures can decrease milk and meat production, reproductive efficiency, and animal health. Climate change can increase the prevalence of diseases and parasites that affect livestock. Water scarcity also leads to competition among livestock for the same resource.

3.7. Rural Livelihoods and Migration

As agriculture becomes less predictable, many rural communities face economic uncertainty. They will tend to move away from agriculture and this can lead to increased rural-to-urban migration as people seek alternative livelihoods. Small and Marginal Farmers will be particularly vulnerable. Migration will also reduce the labour availability for Agriculture.

3.8. Food Security and Prices

Low crop production due to climate change leads to food insecurity besides reducing the household income from field or cash crops of the farmer. This has social impact with wider ramifications like worsening the rural poverty and eroding cultural activities of the communities. Climate - induced food-grain disruptions thus will also aid in inflation.

3.9. Potential Challenges to tackling Climate Change

The challenges of climate change are vast, interconnected, and complex. From rising temperatures and shifting weather patterns to resource scarcity, health risks, and social disruption, the effects of climate change touch every aspect of human life. Addressing these challenges require global cooperation, innovative technologies, and sustainable policies. The major potential challenges to tackling climate change are as under:

- Lack of global consensus
- Economic and financial barriers- High cost of transition
- Slow pace of technological development
- Uncertainty and risk of emerging technologies
- Social and behavioral challenges
- Environmental and ecological challenges

Climate Finance is by far the most important challenge to tackle climate change. The challenge of climate finance in addressing climate change is profound and multifaceted. The obstacles to climate finance are insufficient funding, unequal distribution and the complexity of financial mechanisms. There is a need to increase climate finance for adaptation and more vulnerable countries. There also should be stronger mechanism to ensure accountability, transparency, and impact assessment.

In India 03 funds are available to tackle climate change in project mode – Adaptation Fund (AF), National Adaptation Fund for Climate Change (NAFCC) and the Green Climate



Fund (GCF). NABARD is the National Implementing Entity (NIE) for AF & NAFCC and it is the Direct Access Entity (DAE) for GCF. Greater coordination among governments, international financial institutions, the private sector, and civil society is needed for a just transition to a low-carbon, climate-resilient world.

3.10. Govt Initiatives to address the Climate Impact

The Government of India (GoI) has recognized climate change as a critical issue and has launched various initiatives aimed at mitigating its impact. India's climate actions are shaped by its commitments under international frameworks such as the Paris Agreement, as well as national policies and strategies focused on reducing emissions, transitioning to renewable energy, promoting sustainable development, and enhancing resilience to climate change. Below are some key government initiatives to mitigate climate impacts:

3.10.1. National Action Plan on Climate Change (NAPCC)

Launched in 2008, the NAPCC is India's overarching framework for addressing climate change, consisting of 8 key missions aimed at reducing carbon emissions and promoting sustainability across sectors. These include:

- **National Solar Mission (NSM):** Aiming to increase solar energy capacity to 100 GW by 2022 (revised to 500 GW by 2030), and subsequently reduce dependence on fossil fuels.
- **National Mission for Enhanced Energy Efficiency (NMEEE):** Promotes energy efficiency in industry, buildings, and appliances

to reduce emissions and energy consumption.

- **National Water Mission:** Focuses on water conservation, improved efficiency in water use, and addressing water scarcity issues.
- **National Mission on Sustainable Agriculture:** Encourages sustainable agricultural practices that increase productivity while minimizing emissions.
- **National Mission for Sustainable Habitat:** Promotes energy-efficient buildings, urban planning, and transportation systems.
- **National Mission on Sustainable Cities:** Encourages green building standards, energy-efficient transport, and urban adaptation measures.
- **National Mission on Green India:** Aims to increase forest cover and promote biodiversity conservation and carbon sequestration.

National Mission on Strategic Knowledge for Climate Change: Enhances scientific research and data collection related to climate change and its impacts on India.

3.10.2. India's Renewable Energy Push

- India has set ambitious targets for renewable energy deployment, aiming to achieve 500 GW of non-fossil fuel-based energy by 2030. This includes:
- The National Solar Mission, aiming for a 500 GW solar capacity.
- Wind Power: India aims to reach 60 GW of wind energy by 2030, with significant investments in offshore wind.

- Bioenergy and Hydropower: India is also expanding biomass energy projects and hydropower capacity.
- International Solar Alliance (ISA): India has played a pivotal role in founding the ISA, an alliance of solar-rich countries aimed at promoting solar energy.

3.10.3. Perform, Achieve and Trade (PAT) Scheme

A part of the National Mission for Enhanced Energy Efficiency, the PAT Scheme incentivizes energy-intensive industries (like cement, steel, and textiles) to reduce their energy consumption. The scheme uses a market-based trading mechanism, allowing companies that surpass their energy-saving targets to sell their surplus savings to others that fall short.

3.10.4. Carbon Credit Trading Scheme (CCTS)

India is on the verge of creating a carbon market. The move will set emissions targets for emitters and allow overachievers to sell their excess emission cuts, while underachievers will have to purchase them to meet their goals. The market will be created once the Carbon Credit Trading Scheme (CCTS), notified in June 2023, comes in force.

3.10.5. Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) Scheme

To reduce emissions from the transportation sector, the FAME Scheme (launched in 2015) aims to promote the adoption of electric and hybrid vehicles. This scheme provides subsidies for the purchase of electric vehicles

(EVs), charging infrastructure, and the manufacturing of EVs in India.

3.10.6. National Electric Mobility Mission Plan (NEMMP)

NEMMP is an ambitious government initiative to promote the use of electric vehicles in India. The goal is to have 30% of all vehicles in India be electric by 2030. This initiative supports the development of EVs, charging infrastructure, and research in battery technology.

3.10.7. State Action Plans on Climate Change

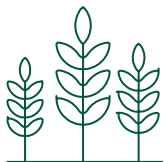
In addition to national-level policies, each state in India is developing its own State Action Plan on Climate Change (SAPCC), tailored to local vulnerabilities and challenges. These plans focus on adaptation and mitigation strategies specific to each state's needs, covering areas such as agriculture, water, forestry, and infrastructure.

3.10.8. Swachh Bharat Mission

Launched in 2014, the Swachh Bharat Mission (Clean India Mission) aims to promote cleanliness, waste management, and sanitation. This initiative is linked to climate mitigation by promoting solid waste management and the recycling of organic waste into biogas, thus reducing methane emissions from landfills.

3.10.9. Pradhan Mantri Ujjwala Yojana (PMUY)

Launched in 2016, PMUY aims to provide LPG connections to households below the poverty line, thereby reducing the use of firewood and other polluting fuels. By reducing reliance on biomass, PMUY helps cut down on deforestation and



air pollution, mitigating both climate change and public health impacts.

3.10.10. Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

Atal Mission for Rejuvenation and Urban Transformation (AMRUT) was launched on 25th June 2015 in selected 500 cities and towns across the country. The Mission focuses on development of basic infrastructure, in the selected cities and towns, in the sectors of water supply; sewerage and septage management; storm water drainage; green spaces and parks; and non-motorized urban transport. A set of Urban Reforms and Capacity Building have been included in the Mission.

3.10.11. Mission LiFE (Lifestyle for Environment)

Launched by Prime Minister Modi in 2022, Mission LiFE aims to encourage sustainable lifestyle choices among citizens to mitigate climate change. The mission emphasizes individual actions like reducing waste, conserving energy, and adopting sustainable practices in daily life.

The mission integrates behavioral change on a mass scale, encouraging eco-friendly lifestyles and choices in food, travel, and consumption.

3.10.12. Niti Aayog's Sustainable Development Goals (SDGs) and Climate Initiatives

Niti Aayog, India's policy think tank, works closely with states and sectors to achieve Sustainable Development Goals (SDGs) with a strong emphasis on climate change mitigation. It collaborates on the Sustainable Development Agenda,

focusing on promoting sustainable practices across energy, agriculture, water management, and infrastructure.

3.10.13. Green Building Codes and Energy-Efficient Housing

The Bureau of Energy Efficiency (BEE) has developed the Energy Conservation Building Code (ECBC), which sets standards for energy efficiency in commercial buildings. The government also promotes green building practices, encouraging developers to integrate sustainable designs, renewable energy, and water-efficient technologies in new buildings.

3.10.14. PM KUSUM

The PM KUSUM Scheme (Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan) is a key government initiative aimed at promoting sustainable energy use in agriculture while improving farmers' incomes. Launched in 2019, the scheme focuses on providing solar energy solutions to farmers, primarily through the installation of solar pumps for irrigation and the setting up of solar power plants on agricultural land.

3.10.15. PM Surya Ghar Yojana

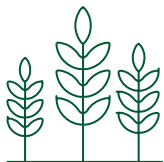
The PM Surya Ghar Yojana (also known as the Pradhan Mantri Solar Rooftop Yojana) is a government initiative aimed at promoting the installation of solar rooftop systems on residential, commercial, and institutional buildings across India. This scheme encourages individuals, households, and institutions to adopt solar power by providing financial incentives and subsidies. The goal is to generate clean, renewable energy at the local level, contributing to energy independence and

environmental sustainability.

3.10.16. National Green Hydrogen Mission

The National Green Hydrogen Mission is a key priority for India in 2024, as announced by the finance minister. The government plans to incentivize

the production and export of green hydrogen, as well as investment in hydrogen-powered infrastructure. Green hydrogen is seen as a key component in decarbonizing hard-to-abate sectors such as industry, transportation, and heavy logistic.





04

Navigating Agricultural Policies: An Overview of Major Schemes



Agricultural policies in India play a critical role in shaping the sector's growth and development, addressing challenges such as food security, rural poverty, and environmental sustainability. Over the years, the government has launched several schemes aimed at improving agricultural productivity, enhancing farmers' incomes, and promoting sustainable practices. These policies and schemes are designed to provide financial assistance, technological support, capacity building, and market access to farmers, while also focusing on infrastructure development and value-added services. In this context, navigating the landscape of India's major agricultural schemes is essential to understanding how these initiatives work together to transform the sector. This overview provides a closer look at some of the key government schemes that have made significant strides in advancing agricultural practices, from crop insurance and credit access to promoting innovation in agribusinesses and fisheries.

4.1. Agriculture Infrastructure Fund (AIF)

The Agriculture Infrastructure Fund (AIF), launched by the Government of India in July 2020, aims to enhance agricultural infrastructure across the country with a total corpus of ₹1 lakh crore. This scheme is designed to provide medium- to long-term debt financing for post-harvest management and community farming projects, benefiting a wide range of stakeholders, including farmers, Primary Agricultural Cooperative Societies (PACS), Farmers Producer Organizations (FPOs), agricultural entrepreneurs, and start-ups.

The scheme is operational from 2020-21 to 2032-33, with loan disbursements completing by 2025-26. The loans offered under the scheme come with a 7-year repayment period, including a 2-year moratorium. Additionally, loans up to ₹2 crore receive 3% interest subvention for up to 7 years, and credit guarantee coverage is available under the CGTMSE scheme for loans up to ₹2 crore, with special provisions for FPOs under NABSanrakshan.

The scheme supports the creation and modernization of infrastructure in two major areas: post-harvest management and community farming assets. Eligible post-harvest projects include the establishment of warehouses, cold chains, sorting and grading units, ripening chambers, packaging units, and logistics facilities. It also supports the development of primary and secondary processing infrastructure, supply chain services, and waste management systems. In the area of community farming, the scheme promotes organic input production (such as vermicomposting), biogas plants, smart agriculture technologies (e.g., drones, AI, and IoT), and projects related to hydroponic farming, mushroom farming, vertical farming, and poly houses. Additionally, the scheme supports solar power plants, seed processing units, and custom hiring centers for farm machinery.

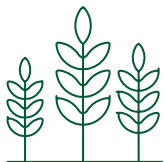
Entities are eligible for interest subvention on loans up to ₹2 crore per location, with the possibility of supporting multiple projects within the same location. Refinance support is also available through NABARD for eligible lending institutions, including cooperative banks and RRBs. Moreover, the scheme allows convergence with other government schemes, enabling access to additional grants and subsidies, such as those available under PMKSY, PM-KUSUM, RKVY, and others. This initiative is expected to significantly improve agricultural infrastructure, enhance post-harvest management, and foster sustainable farming practices, ultimately contributing to the growth of India's agricultural.

4.2 Pradhan Mantri Fasal Bima Yojana (PMFBY)

Pradhan Mantri Fasal Bima Yojana (PMFBY) is a flagship crop insurance scheme launched by Government of India in February 2016. It aims at providing a comprehensive insurance cover against failure of the crop thus helping in stabilizing the income of the farmers and encourage them for adoption of innovative practices. The Scheme covers all Food & Oilseeds crops and Annual Commercial/Horticultural Crops for which past yield data is available and grown during the notified season, in a Notified Area and for which yield estimation at the Notified Area level will be available based on requisite number of Crop Cutting Experiments (CCEs) being a part of the General Crop Estimation Survey (GCES). The scheme is voluntary for loanee/non loanee farmer obtaining Crop Loan /KCC account for notified crops.

The Maximum Premium payable by the farmers will be 2% for all Kharif Food & Oilseeds crops, 1.5% for Rabi Food & Oilseeds crops and 5% for Annual Commercial/Horticultural Crops. The difference between premium and the rate of Insurance charges payable by farmers shall be shared equally by the Centre and State.

The scheme will be implemented through a multi-agency framework by selected insurance companies under the overall guidance & control of the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), Ministry of Agriculture & Farmers Welfare (MoA&FW), Government of India (GOI) and the concerned State in co-



ordination with various other agencies. DAC&FW has designated/empaneled Agriculture Insurance Company of India (AIC) and some private insurance companies presently to participate in the Government sponsored agriculture /crop insurance schemes. The Scheme will be implemented on an 'Area Approach Basis'. The unit of insurance will be Village/Village Panchayat level for major crops and for other crops it may be a unit of size above the level of Village/Village Panchayat.

The scheme covers a wide range of risks from pre-sowing to post-harvest losses. This includes yield losses due to adverse weather conditions, localized calamities like hailstorms, landslides, and inundation as well as post-harvest losses due to unseasonal rains. Risks and Losses arising out of War & kindred perils, nuclear risks, riots, malicious damage, theft, act of enmity, grazed and/or destroyed by domestic and/or wild animals are excluded.

4.3 Central Sector Scheme on Formation & Promotion of 10000 FPOs:

The Government of India has launched the Central Sector Scheme for "Formation and Promotion of 10,000 Farmer Producer Organizations (FPOs)" in the year 2020 with a total budgetary outlay of ₹6865 Crores. The scheme will enable farmers to enhance their bargaining power, leverage economies of scale, reduction in cost of production and enhancing farmers' incomes through aggregation of their agricultural produce, thus playing a major role towards sustainable incomes.

Formation and promotion of FPO under the scheme is based on Produce Cluster Area. While adopting cluster-based approach for produce or produce mix, formation of FPOs will also focus on "One District One Product" approach for development of product specialization, in case the focused agriculture produce has been declared for that district, whereby FPOs will be encouraged for promoting processing, branding, marketing and export of the product for better value realization.

FPO with a minimum farmer-members' size of 300 shall be eligible under the scheme in plains, while in North-Eastern and Hilly areas* (including such other areas of UTs), size of 100 shall be eligible. However, efforts will be made to achieve an average membership size of 500 farmers in plain areas and 200 farmers in Hilly and North-Eastern regions to make them sizable for economic sustainability and profitability. Handholding, capacity building and nurturing services to FPOs will be provided by identified Cluster Based Business Organization (CBBOs).

Under the said scheme, FPOs being provided financial assistance upto ₹18.00 lakh per FPO for a period of 03 years. In addition to this, provision has been made for matching equity grant upto ₹2,000 per farmer member of FPO with a limit of ₹15.00 lakh per FPO. To ensure financial sustainability, a credit guarantee facility upto ₹2 crore of project loan per FPO from eligible lending institution has been created under the scheme. Further, ₹25 Lakhs are given to CBBOs for hand holding each FPO over a period of five years.

4.4 Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme

The PM-KISAN scheme, launched in February 2019 (effective from 01.12.2018), is a Central Sector initiative fully funded by the Government of India and implemented by the Ministry of Agriculture and Farmers' Welfare. Its primary aim is to assist farmers in procuring essential inputs to maintain proper crop health and achieve optimal yields, thereby ensuring a sustainable farm income at the end of each crop cycle. Under this scheme, eligible farmers receive annual financial assistance of ₹6,000, distributed in three equal instalments of ₹2,000 every four months, directly transferred to their bank accounts through the Direct Benefit Transfer (DBT) system.

Beneficiaries of the PM-KISAN scheme includes farmer families that possess cultivable land. Specifically, it targets Small and Marginal Farmers (SMFs), defined as those who own up to 2 hectares of cultivable land according to the land records of their respective State or Union Territory. The identification of eligible beneficiary farmer families is entirely the responsibility of the State and Union Territory governments.

The PM-KISAN scheme has specific exclusion categories that disqualify certain beneficiaries with higher economic status from receiving benefits. These exclusions include all institutional landholders and farmer families with members who hold or have held constitutional posts, such as former and current Ministers, Members of Parliament, and Mayors of Municipal Corporations. Additionally, serving or retired officers and employees of Central

and State Government ministries, departments, and their field units, as well as regular employees of local bodies (excluding Multi-Tasking Staff/Class IV/ Group D employees), are not eligible. Superannuated or retired pensioners receiving a monthly pension of ₹10,000 or more are also excluded, along with individuals who paid income tax in the last assessment year. Furthermore, professionals such as doctors, engineers, lawyers, chartered accountants, and architects who are registered with professional bodies and practice their professions are ineligible for the scheme.

4.5 Mission for Integrated Development of Horticulture (MIDH)

It is a Centrally Sponsored Scheme for the holistic growth of the horticulture sector covering fruits, vegetables, root & tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, and cocoa. MIDH consists of 5 schemes on Horticulture viz. (i) National Horticulture Mission (NHM), (ii) Horticulture Mission for North East and Himalayan States (HMNEH), (iii) National Horticulture Board (NHB), (iv) Coconut Development Board (CDB), (v) Central Institute of Horticulture (CIH), Nagaland.

Under MIDH, Government of India (GOI) contributes 60% of total outlay for developmental programmes in all the States except States in Northeast and Himalayas, 40% share is contributed by State Governments. In the case of Northeastern and Himalayan States, GOI contributes 90%. In case of National Horticulture Board (NHB), Coconut Development Board (CDB), Central Institute for Horticulture (CIH), Nagaland and the National Level Agencies (NLA), GOI contributes 100%.



4.6 National Food Security Mission (NFSM)

NFSM was launched in 2007-08 to increase the production of rice, wheat and pulses by 10, 8 and 2 million tonnes, respectively by the end of the 11 Plan through area expansion and productivity enhancement; restoring soil fertility and productivity; creating employment opportunities and enhancing the farm level economy. The Mission was continued during the 12 Plan with new targets of additional production of 25 million tonnes of foodgrains comprising of 10 million tonnes of rice, 8 million tonnes of wheat, 4 million tonnes of pulses and 3 million tonnes of coarse cereals by the end of the 12th Plan. Beyond the 12th Plan (2017-18 to 2019-20), it was decided to continue the programme with new targets to achieve 13 million tonnes of additional foodgrains production comprising of rice 5 million tonnes, wheat 3 million tonnes, pulses 3 million tonnes and nutri cum coarse cereals 2 million tonnes by 2019-20 with an additional objective to enhance post-harvest value addition at farm gate for better price realization to farmers through efficient market linkages.

The strategy of the Mission is to promote and extend improved technologies of package of practices of crops through various types of demonstrations FLDs, Cluster FLDs, distribution of HYVs/ Hybrid seeds, production of seeds, distribution of micronutrients, soil ameliorants, bio fertilizers, plant protection chemicals, bio pesticides, improved resource management tools, efficient water application devices, capacity building of farmers and local initiatives etc. From the year, 2020-21, primary processing units small/ storage/ bins flexibility

interventions has been added as per local requirement.

Currently, NFSM is being implemented in identified districts of 28 states & 2 Union Territories viz Jammu & Kashmir and Ladakh in the country. NFSM Rice in 193 districts of 24 states & UT of Jammu & Kashmir, NFSM Wheat in 124 districts of 10 states & 2 UTs viz. Jammu & Kashmir and Ladakh, NFSM Coarse Cereals in 269 districts of 26 states & 2 UTs viz. Jammu & Kashmir and Ladakh. NFSM Pulses and NFSM Nutri Cereals are being implemented in all the districts of 28 states & 2 UTs viz Jammu & Kashmir and Ladakh.

4.7 Rashtriya Krishi Vikas Yojana (RKVY)

It was launched as a flagship scheme of the Department of Agriculture & Farmers' Welfare (DA&FW) in 2007-2008 to incentivize States to draw up comprehensive agriculture development plans, taking into account agro-climatic conditions, natural resources and technology for ensuring more inclusive and integrated development of agriculture and allied sectors. The scheme was implemented as a State Plan Scheme till the end of the financial year 2013-14 and is being implemented as a CSS (State Plan) scheme thereafter. In accordance with the directions of the Ministry of Finance, the funding pattern of the scheme from 2015-16 onwards has been altered from 100% funding by the Central Government to in the ratio of 60:40 between the Centre and States and 90:10 for North-Eastern and Himalayan States. However, funding pattern to UTs continued to be as 100% by the Central Government.

RKVY has been re-structured as RKVY

Cafeteria Scheme from 2022-23 onwards merging some schemes of Department of Agriculture & Farmers Welfare which includes Soil Health & Fertility (SHF), Rainfed Area Development (RAD), Paramparagat Krishi Vikas Yojana (PKVY), Per Drop More Crop (PDMC), Agriculture Mechanization (including Promotion of Agricultural Mechanization and Management of Crop Residue (CRM), Agro Forestry and Crop Diversification Programme. RKVY cafeteria scheme has 3 components viz. Annual Action Plan (AAP), Detailed Project Report (DPR) and Administration, Monitoring and Evaluation including startup.

The objectives of the scheme are multifaceted, aimed at strengthening farmers' efforts through the development of pre- and post-harvest agricultural infrastructure. This infrastructure enhances access to quality inputs, storage, and market facilities, enabling farmers to make informed choices. The scheme also provides states with the autonomy and flexibility to plan and implement initiatives that cater to local farmers' needs. Additionally, it promotes value chain addition linked to production models that increase farmers' income while encouraging higher production and productivity. To further support farmers, the scheme focuses on mitigating risks through additional income-generating activities such as integrated farming, mushroom cultivation, beekeeping, aromatic plant cultivation, and floriculture. Lastly, it seeks to empower youth by fostering skill development, innovation, and agri-preneurship based business models.

4.8 Agri Clinic and Agri Business Centre (ACABC)

The Ministry of Agriculture and Farmers Welfare, in collaboration with NABARD, has launched an innovative initiative aimed at empowering agriculture graduates and professionals to improve farming practices across India. This program provides an opportunity for individuals to set up their own Agri Clinic or Agri Business Centres to offer expert extension services to farmers. The initiative targets Agriculture Graduates and those with degrees in related fields such as Horticulture, Sericulture, Dairy, Poultry Farming, Veterinary Sciences, Fisheries, and more.

The Government offers free start-up training to Agriculture graduates, covering entrepreneurship, business management, and agricultural consultancy. The 45-day training course, coordinated by MANAGE and supported by the SFAC, is designed to equip participants with the necessary skills in crop management, post-harvest processes, and other key areas. Upon successful completion, graduates can apply for special start-up loans to establish their Agri Clinic or Agri Business Centre.

To help entrepreneurs establish their businesses, the Government provides bank loans with attractive terms. The loan ceiling is ₹.20 lakh for individual projects and up to ₹.25 lakh for highly successful projects. For group projects, loans can go up to ₹.100 lakh. The loans come with flexible repayment terms, including a moratorium period of up to 2 years. Interest rates and other loan conditions are subject to the bank's policies, in line with RBI guidelines. Additionally, margin money assistance is available for eligible



applicants to help support the financial aspects of their ventures.

This initiative not only creates entrepreneurial opportunities for graduates but also aims to improve agricultural practices by providing professional guidance and consultancy to farmers. By setting up Agri Clinic and Agri Business Centres, participants contribute to the modernization of agriculture and help farmers enhance their productivity, leading to sustainable growth in the sector.

4.9 PM-Formalization of Micro Food Processing Enterprises Scheme (FME)

The PM-Formalization of Micro Food Processing Enterprises Scheme (FME) is a flagship initiative launched by the Government of India under the Atmanirbhar Bharat Abhiyan to promote and formalize the micro food processing sector. The scheme aims to support small food processing units, especially those in the unorganized sector, by providing them with financial assistance, training, and capacity-building support.

Ministry of Food Processing Industry (MoFPI) has launched the Pradhan Mantri Formalisation of Micro food processing Enterprises (PMFME) scheme under the Aatmanirbhar Bharat Abhiyan with the aim to enhance the competitiveness of existing individual micro-enterprises in the unorganized segment of the food processing industry and promote formalization of the sector.

The scheme envisages an outlay of ₹. 10,000 crore over a period of five years from 2020-21 to 2024-25. The expenditure under the scheme would to be shared in 60:40 ratio between Central and State

Governments, in 90:10 ratio with North-Eastern and Himalayan States, 60:40 ratio with UTs with legislature and 100% by the Center for other UTs.

The PMFME scheme support in terms of:

- Food processing entrepreneurs through credit-linked capital subsidy @35% of the eligible project cost with a maximum ceiling of ₹.10 lakh per unit.
- Seed capital @ ₹ 40,000/- per SHG member for working capital and purchase of small tools.
- Credit linked grant of 35% for capital investment to FPOs/ SHGs/ producer cooperatives.
- Support for marketing & branding to micro-units.
- Support for common infrastructure and handholding support to SHGs, FPOs and Producer Cooperatives.
- Providing Capacity building and training support to increase the capabilities of the enterprises and upgradation of skills of workers.

Under the scheme, 2,00,000 micro food processing units will be directly assisted with credit linked subsidy. Adequate supportive common infrastructure and institutional architecture will be supported to accelerate growth of the sector.

4.10 Pradhan Mantri Matsya Sampada Yojana (PMMSY)

The scheme “Pradhan Mantri Matsya Sampada Yojana (PMMSY)” was launched by the Department of Fisheries; Ministry of Fisheries, Animal Husbandry, and

Dairying; to bring about ecologically healthy, economically viable, and socially inclusive development of the fisheries sector of India. PMMSY shall bring about Blue Revolution through sustainable and responsible development of the fisheries sector in India at a total investment of ₹20,050 crore for holistic development of the fisheries sector including the welfare of fishers. PMMSY is implemented in all the States and Union Territories for a period of five years from FY 2020-21 to FY 2024-25.

The PMMSY provides financial assistance to Fishers, Fish farmers, Fish workers, Fish vendors, SCs / STs / Women / Differently abled persons, Self Help Groups (SHGs)/ Joint Liability Groups (JLGs) in fisheries sector, Fisheries cooperatives, Fisheries Federations, Entrepreneurs and private firms and Fish Farmers Producer Organizations/Companies (FFPOs/Cs) for taking up fisheries developmental activities.

The beneficiary oriented activities supported under the PMMSY include development of hatcheries, construction of Grow-out and rearing ponds, input cost for culture activities, Re-circulatory Aquaculture System (RAS), cage culture in reservoirs, open sea cages, seaweed culture, bivalve culture, construction of raceways for trout farming, ornamental and recreational fisheries, support for acquisition of deep sea fishing vessels, up-gradation of existing fishing vessels, support for providing safety kits for fishermen of traditional and motorized fishing vessels, providing boats and nets for traditional fishermen, support for purchase of communication/ Tracking and PFZ devices. The PMMSY also supports for construction of cold storage, ice plants, fish meal plants/

mills, construction of fish retail markets, kiosks, fish value added enterprises units, e-platform for e-trading and e-marketing, establishment of disease diagnostic and quality testing labs, insurance to fishermen and fishing vessels, livelihood and nutritional supports for socio economically backward active traditional fishers etc.

Funding Pattern

A. Central Sector Scheme (CS)

- The entire project/unit cost will be borne by the Central government (i.e. 100% central funding).
- Wherever direct beneficiary oriented i.e. individual/group activities are undertaken by the entities of central government including National Fisheries Development Board (NFDB), the central assistance will be up to 40% of the unit/project cost for General category and 60% for SC/ST/ Women category.

B. Centrally Sponsored Scheme (CSS)

For the non-beneficiary orientated sub-components/activities under CSS component to be implemented by the States/UTs, the entire project/unit cost will be shared between Centre and State as detailed below:

- North-Eastern & Himalayan States: 90% Central share and 10% State share.
- Other States: 60% Central share and 40% State share. (c) Union Territories (with legislature and without legislature): 100% Central share.



05

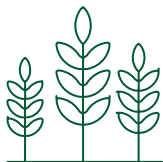
Unlocking Potential: The Role of Credit in Agricultural Development

Credit is a fundamental driver of agricultural development, playing a pivotal role in improving productivity, resilience, and income generation for farmers, especially in developing economies. In countries like India, where agriculture remains a key pillar of the economy, credit access is essential for addressing numerous challenges faced by farmers, such as low productivity, inadequate infrastructure, vulnerability to climate change, and access to markets. Credit enables farmers to adopt modern technologies, purchase essential inputs, invest in climate-smart practices, and enhance overall agricultural sustainability.

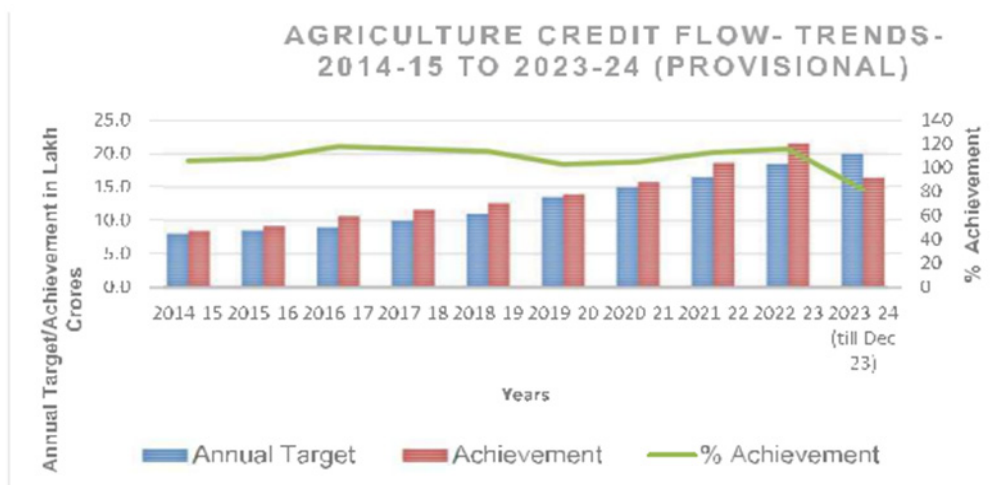
The Economic Survey states that the Gross Capital Formation (GCF) of the agriculture sector and the share of GCF in the agriculture and allied sectors as a percentage of Gross Value Added (GVA) has been growing steadily, mainly due to increased public investment. The GCF of the agriculture sector grew at the rate of 19.04 per cent in 2022-23, and the GCF as a percentage of GVA rose from 17.7 per cent in 2021-22 to 19.9 per cent in 2022-23, suggesting an increase in investment in agriculture. The average annual growth

in GCF from 2016-17 to 2022-23 was 9.70 percent. The Survey states that despite the increasing trend in GCF, there is a need to further boost agriculture investment, especially in the context of doubling farmers' income.

Institutional credit to agriculture reached an all-time high of ₹25.50 lakh crore during 2023-24 against the target of ₹20.00 lakh crore, reflecting the importance of financing in driving agricultural growth.



The credit flow trends since 2014-15 is shared below:



(Source: MoA&FW- Annual Report 2023-24)

5.1. GLC Flow: Ground Level Credit flow statistics.

I. Trend Analysis for Agriculture Credit (2018-2023)

(Source: Data submitted by banks on ENSURE Portal of NABARD - CPD data for the last 05 years (2018 to 2024))

a. Overall Trends

- **Targets vs. Achievements:** Over the past five years, there has been a consistent effort to meet agricultural credit targets. However, the achievement rates vary significantly across different states and years.
- **Yearly Comparisons:** Each year shows fluctuations in both targets and achievements, reflecting changes in agricultural policies, economic conditions, and other factors.

b. State-wise Analysis

- **Top Performers:** States like Maharashtra, Andhra Pradesh, and Tamil Nadu consistently set high targets and achieve significant

disbursements, indicating robust agricultural credit systems.

- **Underperformers:** States such as Manipur and Nagaland often show significant gaps between targets and achievements, highlighting areas needing policy intervention or support.

c. Agency-wise Distribution

- **Commercial Banks:** These banks handle the largest share of agricultural credit, contributing significantly to both crop and term loans.
- **Co-operative Banks and Regional Rural Banks:** These institutions also play crucial roles, especially in rural and semi-urban areas, but their contributions vary significantly by state.

II. Regional Insights

- **Southern Region:** States like Andhra Pradesh, Telangana, and Tamil Nadu show high targets and achievements, indicating strong agricultural credit systems.
- **Northeastern Region:** Generally, shows lower targets and achievements, indicating smaller agricultural credit markets.

III. Ground Level Credit (GLC) flow for the fiscal year 2023-24.

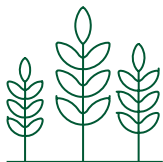
The data on Ground Level Credit (GLC) flow for the fiscal year 2023-24 provides a comprehensive overview of agricultural credit targets and achievements across various regions and banking agencies in India. Here is a detailed analysis:

- Northern Region:** The target for agricultural credit was set at ₹4,02,022.05 crore, with an achievement of ₹3,89,374.79 crore, meeting 96.9% of the target. Notable states like Haryana, Punjab, and Rajasthan showed strong performance, although some states like Ladakh fell short of their targets.
- Northeastern Region:** The target was set at ₹24,723.43 crore, but only ₹17,059.84 crore was achieved, reflecting about 69% of the target. This region generally showed a lower level of credit achievement, indicating possible challenges in reaching the targeted levels.
- Eastern Region:** The target of ₹2,54,789.81 crore saw an achievement of ₹2,27,576.27 crore, reaching approximately 89.3% of the goal. States like Odisha exceeded the target, while Bihar and West Bengal fell short.

- Central Region:** This region achieved ₹3,34,298.54 crore against a target of ₹3,55,782.36 crore, meeting about 94% of the target. Madhya Pradesh slightly exceeded its target, while Uttar Pradesh fell a little short.
- Western Region:** This region exceeded its target, achieving ₹3,12,530.07 crore against a target of ₹2,79,977.96 crore, reaching approximately 111.6% of the goal. Gujarat and Maharashtra performed particularly well, surpassing their targets.
- Southern Region:** The Southern Region significantly exceeded its target, achieving ₹12,67,795.74 crore against a target of ₹6,82,704.39 crore, which is about 185.7% of the goal. Tamil Nadu, Karnataka, and Andhra Pradesh made substantial contributions to this overachievement.

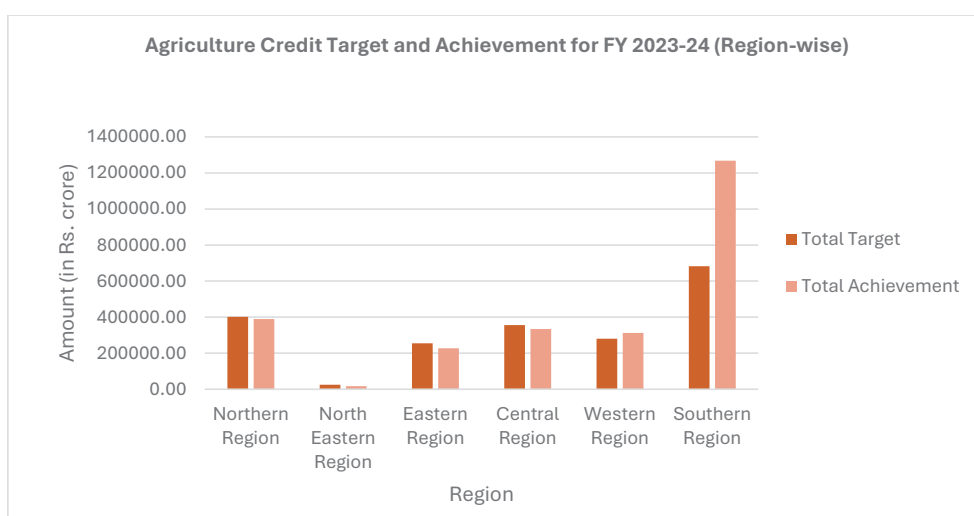
g. National Overview

- The national target for agriculture credit was set at ₹20,00,000 crore, with an actual achievement of ₹25,48,635.25 crore, which is approximately 127.4% of the target.
- The high achievement in certain states, particularly in the Southern Region (notably Tamil Nadu and Karnataka), drove the overall national overachievement.
- Southern states, especially Tamil Nadu (which achieved ₹4,52,384.10 crore), played a substantial role in surpassing the national target, accounting for a significant portion of the total credit disbursement.



h. Key Highlights

- **Top Achievers:** Tamil Nadu, Andhra Pradesh, Karnataka, and Maharashtra stand out for their high achievement rates relative to their targets.
- **Underachievers:** Northeastern states like Manipur, Meghalaya, and Tripura, as well as states like Ladakh and Chandigarh in the Northern Region, had lower achievement rates, indicating regional disparities.
- **Regional Disparities:** Southern and Western Regions outperformed other regions, while the Northeastern Region showed the lowest performance in meeting its credit target.



5.2. The Role of RBI's Priority Sector Lending (PSL) in Agricultural Credit

The Priority Sector Lending (PSL) initiative, set up by the Reserve Bank of India (RBI), plays a critical role in ensuring that key sectors of the economy, including agriculture, receive adequate financial support. The PSL framework mandates that banks allocate a certain percentage of their total lending to priority sectors, including agriculture, which is crucial for the development of rural India. Through this policy, the RBI aims to ensure that agricultural activities, which contribute significantly to the livelihoods of millions of people in the country, receive the necessary financial backing to promote

growth, productivity, and resilience.

PSL refers to loans that banks are required to extend to certain sectors that are considered critical for economic development but are often underserved by formal financial institutions. The sectors that fall under PSL include agriculture, micro, small and medium enterprises (MSMEs), education, housing, renewable energy, and others. The goal of PSL is to ensure that these sectors, which are often underserved or have limited access to credit, receive timely and affordable financing.

Under the PSL guidelines, banks are

mandated to lend:

- 40% of their adjusted net bank credit (ANBC) to priority sectors.
- Within this, 18% must be directed towards agriculture, ensuring that agriculture remains a significant focus of PSL.

This framework is designed to improve credit flow to agriculture, rural development, and other critical sectors while supporting inclusive economic growth.

The Role of PSL in Agricultural Credit

Agriculture in India is often faced with challenges such as undercapitalization, low productivity, climate vulnerabilities, and limited access to formal credit. In this context, the Priority Sector Lending framework helps address these challenges by providing easier access to finance for farmers and agricultural enterprises. PSL plays several key roles in enhancing the agricultural sector's development:

- a. Increasing credit flow to farmers
- b. Reducing dependency on informal credit
- c. Supporting climate-smart agriculture and infrastructure development
- d. Promoting rural economic development

5.3. Challenges in agriculture credit

Despite the positive impact of PSL on agricultural credit, several challenges remain:

a. Limited credit outreach :

While credit under PSL has been increasing, there is still a large segment of farmers, especially small and marginal farmers, who struggle to access formal credit. Informal lending practices remain prevalent in some regions, and the documentation requirements of formal credit institutions can be barriers for those without land titles or a formal credit history.

b. High interest rates in some cases :

Though PSL mandates low-interest loans for agriculture, some farmers still face challenges due to higher interest rates or limited access to lower-cost credit, particularly for more extensive or long-term investments.

c. Credit quality and over-indebtedness :

As the flow of credit increases, especially in underserved regions, there is a risk of over-indebtedness among farmers. Credit institutions need to ensure that credit is extended responsibly, with proper financial awareness and capacity-building programs for borrowers.

d. Strengthening the digital infrastructure :

The rise of digital lending platforms offers a promising opportunity to enhance credit access for farmers. However, there is still a need to strengthen digital infrastructure, improve financial literacy, and ensure that farmers have the necessary tools to use digital financial services effectively.



06

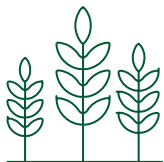
Driving Progress: The Role of Agricultural Research in India

Agriculture is possibly the oldest sector in the country to have research as its core segment. There are evidence of research and development in agriculture in the ancient as well medieval period of Indian history. Systematic research in the country started with the establishment of Imperial Council of Agricultural Research (1929) in Delhi, which is known today as Indian Council of Agricultural Research (ICAR). This is the apex body with its headquarters at New Delhi for coordinating, guiding, and managing research and education in agriculture including animal sciences and fisheries. The Council is an autonomous organization under the governance of Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. Established on 16 July 1929 as a registered society under the Societies Registration Act (1860) in pursuance of the report of the Royal Commission on Agriculture, ICAR now has 113 research institutes, 74 agricultural universities, 4 deemed-to-be-universities, 3 central universities and 731 Krishi Vigyan Kendras spread across the country. With these, ICAR leads one of the largest National Agricultural Research and Education System (NARES) in the world.

India has one of the largest agricultural research human resource capitals in the world with approximately 30,000 scientists and more than 100,000 technical & supporting personnel. ICAR footprints are also extended to the neighboring countries and several international, national and regional

research organizations and universities are engaged with ICAR in agricultural research and development. Additionally, private and non-Governmental organizations and farmers themselves have done significant agricultural research in their own field.

Agricultural research is indispensable for



improving farm productivity, advancing climate resilience, and achieving long-term sustainability. India's growing population—expected to reach 1.5 billion by 2030—requires increased food production, which can only be realized through innovation and improved agricultural practices.

India has a strong network of public and private research institutions dedicated to agricultural innovation. These institutions are at the forefront of agricultural research, addressing a broad spectrum of issues from crop breeding to climate adaptation.

6.1. Key roles of the agricultural research institutes

- a. Conduct research on crops and livestock, including field crops, horticulture, and animal production biotechnology.
- b. Develop technologies to increase crop yields and maintain natural resources.
- c. Disseminate knowledge to farming communities.
- d. Provide human resources and develop human resources for agricultural science.
- e. Provide policy guidance for agriculture.
- f. Serve as a center for academic excellence in agricultural science.
- g. Provide national leadership in agricultural research, education, extension, and technology assessment and transfer.

6.2. Key Agricultural Institutions working in areas of research in India

a) Indian Council of Agricultural Research (ICAR)

The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has enabled the country to increase the production of foodgrains by 6.21 times, horticultural crops by 11.53 times, fish by 21.61 times, milk by 13.01 times and eggs by 70.74 times since 1950-51 to 2021-22, thus making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

b) State Agricultural Universities (SAUs)

India has one of the largest and well-coordinated public agricultural research systems in the world. SAUs are major partners in the growth and development of agricultural education research under the NARES. State Agricultural Universities, (SAUs), in India, have adopted the U.S. land-grant model to meet its goals. They are autonomous organisations with state-wide responsibility for agricultural education, research and extension education. The first SAU in India was established at Pantnagar, Uttar Pradesh in 1961; there are currently 63 SAUs, three central agricultural universities, four deemed universities and four central

universities (with Agriculture Faculty) imparting agricultural education across the India. Furthermore, there are 892 agricultural colleges in India. State Agricultural Universities (SAUs) in India are autonomous organizations that play a significant role in agricultural production, rural development, and education.

c) Krishi Vigyan Kendra (KVK)

The first KVK was established in 1974 in Puducherry. The number of KVKs has risen to 731 with additional KVKs being established in newly created districts and some larger districts. The KVK scheme is completely financed by the Govt. of India and they are sanctioned to Agricultural Universities, ICAR institutes, related Government Departments and Non-Government Organizations (NGOs) working in the field of Agriculture. KVKs are an important part of the National Agricultural Research System (NARS), which aims to assess location-specific technology modules in agriculture and allied enterprises, through technology assessment, refinement and demonstrations. KVKs have been functioning as knowledge and resource centres of agricultural technology supporting the initiatives of the public, private and voluntary sector, for improving the agricultural economy of districts and linking the NARS with the extension systems and farmers. The mandate of KVK is technology assessment and demonstration for its application and capacity development.

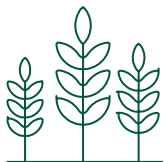
d) The National Innovations on Climate Resilient Agriculture (NiCRA)

NiCRA is a network project launched by the ICAR to develop climate-resilient agricultural practices in response to the

growing challenges posed by climate change. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management. The project consists of four components viz. Strategic Research, Technology Demonstration, Capacity Building and Sponsored/Competitive Grant. NiCRA works on a range of climate-smart practices, including the development of drought-tolerant and flood-resistant crop varieties, efficient water management techniques, and climate forecasting tools. It also aims to enhance soil health, promote sustainable farming practices, and improve farmers' livelihoods through better risk management strategies. The initiative operates through a network of pilot projects across various agro-climatic zones in India, with active involvement of farmers, agricultural scientists, and policymakers to ensure that research outcomes are directly applicable and scalable across different farming communities. NiCRA plays a crucial role in building resilience against climate variability and ensuring food security in the face of increasingly erratic weather patterns.

e) Regional Agriculture Research Stations

Agricultural research stations are critical for advancing practical, science-based solutions to local agricultural challenges. These stations focus on region-specific research to develop high-yielding, pest-resistant, and climate-resilient crop varieties. They also test and promote efficient farming practices, such as



water management techniques and sustainable soil health methods, tailored to the region's unique climate and soil conditions. By conducting field trials, these stations help bridge the gap between laboratory research and on-the-ground farming practices, ensuring that new technologies are accessible and effective for local farmers. They also provide essential training and extension services, offering farmers hands-on knowledge and tools to improve productivity and sustainability. In this way, agricultural research stations directly contribute to increasing food security, reducing the impact of climate change, and enhancing farmers' incomes by supporting innovation and knowledge transfer in agriculture.

f) International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

The ICRISAT, based in Patancheru, Telangana, plays a pivotal role in advancing agricultural research in India, particularly for crops grown in semi-arid and drought-prone regions. ICRISAT focuses on improving the productivity, sustainability, and resilience of crops such as pulses, pearl millet, sorghum, millet and groundnut, which are crucial for the food security and livelihoods of smallholder farmers in India. The institute's research encompasses a wide range of areas, including crop breeding, pest management, soil fertility, and water use efficiency. Through innovative breeding programs, ICRISAT has developed drought-tolerant, high-yielding, and disease-resistant varieties that are better suited to the challenging agro-climatic conditions of India. Additionally, ICRISAT's work on integrated farming systems,

conservation agriculture, and climate-smart agricultural practices helps farmers cope with the adverse impacts of climate change, such as erratic rainfall and rising temperatures. The institute also fosters partnerships with Indian agricultural research institutions, state governments, and farmers, facilitating the transfer of knowledge and technologies that enhance agricultural productivity while promoting sustainable and environmentally friendly farming practices.

6.3. Challenges in Agricultural Research and Implementation

While agricultural research in India has made great strides, several challenges continue to hinder its widespread impact:

- a. Insufficient Funding and Investment
 - Agricultural research in India, though critical, receives relatively low funding compared to other sectors. According to report, India spent only 0.35% of its agricultural GDP on research, which is far lower than the global average of 1-2%. This limits the scope and impact of long-term research projects.
- b. Limited Access to Technology for Smallholder Farmers
 - While technological innovations exist, many smallholder farmers lack access to the latest tools, seeds, and agricultural technologies. A significant portion of farmers in India are still unaware of the benefits of modern farming practices, such as precision agriculture or GM crops. Only around 60% of Indian farmers have access to agricultural extension services, which hinders the adoption

of new research-based solutions.

c. Regulatory and Policy Bottlenecks

- The regulatory landscape around GM crops, especially Bt cotton and genetically modified food crops, has been a source of debate in India. The introduction of GM crops like Bt Brinjal has been delayed due to concerns over environmental and health impacts. This regulatory caution limits the ability to implement certain research innovations on a national scale.

d. Climate Change and Unpredictable Weather

- While agricultural research has made significant strides in developing climate-resilient crops, the rapid pace of climate change poses a constant challenge.

Agricultural research plays an indispensable role in driving the progress of Indian agriculture. It is the engine behind the innovations that have transformed India from a food-deficient nation into a self-sufficient one. The

advancements in crop production, pest management, irrigation techniques, and climate-resilient agriculture have significantly improved food security and the livelihoods of farmers.

However, challenges remain, including inadequate funding, infrastructure gaps, and the slow adoption of new technologies. To fully unlock the potential of agricultural research, India needs to invest more in research and development, bridge the gap between research findings and practical application, and ensure that policies are conducive to agricultural innovation. By addressing these issues, India can continue to strengthen its agricultural sector and ensure food security for its growing population.

Agricultural research is not just about increasing productivity; it is about creating a sustainable and resilient agricultural system that can withstand the challenges of the future.



07

**Towards Sustainability and
innovative technology: Practices
for a Greener Agriculture**

7.1. Sustainable approach towards Agriculture

Agriculture is not just a means of sustenance, but the lifeblood of societies across the globe, shaping economies, cultures, and landscapes. However, as the world faces escalating environmental challenges ranging from climate change to soil degradation and water scarcity the need for sustainable agricultural practices has never been more urgent. Sustainable agriculture offers a pathway to meet the growing demand for food while preserving the delicate balance of our ecosystems. It is a vision that strives to create a harmonious relationship between human development and environmental stewardship, ensuring that current and future generations can thrive without compromising the health of the land, air, and water. By integrating principles such as resource conservation, biodiversity preservation, and climate resilience into farming systems, sustainable agriculture seeks to optimize productivity, enhance food security, and support rural livelihoods.

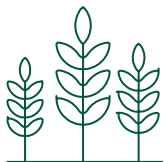
Sustainable agriculture seeks to balance the health of the environment, economic profitability, and social equity. It focuses on meeting present and future societal needs for food, fibre, and other resources, while ensuring the conservation of natural resources and the maintenance of ecosystem functions. At the core of sustainable agriculture is maximizing benefits through efficient and equitable resource use, ensuring food security, and empowering farmers to adapt to changing conditions.

Agriculture, being highly sensitive to climatic changes, relies heavily on climatic variables like temperature, precipitation, and humidity. These

variables significantly impact crop yields, livestock health, and fisheries. Climate change exacerbates these impacts by increasing the frequency and intensity of extreme weather events such as floods, droughts, and storms. Areas like rainfed regions, are particularly vulnerable due to fragile ecosystems, poverty, and high population density. The challenges farmers face includes soil degradation, water scarcity, and limited access to resources like credit, technology, and markets, which hinder their ability to cope with climate shocks.

Despite agriculture's declining contribution to India's GDP, it still accounts for a substantial share of employment and economic activity, especially in states like Punjab, Uttar Pradesh, and Haryana. However, agricultural productivity has stagnated due to factors like shrinking arable land, soil degradation, and competition for water resources. These challenges make it critical for India to adopt strategic, sustainable agricultural practices that ensure long-term food security, improve resilience to climate change, and foster socio-economic development. This approach involves rethinking policies and practices to enhance agricultural productivity, promote resource conservation, and address the vulnerabilities of marginalized farming communities.

The National Mission for Sustainable Agriculture (NMSA), part of the **National Action Plan on Climate Change (NAPCC)**, aims to make Indian agriculture resilient to climate change by focusing on dryland agriculture, biotechnology, access to information, and risk management. Agriculture is vital for India's food security, GDP,



and employment, but climate change presents significant challenges, including increased temperatures, erratic rainfall, and extreme weather events. The mission seeks to integrate modern research with traditional farming knowledge to enhance resilience, preserve agricultural heritage, and address ecological sustainability. Key focus areas include adaptation and mitigation strategies for crops, animal husbandry, and natural resource management. The impacts of climate change on agricultural production are projected to affect crop yields and irrigation needs, with vulnerable regions including coastal areas, Indo-Gangetic plains, and drought-prone regions. To safeguard food and livelihood security, the mission proposes long-term adaptation measures and policy re-orientation to ensure sustainable agricultural growth despite climate uncertainties.

7.1.1. Different Sustainable Agriculture practices in India

Sustainable agriculture practices in India encompass a range of approaches aimed at promoting environmental health, economic viability, and social equity.

- Organic farming focuses on avoiding synthetic agro-inputs like fertilizers and pesticides. Instead, it relies on organic materials such as crop residues, animal waste, and bio-pesticides to maintain soil fertility and manage pests sustainably.
- Natural farming, including zero-budget natural farming (ZBNF) and community-managed systems, advocates for the elimination of synthetic chemicals. It emphasizes the use of locally sourced inputs like cow dung, cow urine, and pulse flour, along with practices like mulching and intercropping to stimulate soil health and enhance biological activity.
- Precision farming uses technology to optimize the use of inputs such as water, nutrients, and pesticides, ensuring crops and soil receive exactly what they need for maximum productivity. This site-specific approach reduces waste and increases efficiency.
- Conservation agriculture aims to protect the ecosystem by minimizing soil disturbance through reduced tillage, maintaining soil mulch, and diversifying cropping systems through rotation and intercropping.
- Integrated pest management (IPM) employs a mix of cultural, biological, and chemical methods to keep pest populations below harmful levels, offering an environmentally friendly and cost-effective solution to pest control.
- Cover crops and mulching are techniques used to protect soil from erosion, improve organic matter, and retain moisture. Mulching, using organic or synthetic materials, enhances soil fertility and prevents runoff.
- Crop rotation and intercropping are practices used to improve soil health and reduce pest pressures by alternating or simultaneously growing different crops on the same land.
- Cover crops are grown to protect the soil, control erosion, add organic matter, supply nitrogen, and manage pests, rather than for harvest. They

can be rotated, intercropped, or planted in off-seasons. Mulching involves covering the soil with organic or synthetic materials to conserve moisture, reduce runoff, and improve soil fertility.

- Vermicomposting involves using earthworms to accelerate the decomposition of organic matter into high-quality compost, enhancing soil nutrient content.
- Biodynamic farming integrates cosmic rhythms with plant growth, using unique preparations like BD-500 to BD-700 to improve soil fertility and encourage biological activity.
- Integrated farming systems (IFS) combine multiple components like livestock, horticulture, and aquaculture to create a sustainable farming ecosystem that supports income, nutrition, and ecosystem health.
- Permaculture designs farming systems that mimic natural ecosystems, focusing on sustainability, resource conservation, and the provision of local needs. Its ethics include caring for the earth, people, and setting limits on consumption.

7.1.2. Barriers to the Adoption and Scaling Up of Sustainable Agricultural Practices

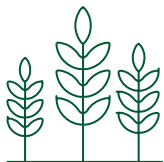
Despite the significant potential of sustainable agricultural practices (SAPS) to address environmental challenges, enhance food security, and ensure the long-term viability of farming, their widespread adoption faces several key barriers. These barriers are not only technical but also institutional, economic,

and social in nature. The following points highlight the main challenges that hinder the scaling up of SAPS:

- **Limited Knowledge and Training:** Farmers lack access to region-specific knowledge and training on sustainable practices, and current support services are insufficient to meet the scale of need.
- **Financial Risks and Lack of Safety Nets:** Transitioning to sustainable practices may lead to initial yield reductions, creating financial risks for farmers. The absence of safety nets or incentives discourages adoption, particularly among smallholder farmers.
- **Underdeveloped Markets:** There is a lack of well-established markets for sustainable agriculture inputs and products. Farmers struggle to access premium pricing due to limited demand and poor market linkages.
- **Challenges in Scaling Successful Models:** Replicating successful sustainable agriculture models is difficult due to local variations in agroclimatic conditions, resources, and infrastructure. (Ref-CEEW report)

7.2. Technological innovation in agriculture

Agriculture in India, a sector that sustains over half of the population, faces numerous challenges, including low productivity, climate variability, fragmented land holdings, and a high dependency on monsoon rainfall. However, technological advancements in recent years have played a crucial role in transforming agricultural practices and improving the livelihoods of farmers.



From mobile applications to drone technologies, India has witnessed the rise of innovative solutions that address these challenges.

a. Artificial Intelligence and Mobile Applications for Crop Management

A notable technological breakthrough in agriculture is the use of Artificial Intelligence (AI), which is helping farmers make data-driven decisions to improve crop health and yields. One of the most significant developments in this field is the AI-DISC (Artificial Intelligence-Based Disease Identification for Crops) mobile application. This AI-powered app allows farmers to take pictures of plant diseases, which are then analyzed to identify over 50 diseases across 19 major crops, including rice, wheat, maize, cotton, and tomato. By simply uploading images of crop symptoms, the app provides instant recommendations on disease management, thereby reducing crop loss due to improper disease identification.

KCC-Chakshu - Another key tool is KCC-CHAKSHU, a system that aggregates insights and alerts from more than 35 million queries logged with the Kisan Call Centre (KCC). By using historical call data, KCC-CHAKSHU helps farmers access real-time information and advisory services, ensuring timely and relevant agricultural support.

b. Virtual Reality (VR) and Simulations in Agricultural Education

Virtual Reality (VR) is revolutionizing agricultural education and training. In India, agricultural universities have integrated VR technologies to create immersive learning experiences for students and farmers. These VR modules cover a range of subjects, from

protected cultivation techniques and hydroponics to artificial insemination and advanced irrigation methods. Such simulations help in demonstrating complex agricultural processes without the need for physical resources, making learning more accessible and effective. One example is the tractor simulation module, which allows students and farmers to practice operating machinery in a safe virtual environment, thus improving skills and knowledge without the risks of real-life training.

c. Gender-Sensitive Models and Empowering Rural Women

Technology is also playing a significant role in addressing gender disparities in agriculture. The Gender-Sensitive Agri-Nutri Farming System Model (G-SAN Model) has been developed to empower rural women, who often face barriers to accessing resources and technologies. This model promotes high-protein paddy, nutrient-rich vegetables, and improved feeding practices, all of which contribute to better nutrition and economic empowerment. Through the establishment of Women Self-Help Group (SHG)-based Custom Hiring Centers (CHCs), women are also provided access to modern farming equipment, reducing the physical labour involved in agriculture and increasing their productivity.

Furthermore, the Gender Responsive Integrated Homestead Aqua-Horticulture (GRIHA) model promotes climate-resilient, diversified livelihoods for women. This integrated farming system, which includes horticulture and aquaculture, has been particularly successful in Odisha, where it has enhanced nutritional security while helping women adapt to climate change.

d. Precision Agriculture Technologies

Precision Agriculture (PA) is a highly efficient farming practice that leverages data and technology to optimize crop production. In India, the adoption of precision farming tools such as drones, sensors, and Internet of Things (IoT) devices is on the rise. These tools enable real-time monitoring of crop health, soil conditions, and environmental factors, leading to more informed decision-making.

Drone technology is one such innovation that has been utilized for precision farming. Drones are equipped with remote sensing tools to assess plant health and optimize inputs like water and fertilizers. For instance, drones have been used to monitor the condition of wheat crops and determine the precise amount of nitrogen needed for optimal growth, reducing the need for over-fertilization and minimizing environmental damage.

Additionally, the RiceNXpert mobile app uses images of rice leaves to recommend the best timing and dosage of nitrogen fertilizer, streamlining nitrogen management in rice cultivation. This reduces wastage of fertilizers and helps farmers optimize crop yields.

e. IoT and Sensor-Based Solutions for Soil Health

Soil health is a critical factor in agricultural productivity, and sensor-based technologies have made significant strides in improving soil management. Traditionally, soil health assessments have been slow and labor-intensive, relying on wet chemistry and manual laboratory testing. However, new rapid sensor-based techniques now allow farmers to assess soil health in real time, providing more accurate and timely

information.

This technology also supports the Soil Health Card initiative by the Government of India, which aims to assess soil fertility and provide farmers with customized recommendations. Through digital soil mapping, farmers can receive data on the nutrient levels of their soil, helping them make informed decisions on fertilizer application and crop rotation.

f. E-Platforms and ICT Solutions for Farmers

India has embraced Information and Communication Technologies (ICTs) to bridge the knowledge gap between farmers and agricultural experts. One such initiative is KisanSarathi, an ICT-based interface that connects farmers with agricultural scientists through toll-free numbers, providing them with advisory services in their local languages. The system has helped over 1.5 crore farmers across India, delivering over 2.5 crore SMS-based advisories on crop protection, disease management, and sustainable farming practices.

The KisanSarathi Mobile App further enhances this service by allowing farmers to register, track their queries, and receive timely notifications and advice. This multilingual platform, which is part of the Digital India initiative, helps farmers access agricultural knowledge and technological solutions with ease.

g. Machine Learning and Data Analytics for Plant Protection

AgriIntel, an AI-based framework, processes nationwide data from farmers' helplines to derive insights on plant protection and pest management. This system uses machine learning algorithms to predict pest outbreaks



and provide actionable insights, helping farmers take preventive measures before infestations occur.

In addition, the e-LISS portal and mobile app for livestock management have digitized the collection of livestock data, providing real-time insights on milk, meat, egg, and wool production across the country. By replacing traditional paper-based surveys with digital platforms, the system ensures more accurate data collection and contributes to better decision-making in the livestock sector.

The adoption of technology in agriculture is no longer a luxury but a necessity for India's farming community. With innovations like AI, drones, mobile apps, and sensor-based solutions, Indian agriculture is becoming more data-driven, efficient, and sustainable. As technology continues to evolve, its potential to enhance productivity, reduce costs, and improve the livelihoods of

farmers becomes even more significant.

However, challenges such as digital literacy, infrastructure limitations, and access to technology for smallholder farmers must be addressed to ensure equitable distribution of these benefits. Continued government support, public-private partnerships, and capacity-building initiatives will be crucial in ensuring that technology reaches every farmer, regardless of location or economic status.

The future of agriculture in India lies in embracing these technological advancements, making them accessible, and fostering an ecosystem that supports innovation and sustainability. With the right policies, investment in infrastructure, and training for farmers, technology can transform Indian agriculture into a more resilient and prosperous sector for generations to come.



08

NABARD: Catalyst for Agricultural Development



The agricultural sector, which is estimated to constitute 18.2 percent of India's GVA in FY2024, is the bedrock of the nation's economy; it provides livelihood support to about 42.3 per cent of country's population. While the country is a major agriculture producer, being the largest producer of milk, pulses and spices and, the second largest producer in rice, wheat, cotton, among other crops, the crop yields in the country are much lower than the other major producers; fragmented land holdings, low farm investment, lack of farm mechanization, insufficient access to quality inputs, and inadequate marketing infrastructure leading to post-harvest losses, dependency on rains and short growing seasons are a few reasons for the low yields.

In the last five years, the agriculture sector has grown at an average growth rate of 4.18 per cent per year. The country also has a comfortable stock of foodgrains, around 40 per cent of which is distributed to two-thirds of the population free of cost. India exports more than 7 per cent of its food grains. The total food grains production for FY2024 was 328.8 million tonnes, marking a rise of 21.1 million tonnes compared to average of last 5 years. The average food grain production per year was 307.75 million tonnes during FY2018-19 to FY2022-23. The growth in the agriculture and allied sectors has contributed positively to the growth of the Indian economy. Several initiatives and measures taken by the government in the form of assured remunerative prices through MSP, improving access to institutional credit, enabling crop diversification, promoting digitization and mechanization,

encouraging adoption of sustainable practices through organic and natural farming, and focusing on productivity enhancement have had a positive impact on the sector.

In its journey of more than four decades, NABARD, in line with its mandate, has transformed agricultural landscape in the country through its diverse operations ranging from refinance to infrastructure finance to promotional and developmental initiatives and many more.

8.1. Overview of NABARD's initiatives

In pursuit of its mission to, "Promote sustainable and equitable agriculture and rural development through participative financial and non-financial interventions, innovations, technology and institutional development for securing prosperity," NABARD has been investing extensively

in rural infrastructure and agriculture to enhance the productivity of the rural economy in general and agriculture in particular. Over the past decades, NABARD's rural infrastructure financing has reached a cumulative sanction of ₹ 8.2 lakh crore, including ₹ 61,000 crore during FY2024. Our flagship Rural Infrastructure Development Fund has had a transformational impact on the rural landscape, creating cumulative irrigation potential for 422.2 lakh ha, laying 5.6 lakh km of rural roads, constructing 14.1 lakh meter of rural bridges, and generating 3,096 crore person-days of non-recurring employment; all contributing directly or indirectly to the agriculture development.

The rural credit structure is pivotal for financial inclusion and delivering credit to rural areas for various purposes including agriculture. Encompassing the diverse credit needs of rural clients, NABARD extends refinance to rural financial institutions (RFIs), SCBs, and non-banking financial companies (NBFCs) against their loan portfolio. NABARD is also facilitating the digitization of 63,000 primary agricultural credit societies (PACS), which are backbone of agriculture financing especially short-term (KCC). This digitization effort is set to enhance transaction speed, access to payment services, and supervision for rural stakeholders. On 24 February 2024, 18,000 digitized PACS were inaugurated by the Prime Minister of India at Bharat Mandapam, New Delhi.

NABARD has remained responsive to emerging needs of India, aligning its policies with national priorities. The shrinking average size of agricultural landholdings poses a challenge to diversification of agricultural activities

and increase in farmer earnings. To address this, NABARD has promoted 7,355 farmer producers' organizations with 25 lakh farmer members, of which about 82% are small and marginal farmers.

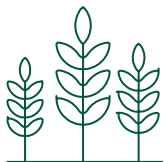
Through its Farm Sector Promotion Fund (FSPF) NABARD has contributed to agri innovations to address issues at national level as well as state-specific issues considering the diverse agricultural landscapes, climate, and socio-economic conditions across different states in India. Further, climate change presents significant risks for agriculture and rural livelihoods; affecting crops, water resources, soils, livestock, and incidence of pests and diseases and thus, acts as a risk multiplier. FSPF supports pilots on innovations that bear potential to address climate vulnerabilities upon scaling up. As the National Implementing Entity of three key climate financing funds, NABARD has funded 40 projects worth ₹ 1,971.5 crore.

8.2. Different schemes of NABARD: summary of key schemes and their impact

I. Developmental & Promotional Initiatives:

a. Tribal Development program

A small orchard-based sustainable livelihood model for tribals, involving development of wadi (small orchard) and other associated interventions has been under implementation in Gujarat and Maharashtra since 1990s under the Adivasi Development Programmes (ADPs). ADP Gujarat and Maharashtra were externally aided by KfW, Germany, which touched the lives of 33500 tribal population. Wadi has evolved as a most



successful model of sustainable income to the tribal families. To replicate the model in tribal areas across the country, NABARD has set up a dedicated Tribal Development Fund (TDF) in the year 2003-04 with an initial corpus of ₹50 crore out of its annual profit. The programme which began with implementing only 11 projects in 2005-06, has now grown to 898 projects since creation of the fund.

The objective of the Fund is to:

- Create replicable models of integrated development of tribal families on participatory basis, through adoption of sustainable income generating activities based on potential of the area and the tribal needs.
- Build and strengthen tribal institutions, which would enable the communities to be partners in policy formulation, execution of programs and improve social and economic status.
- Build and strengthen producers' organizations.

b. Watershed Development program

The NABARD Watershed Development Fund (WDF) is a special fund created by NABARD. It aims to support the development of water resources, particularly through watershed management initiatives, in rural areas. The fund focuses on sustainable water conservation, improving soil health, enhancing water-use efficiency, and promoting integrated natural resource management in watershed regions.

Key objectives include:

- Conservation of water and soil through watershed management techniques.

- Sustainable agricultural practices that improve farm productivity.
- Improvement of livelihoods in rural areas by enhancing natural resource availability.
- Community participation in managing water resources.

The fund is used to finance projects related to soil and water conservation, rejuvenation of watersheds, and rural infrastructure for water management. It also aims to mitigate the impacts of droughts and floods by ensuring better water retention and resource management.

c. FSPF

NABARD supports farm innovations, technology transfer, and capacity building through its Farm Sector Promotion Fund (FSPF). It was created in NABARD, by merging two erstwhile funds, viz., Farm Innovation and Promotion Fund (FIPF) and Farmers' Technology Transfer Fund (FTTF). The primary objective of FSPF is to support farm innovations, technology transfer and capacity building of farming community in the realm of agriculture and allied activities. The objectives of FSPF are indicated below:

- Promotion of innovations in agriculture and allied sectors.
- Enhancing production, productivity in agriculture and allied sectors and wider market access.
- creating Promotion of sustainable and climate resilient agriculture in vulnerable and distressed districts.
- Promotion of Agriculture value chains/Agri Value Chain Financing.
- Promotion of Farmers Collectives including training and capacity

building.

- Supporting expert advisory services, policy advocacy including building up of human capital in rural areas

The fund has a corpus of ₹ 60 crore and is replenished annually by appropriation of NABARD profits. The cumulative disbursements under FSPF are at ₹ 246.7 crore as on 31 March 2024. Activities supported under FSPF are listed below:

Projects in agriculture and allied sectors promoting innovations, productivity enhancement and market access, value chain development, climate-resilient agriculture in vulnerable districts, farmers' collectives, and hi-tech agriculture-focused projects on internet of things, information communication technology, artificial intelligence, and machine learning are supported under the detailed project report (DPR) mode. These projects are sanctioned normally for a period of 2–3 years.

d. Promotion of Farmer Producers' Organizations (FPOs)

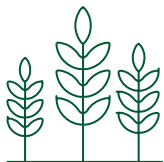
As farmers' collectives, FPOs increase the bargaining power of small and marginal farmers in procuring farm inputs or selling produce and enable access to institutional credit. NABARD pioneered the promotion of FPOs under its Producers Organization Development Fund and Producers' Organization Development and Upliftment Corpus Fund. It is one of the implementing agencies of the central sector scheme on the formation and promotion of 10,000 FPOs. Cumulatively, NABARD has promoted more than 7,000 FPOs with a membership of 25 lakh farmers, of which about 82% are small and marginal farmers and 30% are women. So far, 1,995 FPOs have availed credit from banks or

other financial institutions. In FY2024, NABARD promoted 221 FPOs.

For the promotion and development of FPOs NABARD undertook a number of initiatives including onboarding of 93 eligible lending institutions with NABSanrakshan under Credit Guarantee Fund Trust for Farmer Producer Organizations and sanctioned credit guarantee cover of ₹ 278.2 crore to 1,195 FPOs (1,561 guarantees); sanctioned ₹ 25 crore to National Commodity & Derivatives Exchange Limited for a period of one year for a price protection program for FPOs to encourage farmers to avail themselves of a 'put option' in the commodity market to receive assured strike price and avail credit at reasonable cost from bank/financing institution by realizing minimum price through hedging mechanism in commodity market; undertaken activities under an MoU signed with Agricultural and Processed Food Products Export Development Authority (APEDA) that include promotion of agri-exports, capacity building of farmers in good agricultural practices, packaging, branding, and exporting protocol, etc.

e. CAT—Capacity-building for Adoption of Technology

With a view to facilitating the traditional farmers for adoption of new agro-technology, by motivating and exposing them to innovative projects in different parts of the country, NABARD during 2004 introduced CAT programme. The CAT initiatives mainly aimed at extending support towards the cost of exposure visits of the farmers to enable them to learn and adopt new technology for the purpose of enhancing their production/productivity, optimizing the use of resources and realizing improved returns



through sustainable farming.

Since the inception of FSPF, 2,774 exposure visits have been supported with grant assistance of ₹ 22.3 crore for the benefit of 82,060 farmers. During FY2024, 182 exposure visits were undertaken for the benefit of 4,735 farmers with grant assistance of ₹ 2.8 crore.

II. Refinance

NABARD provides refinance by way of short term and long-term credit to Commercial Banks, Cooperative Banks, Regional Rural Banks (RRBs) and non-banking finance companies (NBFCs) to meet the credit and financial needs of the food processing industry. The short-term credit (production credit) assists the rural financial institutions to meet the production and working capital needs of farmers, while the long-term credit (investment credit) supports the asset creation and capital formation. Refinance is available for various agriculture and allied activities and off-farm activities including food and agro processing. NABARD also identifies thrust areas from time to time to boost the credit flow to a particular sector, wherein up to 100% refinance would be available to the eligible institutions.

Total ST refinance disbursement for FY2024 was ₹ 1.8 lakh crore; whereas the disbursement under LT refinance was ₹ 1.3 lakh crore in FY2024.

III. Infrastructure Support

Investment in infrastructure has a multiplier effect on growth and employment in an economy. Rural infrastructure development strongly figures in the government's plans and policies to map the Indian landscape based on connectivity and logistics. Intra-regional infrastructure to integrate rural areas with nearby urban centres can transform India's growth trajectory.

Robust and reliable rural infrastructure to support modern agriculture, improved irrigation, enhanced rural connectivity, better market access, more renewable energy, and quality education and health is vital for enhancing production, consumption, and trade of goods and services. This, in turn, will lead to more sustainable rural livelihoods in India. NABARD plays a crucial role in facilitating the financing, promotion, and sustainable development of rural infrastructure.

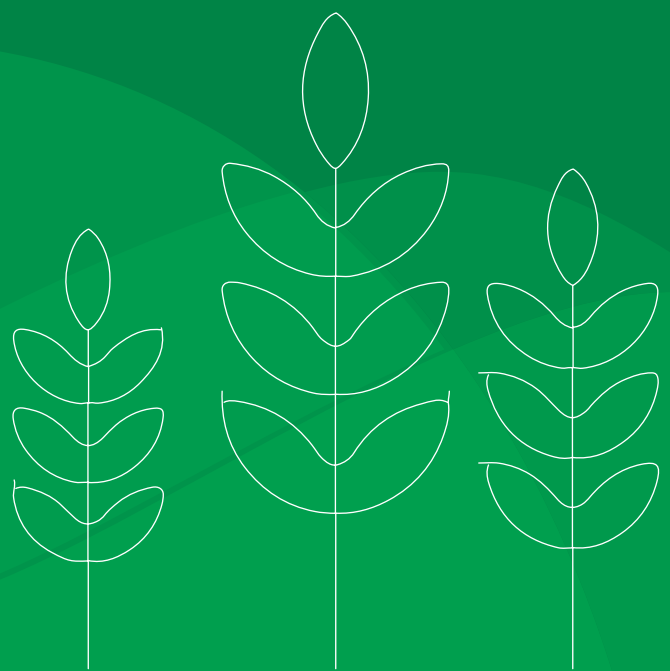
It provides technical assistance and financial support for the construction of rural roads, irrigation systems, warehousing facilities, and renewable energy installations by leveraging various funds vested in it. The cumulative funds sanctioned by NABARD till FY2024 under infrastructure financing stood at ₹ 8.2 lakh crore while disbursements added up to ₹ 6.2 lakh crore.



Notes

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National Sectoral Paper

Agriculture and Crop Science



Farm Sector Development Department
National Bank for Agriculture and Rural Development
Mumbai