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Agriculture in India

Issues & Priorities

AGRI BULLETIN

AGRICULTURE COST MANAGEMENT BOARD

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICMAI)

Statutory Body under an Act of Parliament

www.icmai.in

About The Institute

The Institute of Cost Accountants of India (ICMAI)- formerly known as the Institute of Cost and Works Accountants of India (ICWAI) is set up by an Act of Parliament (viz. Cost and Works Accountants Act, 1959) to develop and regulate the profession of Cost Accountancy in the country and is under the administrative control of the Ministry of Corporate Affairs, Government of India. The Institute is the 2nd largest Cost & Management Accounting body in the world and the largest in Asia. The Institute is a founding member of the International Federation of Accountants (IFAC), the Confederation of Asian & Pacific Accountants (CAPA) and the South Asian Federation of Accountants (SAFA). Presently, the Institute has about 1 Lakh members both in employment and practice and more than 5 Lakhs students on its rolls.

Mision Statement

"The CMA Professionals would ethically drive enterprises globally by creating value to stakeholders in the socio economic context through competencies drawn from the integration of strategy, management and accounting."

Vision Statement

"The Institute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally."

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Email: agriculture@icmai.in

Behind every successful business decision, there is always a CMA

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From the President's Desk

Dear Readers,

The Agriculture Cost Management Board (ACMB) of the Institute of Cost Accountants of India is bringing out the 4th volume of the Agri Bulletin, dedicated to one of the most vital sectors of the nation, Agriculture, the backbone of India's economy and the heartbeat of the rural landscape.

At a time when India stands at the crossroads of transformation, the agricultural sector is undergoing a dynamic evolution. The integration of digital technologies, climate-smart practices, and an increasing focus on sustainability is enabling Indian agriculture to not only respond to global challenges but also shape a future defined by resilience and innovation.

The impact of climate change, irregular monsoons, and resource constraints has necessitated a rethinking of traditional models. Simultaneously, the emergence of agri-tech start-ups, precision farming, AI-driven supply chains, and policy reforms has opened new opportunities for inclusive growth. These developments call for a strategic approach to cost management, productivity enhancement, and financial transparency, areas where Cost and Management Accountants play a pivotal role.

With a strong commitment to nation-building through cost leadership, the ACMB of ICMAI is focused on empowering farmers, agri-entrepreneurs, and policy-makers with actionable insights and cost-effective solutions. Through research, advisory services, and capacity-building initiatives, meaningful contributions are being made to strengthen the agri-economy and deliver value across every node of the agricultural value chain.

This Bulletin stands as a reflection of that commitment. It brings together expert perspectives, data-driven analysis, case studies, and innovative models that can guide the future of Indian agriculture.

Let us move forward with a collective vision, where farmers are prosper, markets are efficient, resources are preserved and India's agricultural growth is sustainable and inclusive.

Jai Hind!

CMA T C A Srinivasa Prasad
President
The Institute of Cost Accountants of India

From the Vice-President's Desk

CMA Neeraj Dhananjay Joshi
Vice President
The Institute of Cost Accountants of India

Dear Readers,

It is with great pride and enthusiasm that I extend my greetings to all of you through this fourth volume of Agri Bulletin published by the Agriculture Cost Management Board of the Institute of Cost Accountants of India. Agriculture is not merely a sector in our economy; it is a way of life, a tradition, and a foundation of our socio-economy.

In the current landscape, agriculture in India is at a turning point. With the convergence of technology, data analytics, financial planning, and sustainability, the sector is undergoing a much-needed transformation. However, this journey is not without its challenges, rising input costs, market volatility, climate risks, and post-harvest inefficiencies continue to affect the livelihoods of millions of farmers.

This is where the role of cost accountants becomes increasingly relevant. Efficient cost management, transparency in agri-financing, and strategic planning are crucial for ensuring that agricultural activities remain economically viable and environmentally sustainable. The ICMAI has a unique opportunity and responsibility to contribute to this transformation by equipping stakeholders with the right tools for cost optimization, value chain analysis, and financial literacy.

Our Institute has consistently emphasized capacity building and knowledge sharing across sectors, and agriculture deserves our special focus. Through this agri bulletin, we aim to showcase innovative practices, success stories, and analytical insights that can guide agri-businesses, organizations and farmer producer organizations (FPOs) toward better outcomes.

Let us continue to work collaboratively to bridge the gap between traditional agricultural practices and cost management systems. Together, we can support a future where farmers are not only producers but also informed entrepreneurs.

My sincere appreciation to all contributors and readers. I encourage you all to reflect, share, and apply the insights presented here for the betterment of Indian agriculture.

With best wishes.

From the Chairman's Desk

Dear Professional Colleague and Readers,

"If agriculture goes wrong, nothing else will have a chance to go right,"

- By M.S. Swaminathan

It is my privilege to present the enriched 4th volume of the Agri Bulletin, published by the Agriculture Cost Management Board (ACMB) of the Institute of Cost Accountants of India.

In the Indian agricultural landscape, the sector continues to be the backbone of rural livelihoods. As of 2023–24, 46.1% of India's workforce is engaged in agriculture, marking a rise from 44.1% in 2017–18. This trend underscores a growing employment dependence on farming. However, agriculture contributes only around 18–18.4% to India's GDP highlighting a stark disparity between the sector's economic output and the proportion of the workforce it sustains.

Women are increasingly becoming the driving force behind Indian agriculture. Their participation in the agricultural workforce has risen significantly from 57.0% in 2017–18 to 64.4% in 2023–24 even as male participation has declined from 40.2% to 36.3% over the same period. This gendered shift carries profound socio-economic implications, revealing both the resilience of women in agriculture and emerging structural inequalities.

This edition of the Agri Bulletin highlights key themes shaping the future of Indian agriculture:

The article "Farming is not a burden, it is a celebration" insightfully combines personal experience with professional perspective, underlining that farming is not a burden, but a celebration a sentiment deeply rooted in the cultural fabric of states and beyond. It further

CMA Chittaranjan Chattopadhyay
Chairman
Agriculture Cost Management Board

reflects on the complexities of ensuring transparency in agricultural costing due to the inconsistent and highly variable nature of input-output relationships and role of the ICMAI. This calls for the creative involvement of CMAs the social accountants in designing viable and farmer-centric costing models.

"Agriculture Budgeting" emphasizes the crucial role of structured financial planning in farming. Whether through enterprise budgets, cash flow projections, or monthly budgeting formats, effective agricultural budgeting is a key enabler of resource optimization, risk mitigation, and improved decision-making for farmers and agri-enterprises.

"Agriculture Infrastructure Fund" focuses on a forward-thinking initiative aimed at addressing the persistent gaps in rural infrastructure. Investments under this scheme are enabling the creation of post-harvest facilities, storage units, and value chains all critical to reducing wastage and enhancing farmer incomes.

The article "Capacity Building for FPOs" explores the vital role of Farmer Producer Organizations in empowering smallholder farmers. By equipping FPOs with technical know-how, governance capabilities, and market linkages, we take a step toward a more inclusive and equitable agricultural economy.

Further, "Critical Analysis of the Deviation between Budgetary Allocations and Actual Spending in Agriculture and Allied Activities" raises important questions about the efficiency of public expenditure. It calls for enhanced transparency, accountability, and better alignment between policy intent and implementation.

Friends, we all know that, Sustainability remains a central pillar, the article titled "Use of Biochar as a Sustainable Tool for Soil Health Augmentation and Climate Change Mitigation in India" highlights how biochar can improve soil fertility, enhance carbon sequestration, and support our broader climate goals.

Finally, "Role of Agriculture and Effect of Economic Reforms on Indian Agriculture" provides a macro-level view of how liberalization and evolving policy frameworks have shaped agricultural development and farmer welfare over the decades.

As we reflect on these interconnected themes, it becomes evident that a multi-pronged approach combining policy reform, sustainable practices, financial investment, and institutional strengthening is the need of the hour.

I hope this agri bulletin stimulates informed discussions and inspires actionable change within our community and beyond. I extend my sincere gratitude to our contributors and readers. Together, let us cultivate an agricultural future where data-driven insights, grassroots wisdom, and institutional excellence converge.

With Best Wishes for A Happy Durga Puja and Dussehra!!

"खेती बोझ नहीं, एक उत्सव है।"

"Farming is not a burden , it is a celebration"

This article is dedicated is dedicated to "**Bharat Ratna" Late Dr.M.S.Swaminathan** who lived for the cause of the Farmer and the welfare of the Farmer

CMA CA Dendukuri Zitendra Rao
Cost and Management Accountant in Practice
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INTRODUCTION

Let me confess that I am not going to deal with any statistics in a big way – but will share some of my experiences. I am happy that I am grown in an agricultural family . Till early 90s I have been regularly visiting my agricultural fields situated near the popular temple town Bhadrachalam. I am still in possession of a Patidar Passbook in my name in the state of Telangana. In our Telugu states the main occupation of people at large is AGRICULTURE. The rights over the statement that "VYAVASAYAM DANDUGA KAADU – PANDUGA" (implying in a way farming is not a burden – but celebration) are also been claimed by almost all the political parties. An attempt is made in the following lines to present an analytical picture that substantiate the tittle conferred to this write up.

I am impressed with a phrase "TRANSPARENT APPROACH TO COSTING" that appeared in one document. As a person exposed to agriculture from the childhood days onwards - I am of the view that agriculture (particularly in India) adopts OPEN SYSTEM approach and been exposed to many risks - certain of them can be measured and certain others are not measurable. Thus, TRANSPARENCY at Costing is difficult perhaps. The difficulty comes from the fact that CONSISTENCY can not be achieved with reference to - Relationship between Costs on Inputs and Proceeds of Output – Consistency in the data between Farmer to Farmer – Consistency in the data between Village to Village or Zone to Zone etc..

On the other hand, we advocate the concept of ONENESS in many aspects including the Minimum Support Price (MSP) that is been offered to the Farming Community. When I attempted to cross check with few economists, political leaders and executives associated with POLICY MAKING machinery of MSP – I have been told that reimbursement of actual costs is not practical.

Thus, it is the responsibility of a CMA (precisely also known as SOCIAL ACCOUNTANT) to come out with appropriate creative solutions irrespective of the acceptability of such solutions. Let us now connect

to what Lord Sri Krishna said it in Bhagavad Gita – Do your Duty and do not bother about the result. Gita also advocates a view that do not ignore "SWADHARMA" To conclude the introduction part let me put in a hypothetical situation. Imagine a scenario where in all the Farmers stopped cultivation complaining the viability aspects. The pain will be immense to all the stakeholders including you and me. Thus, let us strive to do our might for the noble cause of safeguarding the precious specie called FARMER

Issues and Concerns

About half a decade ago I read an article in my native language TELUGU talking about embedding the COMMERCE to CULTIVATION. The author was driving a point that Indian agricultural produce should outsmart the domestic requirement – such that the surplus can be exported to countries like Philippines and China. We also need to realize a fact that the population of our country is growing by about 1.5% to 2% every year. If not anything else – Food security is a must for the people of our country. This drives a point that FARMER should be motivated to continue his trade with responsibility.

Having said that let us also foresee another issue on the cards. The European Union is likely to insist upon Carbon certification for imports particularly. This may pose a big problem for export of Food Grains. We all know that the activity called cultivation consumes substantial quantities of water. The mechanism to provide the water for cultivation gives rise to Carbon Emissions as most of the Irrigations schemes are based on "Lifts" consuming Electricity. Generation of Electricity involves Carbon Footprint at times. Thus, these aspects are to be MEASURED and be MONITORED. Similarly in the context of Carbon Credits itself – a small farmer ploughing with the support of Bulls may witness ZERO emissions. Suitable mechanism can be thought off to reward such farmers. Export Revenues of the agricultural produces can be earmarked for the welfare of the FARMER. This can also augment the revenues of the farming community.

Productivity and efficiency are the other issues that are to be addressed. We cannot have the copy paste approach for all the concerns. Frequently I hear an argument that in developed countries the Farm size is substantially large compared to that of our country. It is a fact that Productivity comes with larger farm areas. Nearly 80% of the Indian Farming Community own land ranging between 0 to 5 acres. The mechanization of the activities in full scale is not that feasible in such small farms. If we are to suggest the consolidation of the land – the entrepreneurial quality (the essence) may get killed. In a farmer we can witness the set of skills that can be mapped to varied functions such as Finance, Production, Marketing and HR as well. Hence, we should not think of chopping off the legs to have the weight be reduced. ***We need small farmers***. Thus, it is suggested that a mandate can be prescribed to have minimum acreage for cultivation of certain crops that require to be produced in bulk – say Paddy/Wheat. The entire population of 140 crore need either of these items for their daily life. In a village I have seen a re-modelled Tractor carrying the spraying activity of a pesticide because the farm size is 10 acres. I am told by the Farmer friend that they can complete the task of spraining in less than 20 minutes per acre (Photo 1).

(Photo 1)

Thus, Big Farm areas are to be focused at crops of bulk production. Small extent owners should be discouraged from cultivating crops of mass production. Such farmers are to focus at other items such as vegetables, flowers, grains or can focus allied activities.

(Photo 2)

In my village in my childhood almost every house used to be a GHEE MANUFACTURER. Nowadays it is becoming a tough task to nurture the cattle. There is no land in the vicinity of a village where the cattle can be taken for a Day out. The problem for this is deforestation that is taking place to offer land to landless on a continuous mode without realizing the fact that LAND IS LIMITED. Village level Cattle nurturing activity should be the order of our Rural life of around 6 lakh villages of our country to address this Cattle Management Issue. Interestingly when I visited a village that is about 25 KM away from popular Temple town Bhadrachalam; I am surprised to witness the sale of Milk Packets of a reputed dairy in the local retail shop (Photo 2).

Johar MSS

Way back in 2018 - I am fortunate to have a 5 minute interaction with Late Prof. M.S. Swaminathan – who has coined a formulae for fixation of Minimum support price which is been brain stormed across the legislature and executory. He gave space to no other thought except FARMER. He is the man who gave food security to the nation in a way. Aptly conferred with the country's highest civilian award "Bharat Ratna" Late Prof. M. S. Swaminathan has only one phrase to say when I made a presentation on Agricultural Costing to him way back in 2018. "Who else can be the authority to say what is COST than your Institute" inferring a strong view that our Institute should have a say in the Cost related issues (Photo 3)

(Photo 3)

Costing Complexities - Role of the ICMAI

Farmer being an entrepreneur the conventional equation of "Cost plus Profit = Price" holds good even for the Anna Daatha (the farmer). The derivative surplus should be matching the Budgetary requirements of his social life viz., Food, Clothing, Shelter, Education, Health and other social needs like celebrating marriages and other events. Late Prof. MS Swaminathan – the father of Green Revolution came up with a researched

structure of arriving at the Cost of Cultivation taking into consideration different factors . The suggested Costs are broadly truncated into different stages viz., A1, A2, etc., where A1 refers to Costs accumulated on account of Inputs and A2 refers to Rents paid for Leased Land in addition to Costs calculated at A1. Likewise, there were definitions for B1, B2, C1, C2 and C3 costs.

In the entire discussion the fact that is getting established is that the Cost Calculations are to be drawn which fits into the methodology of "Researched approach of The Institute of Cost Accountants of India". The Institute has already laid down "tested and proved" principles and consolidated the same as Cost Accounting Standards. Driven by proper Data Collection Mechanism – perhaps these Cost Accounting Standards can come to the rescue of the farmer by all means. Having said that – I advocate a view that these Cost Accounting Standards are to be converged into a specific set of practices that suit the practical aspects of Agriculture. Thus, I visualise the need for a single "Applied Cost Accounting Standard for Agriculture (ACASA)" combining the salient aspects of all the relevant Cost Accounting Standards (CAS). All the different costs can be reduced to 3 types of costs such as Input Costs, Charging of Capital asset costs and Other Costs.

The Term Cost Centre and Profit Centre gets replaced with the name of the Field or Farmer or Village or Taluk or District or Agro Climatic Zone. Those who are familiar with the Village atmosphere in Telugu states would be familiar with the concept of naming a particular field to establish the Identity. For Ex: My elders named part of our land situated at a place as "PERANTALA POLAM and another part as "NAGULA POLAM" and so on. Thus, the sub groups or sub cost centres also can be drawn (farmer specific or village specific).

Taking a cue from Cost Accounting Standard 3 – the **Cultivation Overheads** that are generally not directly traceable to Cost Object can be defined. For Example – the temporary Fencing costs or the security costs that overlap to different types of crops situated in a single bit of land can be defined . The conventional wordings in CAS 3 of SUITABLE BASIS can be replaced with more affirmative basis of apportionments of the costs to different Cost Objects.

Normally Tractors or Bullock carts or other Farm equipment are in usage for commuting between Field and the other locations. It is here the slogan of **Net Zero** can be embedded. For the usage of Bullock cart - incentive mechanism can be advocated for and such incentive can actually reduce the cost of cultivation. Suitable tracking mechanism of no. of trips plied using Bullock carts and the relevant saving in Carbon Emission can be fixed. In case of selected crops like sugar cane – the outward transportation has to be treated as a part of Cost of Cultivation.

Repairs and Maintenance costs for the Farm equipment are incurred by the Farmer on need base. Similarly the Fields are also re-conditioned once in a while by strengthening the Bunds to accommodate bigger clusters for improving the productivity. These aspects are not to be considered as Input Costs for the produce. Instead, it will result in the enhanced productivity. The funding of this aspect needs to be taken care by the farmer for himself. A fixed principle of absorbing such costs as **Charging of Capital asset costs** needs to be spelled out. Interestingly the Cost Accounting Standard 23 has few points for consideration. In case a farmer is successful after 2 failures in digging a Borewell; the costs incurred by the farmer for the initial 2 failed attempts matter a lot. The said costs are to be considered as part of **Charging of Capital asset costs.**

There could be many more points that would emerge for consideration depending upon the practices at different areas and for different crops. The thoughts can be further brain stormed and be reduced into one single standard called **Applied Cost Accounting Standard for Agriculture (ACASA).**

Finally…

Thus, good amount of synergy can be brought in between the VISION of our Institute and the backbone of our country – the agriculture. We have Infrastructure in the form of chapters spread across the length and breadth of the country. Further we have huge member base and student base who had their roots in villages. I only wish that the thoughts can be further be deliberated and be studied. Finally, all of us should be concerned to see the smile on the face of the ANNA DAATHA. The smile should be filled with Pride at his Occupation. Thus, we have real celebration across all the 6 lakh villages of our country - INDIA.

।। सर्वे जनाः सुखिनो भवन्तु ।। (Sarve Janah Sukhino Bhavantu)..-18:78 -

Agriculture Infrastructure Fund

Introduction

India's agricultural sector, which provides livelihoods for more than half of the nation's population, has long grappled with fragmented markets, limited processing capabilities and significant post-harvest losses. The role of infrastructure is crucial for agriculture development and for taking the production dynamics to the next level. It is only through the development of infrastructure, especially at the post-harvest stage that the produce can be optimally utilized with opportunity for value addition and fair deal for the farmers. Development of such infrastructure shall also address the vagaries of nature, the regional disparities, development of human resource and realization of full potential of our limited land resource.

Dr. Aparna Samudra
Assistant Professor, Department of Economics,
RTM Nagpur University, Nagpur

In view of above, Government of India announced allocation of ₹1 lakh crore Agri Infrastructure Fund for farm-gate infrastructure for farmers on 15.05.2020, Financing facility of ₹ 1,00,000 crore is planned to be provided for funding Agriculture Infrastructure Projects at farm-gate & aggregation points Primary Agricultural Cooperative Societies, Farmers Producer Organizations, Agriculture entrepreneurs, Start-ups, etc. Impetus for development of farm gate & aggregation point, affordable and financially viable Post Harvest Management infrastructure.

Accordingly, Department of Agriculture & Farmers' Welfare has formulated the Central Sector Scheme to mobilize a medium - long term debt financing facility for investment in viable projects relating to post-harvest management Infrastructure and viable farming assets through incentives and financial support. Subsequently, in the budget announcement made on 01.02.2021, it was decided to extend the benefit of the scheme to APMCs (Agricultural Produce Market Committee). Accordingly, modifications in the scheme were carried out with the approval of Cabinet to make it more inclusive.

What is the Agriculture Infrastructure Fund (AIF) Scheme?

Agricultural infrastructure entails all the basic services, facilities, institutions and equipment that are needed

for efficient production and marketing of agricultural commodities. Farmers and ranchers depend on reliable infrastructure to deliver their products and expand their operations. Out-of-date, underfunded transportation systems and a lack of available labour hinder agriculture production, while advancing technology encourages growth.

The Agriculture Infrastructure Fund is a Central Sector Scheme administered by the Department of Agriculture & Farmers' Welfare under the Ministry of Agriculture & Farmers' Welfare, Government of India. It provides a financing facility of ₹1 lakh crore over five financial years (2020–21 to 2025–26) to eligible beneficiaries through a network of lending institutions that includes scheduled commercial banks, regional rural banks, cooperative banks, small finance banks, non-banking financial companies, the National Cooperative Development Corporation and other designated entities. The tenure for disbursement under this fund extends from the financial year 2020–21 up to 2025–26, with the repayment period stretching until 2032–33 for approved projects. The following Table 1 shows the Tentative Fund Allocation for each state and union territories under AIF scheme.

Table 1: Tentative Fund Allocation under AIF Scheme.

State/UT	Fund Allocation (₹ Cr)	State/UT	Fund Allocation (₹ Cr)
Uttar Pradesh	12,831	Himachal Pradesh	925
Rajasthan	9,015	Jammu & Kashmir & Ladakh	900
Maharashtra	8,460	Uttarakhand	785
Madhya Pradesh	7,440	Tripura	360
Gujarat	7,282	Arunachal Pradesh	290
West Bengal	7,260	Nagaland	230
Andhra Pradesh	6,540	Manipur	200
Tamil Nadu	5,990	Mizoram	196
Punjab	4,713	Meghalaya	190
Karnataka	4,525	Goa	110
Bihar	3,980	Delhi	102
Haryana	3,900	Sikkim	56
Telangana	3,075	Puducherry	48
Kerala	2,520	Andaman & Nicobar Island	40
Odisha	2,500	Daman & Diu	22
Assam	2,050	Lakshadweep	11
Chhattisgarh	1,990	Dadra & Nagar Haveli	10
Jharkhand	1,445	Chandigarh	9
		Total	**1,00,000**

Source: https://agriinfra.dac.gov.in

Objectives of the Scheme

To mobilize a medium - long term debt financing facility for investment in viable projects for post-harvest management Infrastructure and viable farming assets through incentives and financial support in order to improve agriculture infrastructure in the country. This financing facility will fulfil numerous objectives for all the stakeholders in the agriculture eco-system.

a. Farmers and Collectives

Farmers, FPOs, cooperatives and marketing societies (including FPOs, PACS, Marketing Cooperative Societies, Multipurpose cooperative societies, State Agencies, Agricultural Produce Market Committees (Mandis), National & State Federations of Cooperatives, Federations of FPOs and Federations of Self Help Groups (SHGs) etc.) will gain access to improved marketing infrastructure, enabling direct sales, better price realisation and reduced dependence on intermediaries. Investments in logistics, packaging and cold storage will reduce post-harvest losses and allow farmers to time their market entry. Viable farming assets will enhance productivity and input efficiency, leading to cost savings.

b. Government

The scheme enables the Government to channel priority sector lending into previously unviable projects, encouraging innovation and private investment. Enhanced infrastructure will reduce national food wastage and improve global competitiveness. Central and state agencies can also structure standalone or PPP-based projects to attract investment.

c. Agri-entrepreneurs and Start-ups

With a dedicated source of funding, entrepreneurs will push for innovation in agriculture sector by leveraging new age technologies including IoT, AI, etc. It will also connect the players in ecosystem and hence, improve avenues for collaboration between entrepreneurs and farmers.

d. Banking Ecosystem

With Credit Guarantee, convergence and interest subvention lending institutions will be able to lend with a lower risk. This scheme will help to enlarge their customer base and diversification of portfolio. Also, refinance facility will enable larger role for cooperative banks and RRBs.

e. Consumers

With reduced inefficiencies in post-harvest ecosystem, key benefit for consumers will be a larger share of produce reaching the market and hence, better quality and prices. Overall, the investment via the financing facility in agriculture infrastructure will benefit all the stakeholders in the eco-system.

Overall, the scheme is designed to create a robust, inclusive and efficient agricultural infrastructure that benefits producers, investors, institutions and end-users alike

Rationale of the Scheme:

Agriculture and allied activities are the primary income source for ~58% of total population of India. ~85% of the farmers are Small Holding Farmers (SHFs) with less than 2 hectares of land under cultivation and manage ~45% of agricultural land. Annual income of majority of the farmers is very low. Further, India has

limited infrastructure connecting farmers to markets and hence, 15-20% of yield is wasted which is relatively high in comparison to other countries where it ranges between 5-15%. Investment in agriculture in India has further been stagnant with less than 2% CAGR over last 5 years. Investment in FY17 was ~ ₹ 2.19 lakh crore out of which private sector share was ~83% vs. a higher investment of ~ ₹ 2.50 lakh crore in FY14 and a higher share of private sector at ~88%. Also, lack of investor confidence is leading to lower plowback ratio (~14% of Gross Value addition in FY18) vs. other sectors (~33% of Gross Value addition in FY18).

Implementation Period of Scheme: The Scheme will be operational from 2020-21 to 2032-33. Loan disbursement under the scheme will complete in six years, i.e. by the end of Financial Year 2025-26. As on 30th June 2024, ₹43,391 crores have been sanctioned, out of which ₹28,171 crores have been disbursed under the scheme. Remaining ₹71,829 crores out of ₹1 lakh crores is to be disbursed during the remaining period between 2024-25 and 2025-26. Repayment period covered under the financing facility will be for a maximum period of 7 years including the moratorium period of up to 2 years.

Progress and Achievement

India's agricultural infrastructure is undergoing a significant transformation, driven by the Agriculture Infrastructure Fund (AIF). Since its launch in 2020, the scheme has steadily expanded its reach, making a measurable impact in rural areas by supporting a wide range of stakeholders. These include individual farmers, Agri-entrepreneurs, Primary Agricultural Credit Societies (PACS), startups, Farmer Producer Organisations (FPOs), and Self-Help Groups (SHGs), among others.

Overall Impact and Investment

- As of 15th August 2025, the AIF had received a total of 2,29,239 applications, reflecting strong interest and active participation from across the country. The total loan amount applied for stood at ₹1,02,438 crore, which highlights the robust demand for long-term financial support in the agriculture sector.
- Out of these applications, 1,20,966 projects have been sanctioned, resulting in an approval rate of approximately 52.7%.
- The programme spans 36 States and UTs, engaging 484 lending institutions, including 26 State Cooperative Banks, 365 District Cooperative Banks, 34 Commercial Banks, and 59 Other Lending Institutions, supported by 95,571 commercial bank branches.
- A total of 1,20,967 projects has been sanctioned, comprising 1,11,061 by Scheduled Commercial Banks and 9,906 by Cooperative Banks, with a combined sanctioned amount of ₹70,728 crore.
- Disbursement has been completed for 1,10,209 projects, including 1,02,323 by Scheduled Commercial Banks and 7,886 by Cooperative Banks, with a total disbursed amount of ₹48,647 crore ₹47,484 crore from Scheduled Commercial Banks and ₹1,162 crore from Cooperative Banks.
- This strong leveraging effect underscores the scheme's capacity to attract private investment and stimulate infrastructure development in agriculture.

Table 2: State-wise Sanctioned and Disbursed Details

Sl No.	State/UT	Sanctioned Count	Sanctioned Amount (₹ Cr)	Disbursed Count	Disbursed Amount (₹ Cr)
1	Andaman and Nicobar Islands	0	0	0	0
2	Andhra Pradesh	3,866	2,521	2,384	1,264
3	Arunachal Pradesh	5	5	5	3
4	Assam	620	1,010	538	640
5	Bihar	1,881	1,565	1,684	1,012
6	Chandigarh	6	11	5	4
7	Chhattisgarh	2,337	2,068	2,163	1,534
8	Delhi	17	36	10	10
9	Goa	34	49	27	10
10	Gujarat	4,423	5,148	3,965	2,768
11	Haryana	7,244	4,053	6,711	2,913
12	Himachal Pradesh	777	357	699	200
13	Jammu and Kashmir	284	598	223	245
14	Jharkhand	516	540	442	314
15	Karnataka	4,440	4,201	4,015	3,207
16	Kerala	3,749	1,341	3,286	851
17	Ladakh	0	0	0	0
18	Lakshadweep	0	0	0	0
19	Madhya Pradesh	14,919	9,420	14,181	7,388
20	Maharashtra	12,268	8,094	10,845	5,378
21	Manipur	3	0.65	3	0.55
22	Meghalaya	3	9	2	6
23	Mizoram	0	0	0	0
24	Nagaland	4	6	2	3
25	Odisha	3,262	1,913	2,929	1,395
26	Puducherry	9	7	7	3
27	Punjab	26,886	6,398	25,655	5,332
28	Rajasthan	4,076	3,861	3,590	2,455
29	Sikkim	0	0	0	0
30	Tamil Nadu	8,205	2,822	7,489	2,049
31	Telangana	3,181	3,840	2,864	2,502
32	Dadra & Nagar Haveli and Daman & Diu	1	1	1	0.99

Sl No.	State/UT	Sanctioned Count	Sanctioned Amount (₹ Cr)	Disbursed Count	Disbursed Amount (₹ Cr)
33	Tripura	11	16	6	8
34	Uttar Pradesh	11,004	7,531	10,104	4,820
35	Uttarakhand	624	647	551	414
36	West Bengal	6,311	2,659	5,823	1,900
	Total	1,20,967	70,728	1,10,209	48,630

(Source: https://agriinfra.dac.gov.in

Infrastructure Supported

The AIF has enabled the creation of a wide range of agricultural infrastructure assets that are critical to improving productivity, reducing post-harvest losses, and enhancing market access. As of July 2025, the scheme has supported the development of 32,054 Custom Hiring Centres, which provide farmers with access to modern farm machinery on a rental basis. It has also facilitated the establishment of 23,794 Processing Units, helping to add value to raw produce and reduce wastage.

In addition, 16,388 Warehouses have been constructed to improve storage capacity, while 3,806 Sorting and Grading Units have been set up to enhance the quality and marketability of agricultural products. The scheme has also supported 2,576 Cold Stores, which are essential for preserving perishable commodities. Beyond these, over 40,457 other critical post-harvest and farm-related assets have been created, contributing to a more resilient and efficient agricultural supply chain.

Beneficiary Profile

The distribution of sanctioned projects reflects the inclusive nature of the scheme. Farmers account for 46% of the total beneficiaries, indicating strong grassroots engagement. Agri-entrepreneurs make up 42%, showing that the scheme is also encouraging innovation and enterprise in the sector. PACS represent 8%, while startups, FPOs, and other stakeholders constitute the remaining 4%, demonstrating a broad and diverse beneficiary base.

State-Wise Performance

State-level engagement has been a key driver of the scheme's success. During July 2025, Punjab, Uttar Pradesh, and Maharashtra together accounted for 46% of the sanctioned projects, highlighting their proactive participation and strong institutional support for agricultural infrastructure development.

Bank-Wise Contribution

Banks have played a central role in implementing the scheme and facilitating credit flow. The State Bank of India emerged as the leading contributor, accounting for 37% of sanctioned cases. It was followed by Bank of India, which contributed 12%, and Punjab National Bank, which accounted for 10%. Collectively, these three banks were responsible for 3,333 approvals in July.

Other notable contributors included Union Bank of India, Bank of Baroda, HDFC Bank, Canara Bank, and UCO Bank, all of which have actively supported the scheme and helped expand its reach.

Geo-Tagging and Transparency

To ensure transparency and accountability, significant progress has been made in geo-tagging of sanctioned projects. Out of 1,10,017 eligible projects, 70,024 have been geo-tagged, representing 63.65% coverage. This digital tracking mechanism allows for real-time monitoring and verification of infrastructure development.

State-wise Geo-tagging: Several states have demonstrated exemplary performance in geo-tagging (See Fig. 1). Himachal Pradesh achieved 95.57% coverage, followed by Tamil Nadu (87.33%), Assam (86.85%) and Madhya Pradesh (86.14%) (Table 3). Notably, Meghalaya achieved 100% geo-tagging for its two sanctioned projects, reflecting full compliance and effective implementation.

Table 3: Top-five states with highest Geo-Tagging Completed (%)

State	Total Projects to be Geo Tagged	Fully Disbursed	Geo Tagging Completed	Pending to be Geo Tagged	Geo Tagging Completed (%)
Meghalaya	2	0	2	0	100
Himachal Pradesh	699	135	668	31	95.57
Tamil Nadu	7,489	244	6,540	949	87.33
Assam	540	52	469	71	86.85
Madhya Pradesh	14,181	1,049	12,215	1,966	86.14

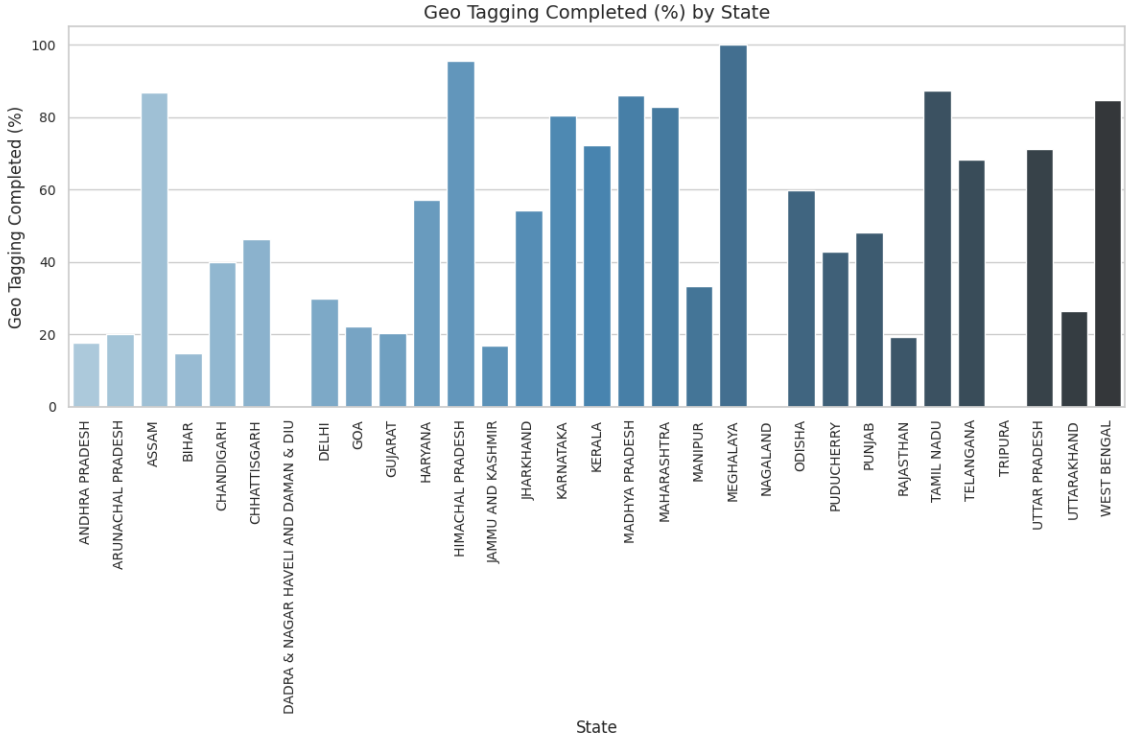

Fig. 1: State-wise Geo-Tagging Completion Status (Source: https://agriinfra.dac.gov.in)

Bank-wise Geo-Tagging: Fig. 2 shows geo-tagging completion rates across nine institution categories. Scheduled Cooperative Banks lead with 100% completion, followed by Small Finance Banks (94.8%) and NCDC (88.89%). Scheduled Commercial Banks, despite managing the highest number of projects, show only 59.72% completion. In total, 109,017 projects were to be geo-tagged, of which 11,579 were fully disbursed. 70,032 have been geo-tagged, while 38,985 remain pending (Table 4).

Table 4: Bank-wise Geo-Tagging Completion status (%)

Institution Category	Total Projects to be Geo Tagged	Fully Disbursed	Geo Tagging Completed	Pending to be Geo Tagged	Geo Tagging Completed (%)
Scheduled Cooperative Banks	11	1	11	0	100.00%
Small Finance Banks	173	1	164	9	94.80%
National Cooperative Development Corporation	18	7	16	2	88.89%
Non-Banking Financial Companies	123	11	108	15	87.80%
DCCBs with PACS affiliation	7,670	215	6,605	1,065	86.11%
Regional Rural Banks	8,997	1,102	7,559	1,438	84.02%
State Cooperative Banks	106	2	81	25	76.42%
Scheduled Commercial Banks	92,901	10,238	55,482	37,419	59.72%
Multi State Scheduled Cooperative Banks	18	2	6	12	33.33%
TOTAL	**1,10,017**	**11,579**	**70,032**	**39,985**	**63.66%**

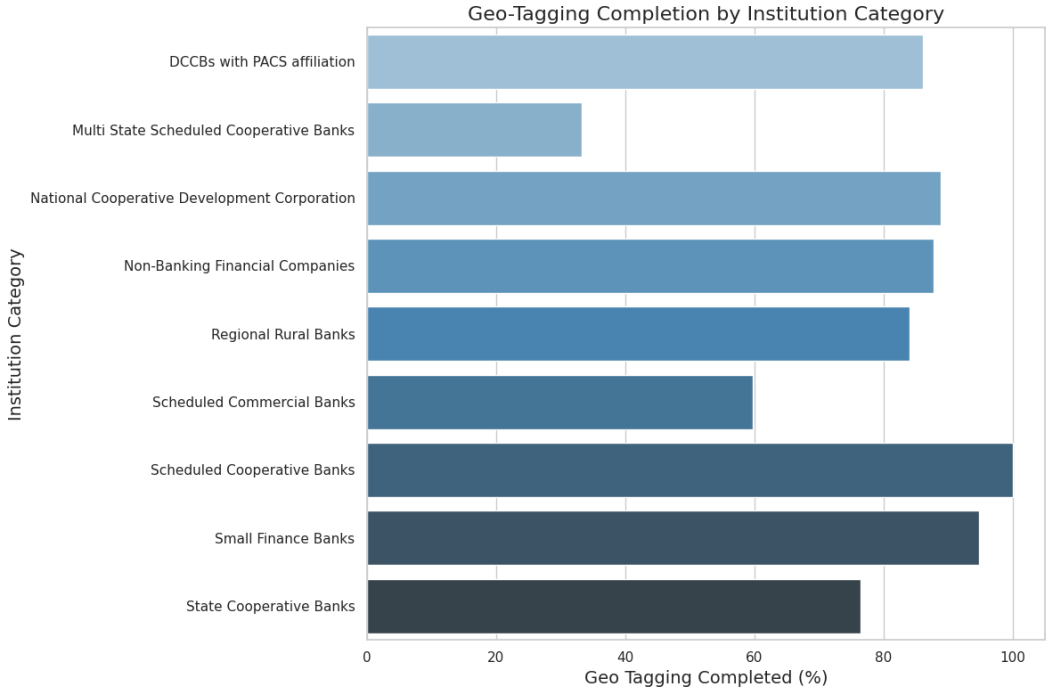

Fig. 2: Bank-wise Geo-Tagging Completion Status (Source: https://agriinfra.dac.gov.in)

Project Type Wise: As shown in Fig. 3, categories like Logistics Facility (84.53%), Aeroponic Farming (83.33%), and PPP projects by State agencies (80%) show the highest geo-tagging completion rates. Lower-performing categories include Poly House/Greenhouse (33.27%) and Assaying units (35.29%).

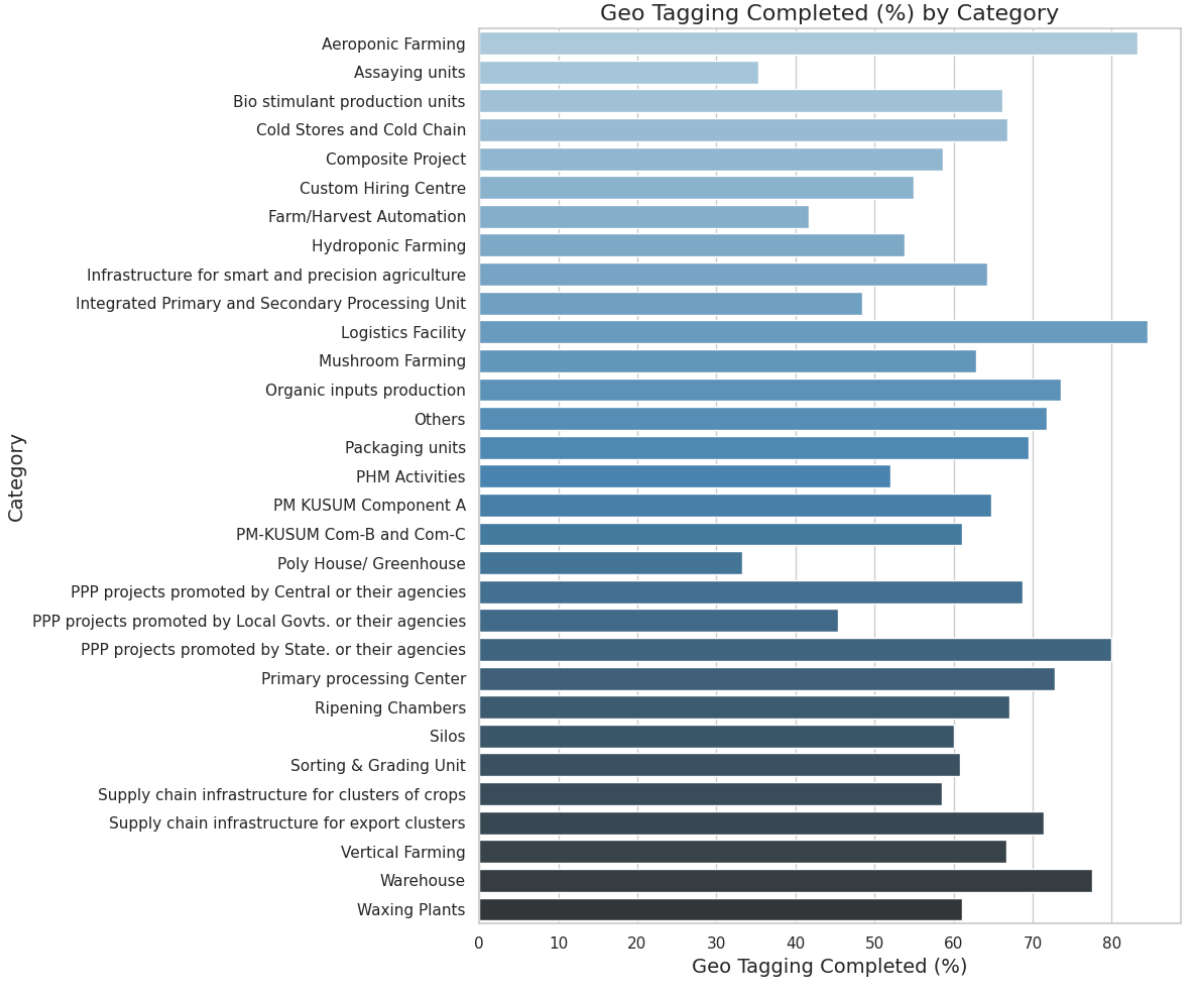

Fig. 3: Project Type wise Geo-Tagging Completion Status (Source: https://agriinfra.dac.gov.in)

Beneficiary Type Wise: State Agencies achieved full completion at 100%, followed closely by State-sponsored Public-Private Partnership Projects (88.89%) and Primary Agricultural Credit Societies (86.10%). In contrast, Joint Liability Groups recorded the lowest completion rate at 23.86%, indicating significant lag in geo-tagging progress. The visual comparison helps highlight disparities in implementation efficiency across beneficiary types.

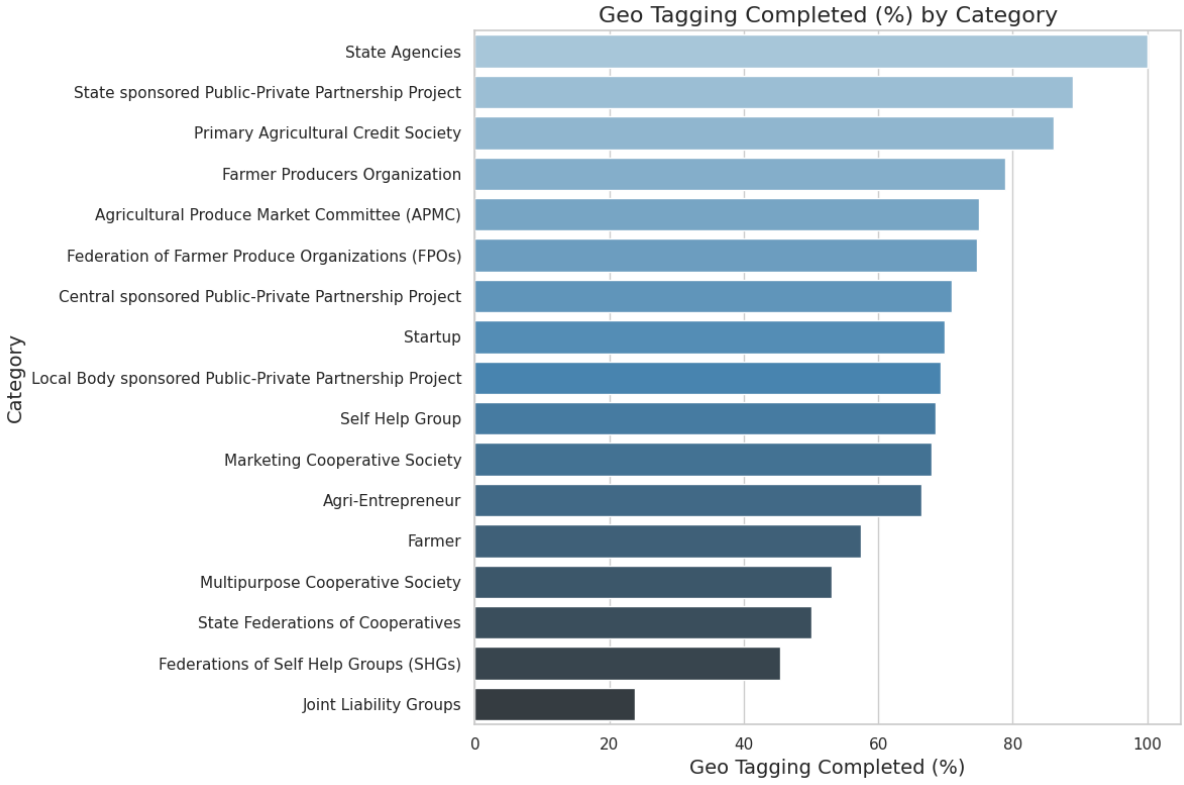

Fig. 4: Beneficiary Type wise Geo-Tagging Completion Status (Source: https://agriinfra.dac.gov.in)

Challenges

Agriculture remains the backbone of India's rural economy, yet the sector continues to face several structural and infrastructural hurdles. These challenges prevent farmers from securing fair prices for their produce, discourage private investment, and hold back long-term progress. As with all government schemes, the Agriculture Infrastructure Fund scheme also has several challenges which include:

- Lack of Post Harvest Management and direct marketing infrastructure to allow farmers to have access to remunerative markets.
- Shortage of infrastructure leading to higher post-harvest losses and a higher number of intermediaries.
- Shortage of modern packaging and grading facilities resulting in low realization of crop value.
- Holding capacity of farmers is low resulting in low bargaining capacity.
- Inadequate private investment in rural areas results in low employment opportunities leading to large scale migration.
- There is skewed credit system for farming sector with focus on short term credit while viable investment in long term assets is missing.

Conclusion

The Agriculture Infrastructure Fund is celebrated as a landmark scheme to integrate rural India into productive, market-linked Agri-value chains, thereby securing higher incomes and diversified opportunities for beneficiaries. The current data suggests that AIF scheme is helping to improve farming facilities and support rural development across India. Many projects have already been approved, and funds are being given to beneficiaries to build better storage, transport, and market systems. To make sure the scheme works well for everyone, it is important to keep track of progress, check how institutions are performing, and make sure all regions get fair support. With proper planning and monitoring, the AIF Scheme will not just modernize Indian agriculture but will also lay firm foundations for a sustainable, profitable and resilient agricultural system true to its original objectives.

Use of biochar as a sustainable tool for soil health augmentation and climate change mitigation in India

Keywords: *Soil health, biochar, soil organic carbon, climate change, natural soil amendments*

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Abstract

Around 30% of the Indian land is under the threat of degradation due to various climate change variability issues and nutrition depletion. This is putting extreme pressures on Indian farmers and farm productions. Government of India is addressing these issues through their various agricultural schemes promoting organic agriculture, better utilizations of natural resources, integrated farming, soil health card etc. Use of charged and inoculated biochar, a type of charred natural amendment, as a good practice for soil health augmentation can be highly useful in this regard. Long lasting positive influences of such biochar on the quality and health of soil, its recalcitrance, ease of making and economic considerations along with its along with its ability towards climate change effects mitigation makes it a poignant choice and hence should be further considered for related policy interventions.

Introduction: Global food systems are estimated to contribute 1/3rd of the total anthropogenic Green House Gases emissions (GHG) in 2018 i.e., about 16 CO2eq/yr, with carbon impacts from food production through interlinked value-adding activities ranging from processing to disposal. Food systems encompass

every process and infrastructure embracing aspects from growing, harvesting, post production processing to packaging, transportation and even waste management. Thus, transformed food systems are essential for moving beyond merely raising food production but finding paths to nourish all people in an environmentally, economically, and culturally sustainable manner. Healthy soil is the most fundamental base of sustainable food systems. In particular, threshold level of soil organic carbon (SOC) content is essential for better crop productivity, enhanced water management, maintaining diverse soil functions, providing multiple ecosystem services and mitigating the negative effects of climate change. SOC, is an integral part of soil organic matter (SOM), comprising 45-60% of the latter. SOC contributes toward maintenance of soil structures and aggregations; enhances soil resistance to heat waves, drought and abrupt effects of climate change; nutrient retentions and efficient usage; rhizospheric processes and GHG emissions (e.g., CO2, CH4, N2O) regulating climate change (Lal 2016). In contrast, unhealthy, degraded soils are depleted in SOC content; displays excessive wind and water erosion, compaction, surface run-off, soil temperature fluctuations; lower water infiltration; reduction in ecosystem functions and services hence seeking higher external inputs and thereby increasing economic burden on the farmers. Degraded soils are frequently characterized with salinization, acidification, increased metal toxicities especially Al and Mn, lowered cation exchange capacity, depletion of nutrients, lack of biodiversity. Moreover, degraded soils deficient in SOC pool convert into a net source of GHG emissions rather than acting as a sink. Globally, more than 100 million hectares of land succumb to degradation annually because of the vicious trio - urbanization, deforestation, and overexploitation. The situation is further worsened by the drastic effects of climate change wreaking havoc worldwide. Climate change entails a shift in the climate over time brought on by anthropogenic activity or natural variability. It has become a complex global issue because of its long-term changes on the earth's climate patterns. Fluctuations in climate patterns negatively affect soil health by imposing adverse effects on soil microbial activity, nutrient availability, enhanced soil erosion etc. This causes decline in crop productivity which in consequence adversely affects food production systems and poses challenges on crop and livestock management. Human activities like rampant usage of fossil fuels; lack of appropriate treatments of industrial effluents and domestic wastes; uncontrolled deforestation; unplanned stubble and crop residue burning over large areas; extreme use of plastic products in daily life etc. is further adding fuel to the fire.

Impact of conventional farming practices on soil health

Conventional agricultural practices encourage monoculture; focus on intensive tillage by using heavy farm machinery; excessive use of synthetic fertilizers, weedicides, and pesticides; promote water intensive crop; keep soil bare in between crop cycles along with burning of crop residues. In fact, biomass burning in agricultural fields ranks third following industrial and vehicular emissions.

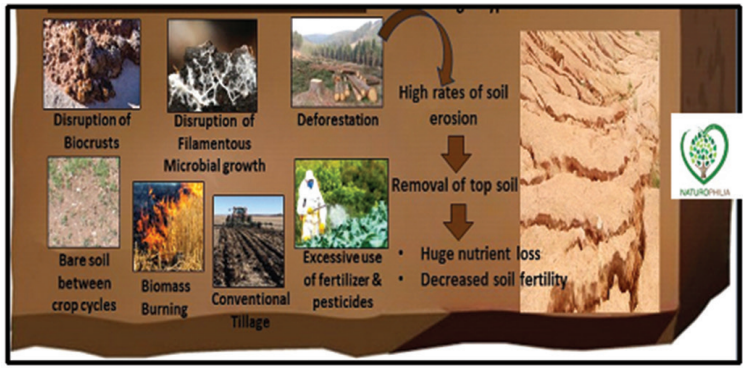

Fig.1: Conventional farming practices adversely affecting soil health

All these practices not only take a toll on the environment but are also expensive for the farmers because of the high fertilizer prices due to soil nutrient imbalances, excessive water consumption rates, increased paid labor charges involved in farming activities with a concurrent loss in soil structure and its healthy microbiomes. The India-wide impact of various climate disasters is tabulated in Table 1. Hence, there is a crucial need for climate smart and sustainable integrated waste management strategies for utilisation of crop waste residues along with building SOM and enhancing SOC, as an essential step toward building healthy soils.

Biochar as an emerging sustainable tool for soil health restoration

Sustainable agricultural practices like minimal tillage; mulching; crop rotations; cover cropping; planting multifunctional trees and green manure crops; use of compost, farmyard manure (FYM), vermicompost, jeevamrut, fish amino acids as natural soil amendments can hugely contribute towards this goal while reducing carbon losses. Use of charged biochar, a type of charred natural amendment, as a good practice for soil health augmentation is fast gaining popularity. Long lasting influences of charged biochar on the quality of soil, its recalcitrance, ease of making and economic considerations make this natural soil amendment popular. International Biochar Initiative, 2012, defines biochar as "a compacted material produced by the thermochemical reduction of biomass in an oxygen limited environment", whereas charcoal is defined as "a dark or black porous carbon primed from vegetable or animal materials where the air is excluded". Although the use of biochar in soil is recently getting traction, its use in soil to boost has been documented as long as hundreds of years ago. Terra Preta de Indio, thousand acres of cultivated black soils in Amazon Basin had been reported to be laden with biochar. This biochar is hypothesized to be anthropogenically added, with the area having high fertility to date.

Biochar production methods

Biochar is made through pyrolysis of biomass i.e., heating the biomass at high temperature (400-800°C) in absence of oxygen (Adwani and Singh, 2023). It can utilize feedstocks like agrowastes; forest wastes including wood, bamboo; municipal wastes and animal manures. Besides, biochar production can also use unconventional feedstocks such as invasive plants like mesquite (Prosopis juliflora), water hyacinth (Eichhornia crassipes) and kudzu (Pueraria montana), etc. (Nguyen et al., 2019). But to be economically feasible the biomass feedstock should be sourced locally and make use of underutilized lignocellulosic natural resources otherwise considered to be waste (Chakraborty 2025).

Image 1: Biochar production in TLUD

Use of high temperature during pyrolysis provides enough heat to deconstruct the biopolymers like cellulose, hemicellulose, lignin etc. As the process is oxygen deficient, instead of combustion, the biomass thermally decomposes into combustible gases and bio-char. The combustible gases can be further condensed into a combustible liquid, called pyrolysis oil (bio-oil, pyrogenic acid bio-oil) which is a dark, viscous liquid. The gases produced during biomass pyrolysis

include gases including methane, hydrogen, carbon monoxide, and carbon dioxide, etc. (Balat et al. 2009). The aromatized structures and alkyl groups formed by these elements are the main components of biochar.

A plethora of techniques exists for biochar production ranging from very low cost, crude, traditional methods to highly sophisticated, advanced, automated industrial ones. Generally, the low-cost methods utilising pits, retorts, kilns, barrels are utilized by farmers for the ease of production and economic feasibility. These types of biochar are designated as artisanal and are often made in low-tech settings and community-based manners. Due to less rigorous quality control, these may suffer from variability in production quality. However, with appropriately trained manpower and regular practices this barrier can be overcome. Whereas large-scale, industrial technologies ensure stringent quality control, operate under standardized production conditions, go through rigorous testing, and certification for reaching specific standards.

Because of specialized equipment and infrastructure, the industrial set-up has higher installation and operational costs, but with proper planning and monitoring can achieve economically successful. Generally, industrial biochar offers higher quality and regular supply of consistent quality of biochar, due to stringent control potentially leading to broader scopes of its applications and reliable carbon sequestration. Biochar thus produced is raw, nutrition less and needs to be modified according to the needs of final application. Particularly for soil-based applications charging and inoculation are mandates. It can be done by mixing biochar with natural soil amendments e.g. compost, farmyard manure, vermicompost, fish amino acid, jeevamrut, compost tea or co-composting biochar by mixing with compostable materials and composting it.

Factors affecting biochar production quality

The characteristic features of any biochar like high surface area, porosity, water holding capacity etc. depends on the biomass feedstock type (plant/animal/waste), species, quality, size (length, dia) based sorting, moisture content and density. Moisture content of the feedstock can be a significant rate-limiting factor during pyrolysis and can affect biochar yield and quality like ash and mineral content severely. A moisture range of 10-15% is generally recommended. Size sorting of feedstocks is another important factor influencing biochar quality. If the feedstock is cut too big the heat transfer will be poor because of the lower ratio of surface area-to-volume which implies heat is not able to reach the core. It can cause incomplete pyrolysis, producing char inside while leaving raw feedstock material inside; slower decomposition, reducing yield of valuable gases and pyroligneous acid/bio-oil. Whereas if the feedstock is too small/finely chopped, there will be a high amount of dust generation, clogging and fouling of equipment facing reduced efficiency, imposing safety risks, increased maintenance, and operational challenges (Chakraborty 2025).

Porosity of a biochar determines its ability to interact with water and the nutrients it carries. The nanopores (<0.9 nm), micropores (<2 nm), mesopores (i.e., diameters between 2-50 nm) can adsorb liquids, whereas the macropores (i.e., >50 nm diameter) can retain plant-available water. Micro and mesopores of biochar act as capillary spaces having large surface area to volume ratios enabling them to retain moisture.

Effects of charged and inoculated biochar on soil health

1. **Better soil structure:** The charged surfaces of biochar can bind with soil peds together to form stable aggregates although the ability varies depending on biomass feedstock, pyrolysis temperature, and amount of application. Biochar also improves soil structure by reducing soil bulk density; enhancing

aeration, by creating channels and spaces; and thereby aiding to heal high soil compaction.

2. **Improvements of beneficial microbial activity:** Biochar's high surface area and porous nature provides viable, stress free space for microorganisms to proliferate. Hence a conducive environment promoting the deposition of microbial exudates and enhanced mycelial growth occurs, increased mineralization which aids to bind soil particles together improving soil aggregation. Besides, as the soil microbes are involved in various biochemical reactions, they often suffer from an imbalance of electrons. To overcome this, they use microbial appendages like pili to reach out to other bacteria. However, the number of bacteria to aid with electron deficit is often low and their pili have limited conductivity (Churchill 2022). To remediate this, biochar can transfer electrons either by geobattery mechanism or by a much faster and more prolific mechanism of geoconducting. The former mechanism is displayed by biochars produced at temperatures under 600˚C, whereas the latter is achieved by biochars produced at temperatures above 700˚C.

3. **Soil fertility and nutrient availability:** Biochar application improves the soil's ability to absorb and hold onto nutrients, preventing nutrient leaching and increased availability of nutrients to plants through slow release over a longer period. Greater surface area, presence of hydroxyl and carboxy functional groups on surface, and variable charges of biochar improve the cation exchange capacity (CEC) of the soils (Van Zwieten et al. 2010).

4. **Enhancement of soil water retention:** Due to its porous nature and high surface area, biochar has the potential to facilitate better water infiltration in soil and improve soil water retention ability. The presence of microspores and mesospores in biochar facilitate this. This is especially helpful in arid and semi-arid regions where water scarcity has been a major constraint to crop production. Age of the biochar significantly influences its soil moisture retention ability rather than its application rates (Martin et al. 2023).

5. **Improvement of soil organic carbon content:** Biochar carbon is thermally stable and can resist biotic and abiotic degradation decomposition for a very long time thus enhancing carbon sequestration level of soil (Zheng et al. 2018). It can remain in soil for years when applied and builds soil organic carbon and improves the fertility of soils. It also plays a key role in regulating soil carbon sequestration. Incorporation of charged biochar/biochar-compost/co-composted biochar/biochar-FYM mixtures in soil increases the SOC and SOM content and also enhances beneficial soil microbial activity (Gross et al. 2024). ASDC Naturophilia Agrotech Pvt. Ltd. is working on this aspect of biochar utilizing cotton stalk feedstocks.

6. **Soil acidity remediation:** Due to the presence of alkaline minerals and carbonates formed during pyrolysis, biochar has an alkaline pH. The pH of biochar is also closely related to the pyrolysis temperature at which it is prepared. Incorporation of biochar in soil reduces soil acidity by binding the plentiful H+ ions of acidic soils with its '-'vely charged functional groups. Increased soil pH helps to enhance nutrient bioavailability and microbial activity, benefiting acidic soils (Olayemi et al. 2025).

7. **Enhanced nitrogen use efficiency:** Biochar aids the slow release of nitrogen during fertilizer mineralization, thus nourishing the plant throughout its growth stages (Wang et al. 2022). A recent study reported a high increase in nitrogen and phosphorus uptake by 74%-80% and 76%-95% respectively by tomato plants with biochar usage, and an increment in tomato yield by more than 50% even with less nitrogen fertilizer application (Guo et al. 2021).

8. **Remediation of contaminated soils:** Biochar has the potential for remediating contaminated soils defiled by excessive exposure to toxic trace metals (often addressed as heavy metals), pesticides, weedicides; reducing soil enzymatic and microbial functions. Such affected soil sites have less conducive and even fatal plant growth conditions (Safaei Khoran et al. 2016; Borowik et al. 2023). Use of modified biochar can remediate such soil sites due to its high adsorption capacity that allows it to bind heavy metals or organic pollutants, preventing those being up taken by plants and thereby reaching deep down in the food chain. The adsorption capacity of any biochar is directly proportional to its functional groups, cation exchange capacity (CEC) and surface area (Yaashika et al. 2020). The factors influencing the effectiveness of soil toxicity remediation by biochar are feedstocks, biochar application dosage, and method of applications, soil properties and heavy metal species (Wang et al. 2021). ASDC Naturophilia Agrotech Pvt. Ltd. is working on this aspect of biochar utilizing different feedstocks.

9. **Amelioration of the impact of biotic and abiotic stress:** Biotic and abiotic stresses often lower crop nutrient uptake and productivity. Which can be solved by biochar application. For instance, in saline soil, nutrients and water uptake by plants improves biochar incorporation. This is because biochar improves cation exchange capacity enabling it to adsorb sodium, making them less bio-available and raising the calcium and magnesium level, thus modifying the soil pH, and promoting crop growth.

10. **Reduction of GHG emission:** Biochar incorporation in GHG emissions specifically significant contributors like nitrous oxide (N_2O), carbon dioxide (CO_2), and methane (CH_4) (Sultan et al. 2024). The biochar mechanisms of GHG reduction may vary based on the environmental conditions and specific GHG, but the overall impact is consistent over different ecosystems.

Current Indian scenario : Soil management practices for healthy soils are receiving continuous support through various schemes of Government of India like Rashtriya Krishi Vikas Yojana (RKVY), Paramparagat Krishi Vikas Yojana (PKVY), Pradhan Mantri Krishi Sinchayee Yojana- Per Drop More Crop (PDMC-PMKSY), National Mission on Natural Farmingall focuses on improving the productivity and sustainability of rainfed agriculture, organic farming and better natural resource management and better utilizations of water resources in rainfed areas. Although use of biochar is not yet particularly incentivized under any schemes, use of

Image 2 Application of biochar in turmeric field (courtesy: Aranya Permaculture, WeAct Bio)

biochar can aid towards achieving the designated goals of these schemes. India is facing a severe soil crisis, with vast areas of land suffering from erosion, the loss of fertile topsoil, and a critical decline in soil organic carbon. This degradation poses a significant threat to the nation's agricultural productivity, food security. Incorporation of charged and inoculated biochar in soil can solve these issues extensively by improving soil structure, enhancing nutrient retention, better moisture retention and fostering a vibrant microbial community while ensuring consistent crop yields. Moreover, biochar production can act as an extra source of sustainable income for farmers, aiding better natural resources management while acting as a powerful and sustainable tool for the recovery of soil health.

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Capacity Building for FPOs

Introduction

Capacity building is a process for strengthening the management and governance of an enterprise, business or social, to attain its objectives and mission.

Capacity building is an intervention that strengthens an organization's ability to fulfil its mission by promoting sound management, strong governance, and persistent rededication for achieving results. It can also be defined as the process of developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities need to survive, adapt and thrive in a fast-changing world.

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Capacity building for the management of Farmer Producer Organizations (FPOs) involves developing the skills, knowledge, and capabilities of individuals involved in FPO management. It aims to strengthen their capacity to effectively lead, plan, implement and monitor FPO activities.

Benefits of Capacity Building for FPOs

Capacity building is important and valuable for the development of the FPO and society at large. Its benefits include:

i. Capacity building programs have long-term impact on the participants.

ii. Capacity building fosters a sense of ownership and empowerment on the members for the effective operations of the activities of the FPO.

iii. It strengthens confidence, skills, knowledge, and creativity of the participants.

iv. Knowledge and skills imparted through Capacity building programs minimize an over-reliance on outside experts as resource person. This encourages members to take action on small and local issues themselves.

v. Capacity building is essential in creating sustained change in communities

Types of Capacity Building

Capacity building is a very wide and inclusive term. It involves developing and enhancing the capacity of individuals, institutions and community to address specific challenges, meet goals and achieve desired

outcomes. The process of capacity building varies according to trainees. Broadly, there are three types of capacity building programs:

Types of Capacity Building Programs

i. Individual Capacity Building focuses on enhancing the knowledge, skills, and competencies of individuals to perform their specific roles effectively. It includes training programs, workshops, coaching, and related professional development activities.

ii. Organizational Capacity Building aims to strengthen the capacity of organizations, such as businesses enterprises including Farmer Producer Organizations (FPO), Social enterprises (NGOs), government agencies, or. It involves improving organizational processes, structures, systems, and resources to enhance performance and achieve objectives.

iii. Community Capacity Building involves empowering communities to address their own needs and challenges. Focus is on enhancing the collective abilities of community members to participate in decision-making, take action, and be the change makers of society.

Modes of Capacity Building Programs in FPOs

Overall, capacity building plays a critical role in empowering individuals, organizations and communities to achieve their full potential, address challenges and contribute to positive change. It fosters sustainable development, resilience and collaboration, ultimately leading to improved impact and outcomes. Below are various modes of capacity building programs giving the areas of specialization for FPO management:

Training and Workshops can cover various aspects of FPO management, including:

a. **Governance and leadership:** Focusing on developing effective governance structures, decision-making processes and leadership skills within FPOs.

b. **Financial management:** Providing training on financial planning, book keeping, accounting, budgeting and accessing financial services and schemes.

c. **Marketing and value addition:** Equipping FPO managers with knowledge on market trends, value chain analysis, branding, packaging and quality standards.

d. **Sustainable agriculture practices:** Training on modern farming techniques, organic farming, crop diversification and resource management to enhance productivity and sustainability.

e. **Social empowerment:** Including sessions on gender mainstreaming, inclusivity, social equity and community engagement.

Skill Development: FPO managers require specific skills to effectively manage their organizations. Capacity-building efforts can focus on:

a. **Business development:** Enhancing skills in business planning, market research, product development, and strategic partnerships.

b. **Negotiation and advocacy:** Equipping managers with negotiation skills to secure fair prices, contracts, and access to inputs and services.

c. **Communication and networking:** Enhancing interpersonal and communication skills for effective collaboration, stakeholder engagement, and networking.

d. **Data analysis and technology adoption:** Developing skills in data collection, analysis, and utilizing technology for decision-making and farm management.

Networking and Knowledge Exchange: Participation in networking events and knowledge-sharing platforms can provide valuable opportunities for FPO managers:

a. **National and international conferences:** Attending conferences, summits, and workshops focused on agricultural development, cooperative management, and rural entrepreneurship.

b. **FPO-specific platforms:** Joining FPO networks, associations, and forums that facilitate knowledge exchange, experience sharing, and collaboration among FPOs.

c. **Exposure visits:** Organizing visits to successful FPOs, agricultural research institutions, and agribusiness enterprises to learn from their experiences and best practices.

Access to Information and Resources: Ensuring FPO managers have access to relevant information and resources can enhance their decision-making:

a. **Online platforms:** Providing online portals, websites, and databases with information on market trends, government schemes, agricultural practices, and success stories of FPOs.

b. **Government support:** Enabling FPOs to access information about government programs, subsidies, grants, and policies that can benefit their operations.

c. **Agricultural research institutions:** Collaborating with research institutions to disseminate research findings, innovations, and technologies to FPO managers.

Mentoring and Coaching: Engaging experienced mentors or coaches can provide personalized guidance and support to FPO managers:

a. **Matching mentors:** Pairing FPO managers with mentors who have expertise in areas such as cooperative management, business development, or agricultural marketing.

b. **Regular interactions:** Facilitating regular meetings or virtual sessions for mentoring and coaching, where mentors can provide guidance, advice, and feedback.

c. **Goal setting and progress tracking:** Setting goals and monitoring progress with the help of mentors to ensure continuous improvement and achievement of desired outcomes.

Monitoring and Evaluation: Establishing systems for monitoring and evaluating FPO performance and manager's capacity building efforts:

a. **Performance indicators:** Defining key performance indicators (KPIs) to measure the success of FPOs in areas such as financial management, market linkages, and farmer empowerment.

b. **Feedback mechanisms:** Collecting feedback from FPO managers and members to assess the impact of capacity-building initiatives and identify areas for improvement.

c. **Learning from evaluations:** Using evaluation results to refine training programs, modify strategies, and improve the effectiveness of capacity-building efforts.

Beneficiaries of Capacity Building Programs

The Capacity building programs are aimed for various stakeholders of FPOs viz. members, Chief Executive Officer (CEO), Board of Directors (BOD) and Chairman. Various programs are designed and conducted for a group of FPOs having common activities and its beneficiaries.

1. **Members** of FPOs are essentially primary producers that include farmers, milk producers, fishermen, weavers, rural artisans, craftsmen etc. These also include small and marginal farmers and landless labourers. Training programs for the members are focused on technical aspects. The idea behind this training program is to enhance the technical skills of the members in their respective field of working to enhance the productivity. For example, the members of FPOs in dairy business can be trained for better occupational practices or members of FPOs in rice cultivation activity can be trained for improved cultivation, harvesting, milling and storage practices for rice.

2. CEO (Chief Executive Officer) is the top-ranking employee in the FPO and is responsible for the overall performance of the business. He is the public face of the organization and accountable to the Board of Directors and other Stakeholders. His role is multi-dimensional and so are his training needs. He is expected to perform many functions to complete day to day routine operations and give support to the Board, Chairperson and other office bearers. CEOs need to be trained for better marketing of their products by identifying their customer and niche market, for Input procurement, administrative works, financial aspects for dealing with day to day banking works and routine accounting.

   Marketing and input procurement training are imparted for specific commodity or group of commodities like dairy, fishery, pulses and grains, fruits and vegetables etc. Training for other activities like administrative, financial and legal compliances etc. are usually conducted for a particular geographical area.

3. **Board of Directors** is a group of people that provides guidance and advice to CEO and executive team of a FPO. The Board provides general oversight of operations without getting involved in day-to-day operations.

Board members also need to undergo specialized training to carryout various responsibilities related to mobilization of members and capital, evolution of business model, preparation of business plan, execution and evaluation of business plan, mobilizing financial resources (loan, subsidy, working capital syndication), availing benefits of State and Center sponsored schemes etc.

Since Board of Directors are initial administrative body of the FPO, they need to be well versed with the business operations and handle properly till CEO is appointed. So they need to be trained in all the aspects that are needed for CEO also.

Various Agencies involved in the Capacity Building of FPOs

There are many Government and non-government agencies involved in conducting the capacity building programs for FPOs. Mainly these Government agencies include:

NABARD

The National Bank for Agriculture and Rural Development (NABARD) plays a significant role in supporting Farmers Producer Organizations (FPOs) in India. NABARD is a specialized financial institution that operates under the guidance of the Reserve Bank of India (RBI) and the Ministry of Finance. Its primary mandate is to promote sustainable and equitable agriculture and rural development. It provides financial and non-financial support to promote FPOs, with an objective to enhance the livelihoods of small and marginalized farmers.

Capacity Building of FPOs is one of the important aspects that NABARD takes care by conducting training and capacity-building programs for FPO members, CEO and Board of Directors. These programs aim to enhance their knowledge and skills in areas like agricultural best practices, financial management, marketing strategies and governance etc.

NABARD has created a Training facility for capacity building and skill development of FPOs at Bankers Institute for Rural Development (BIRD), Lucknow and Laxman Rao Inamdar National Academy for Co-operative Research & Development (LINAC), Gurugram.

NCDC

NCDC (The National Cooperative Development Corporation) is a statutory corporation in India that operates under the Ministry of Cooperation, Government of India. Initial mandate of NCDC was primarily to focus on promoting and supporting cooperatives and cooperative development in various sectors of the economy, including agriculture. Currently, NCDC has also played a significant role in supporting and funding Farmers Producer Organizations (FPOs). It is one of the Implementing Agency (IA) designated under the Central Sector Scheme for FPOs.

NCDC has promoted an institute viz. LINAC (Laxman Rao Inamdar National Academy of Cooperative Research and Development) that is primarily responsible for training activities of FPOs. LINAC is imparting training to the FPOs through CBBOs on the crucial topics like organizational management, crop husbandry, value addition, processing, marketing, trading, export, supply chain management, grading, branding, packaging, accounting, auditing, legal compliances, incubation, MIS etc. as may be relevant for the smooth functioning of FPOs.

NAFED

The National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED) is a cooperative organization that plays a significant role in the agriculture sector. It operates under the Ministry of Agriculture and Farmers Welfare, Government of India. NAFED is primarily involved in marketing agricultural produce and supporting farmers' cooperatives. It is one of the Implementing Agencies for promotion of FPOs under the Central Sector Scheme of Government of India.

NAFED conducts training and capacity-building programs for FPO members. These programs aim to enhance their skills in areas such as marketing strategies, quality assurance, and value addition.

Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM)

This is a flagship program of the Government of India aimed at promoting poverty reduction and rural livelihood enhancement. While the primary focus of DAY-NRLM is on women's self-help groups (SHGs) and their federations, it also supports the promotion and development of Farmer Producer Organizations (FPOs) as part of its broader mandate. It contributes to FPO promotion by giving financial assistance, market linkages and value chain development. It is also instrumental in capacity building initiatives.

DAY-NRLM conducts training programs, workshops, and exposure visits for FPO members. It enhances their knowledge and skills on topics such as entrepreneurship development, agricultural best practices, financial management, marketing, and value addition. These capacity-building initiatives aim to strengthen the capabilities of FPOs and their members.

NAFPO

National Association for Farmer Producer Organisations (NAFPO) is registered as a non-profit, multi-stakeholder owned platform to support institutional development and business stabilisation for FPOs. The primary goal of NAFPO is to focus attention on the immense opportunity that FPOs present to transform agriculture in India and contribute towards the goal of doubling the farmers' income.

FPOs have diverse need of capacity building, mainly in the areas covering FPO operations, management, governance, compliances to human resource skilling, membership enhancement and tech adoption. In this respect, NAFPO has curated a training module for capacity building of FPOs at different stages of promotion and maturity. Various programs are designed considering the needs of all stakeholders and covering all the essential skills for a performing FPO.

State Government Agencies

STATE Government agencies in India play a crucial role in promoting and supporting Farmer Producer Organizations (FPOs) at the regional level. Some of these agencies are involved in Capacity building programs. Some of these are State Agricultural Marketing Boards, State Horticulture Mission, State Rural Livelihood Missions, State Cooperative Departments, State Agriculture Departments, and State Agribusiness Promotion Agencies etc. All these agencies provide technical training to FPOs as per their mandate.

Way Forward

As it is known that the concept of FPO is carved out to give strength to small and marginal farmers. FPOs are being envisaged as a tool for agripreneurship development and a feasible way to augment the farmers' income by exploiting the potential of these small farmers. Since FPOs are full fledge business entity with a lot of aspects to be handled, it needs a focussed approach towards the capacity building of all stake holders for proper functioning of the entity. It is evident from the above submission that capacity building is a significant tool for sustainability and consistent growth of FPOs. Many government agencies are playing a crucial role in this aspect. By taking the advantage of these programs, FPOs can explore their full potential and take the agriculture sector to the next level.

Role of Agriculture and Effect of Economic Reforms on Indian Agriculture

Abstract:

Agriculture has been the backbone of Indian economy, contributing lion's share to GDP, employment and food security.In India agriculture is a primary sector to play a key role in tranforming rural livelihoods and industrial linkages. This study examines the nature and significance of Indian Agriculture and also its persistent challenges like low productivity, dependence on monsoon, inadequate infrastructure, price volatility and credit constraints.This study also explores the impact of economic reforms on agricultural growth in India. This study highlights the evolving role of India's foreign trade, where its share has declined and policy intivaties for boosting in critical areas like rice and spices.This study emphasizez the need for sustainable methods, improved institutional support and interaction with global value chains to exploit the full potential of Indian agriculture in the period of globalization while simultaneousltu improving farmers' welfare.

Key Words: Indian Agriculture, Economic reforms, Fereign trade, Farmers Welfare.

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Background: Importance Of Agriculture

The majority of India's population, who reside in rural areas and makeup 58 percent of the nation's population, depend on agriculture for their livelihood, which also helps to shape the country's economy. 60 percent of the land in India is ideal for agriculture, and the country is known for its abundant biodiversity. The production of capital as well as the supply of raw materials to the industries are significantly influenced by the agricultural sector. By providing enough food grains, the Green Revolution increased agricultural productivity and helped the population's need for nourishment.

India ranked second in the world when it comes to agriculture, although some states still have issues with low output. Currently, the agriculture sector faces a lot of challenges and the same will be addressed in various ways, some are in the form of basic changes and others by way of policy support.

GDP From Agriculture

- Currently, the agriculture sector contributes over 15% of the country's GDP and employs more than 40% of all people in India. Because

it employs a significant number of people and ensures equitable growth, agriculture is regarded as the greatest private sector activity. By increasing per capita productivity, with priority given to agriculture, it is possible to both decrease poverty and stimulate the economy. In 2018–19, agriculture made up 15.96 percent of the GDP, down from 17.15 percent in 2013–14. The agriculture sector's growth has been erratic, rising from -0.2% in 2014–15 to 6.3% in 2016–17 before falling to 2.8% in 2019–20. Agriculture's gross fixed capital creation fell from 17.7% of Gross Value Added (GVA) in 2013-14 to 15.2%.

- The contribution of agriculture to the GVA has decreased from 18.2% in 2014-15 to 16.5% in 2019-20. The decline was mainly due to a decrease in the share of GVA of crops from 11.2% in 2014-15 to 10% in 2017-18. The share has been declining on account of the relatively higher growth performance of non-agricultural sectors. The following graph shows the various sectoral contribution to India's GDP for the last 10 years.

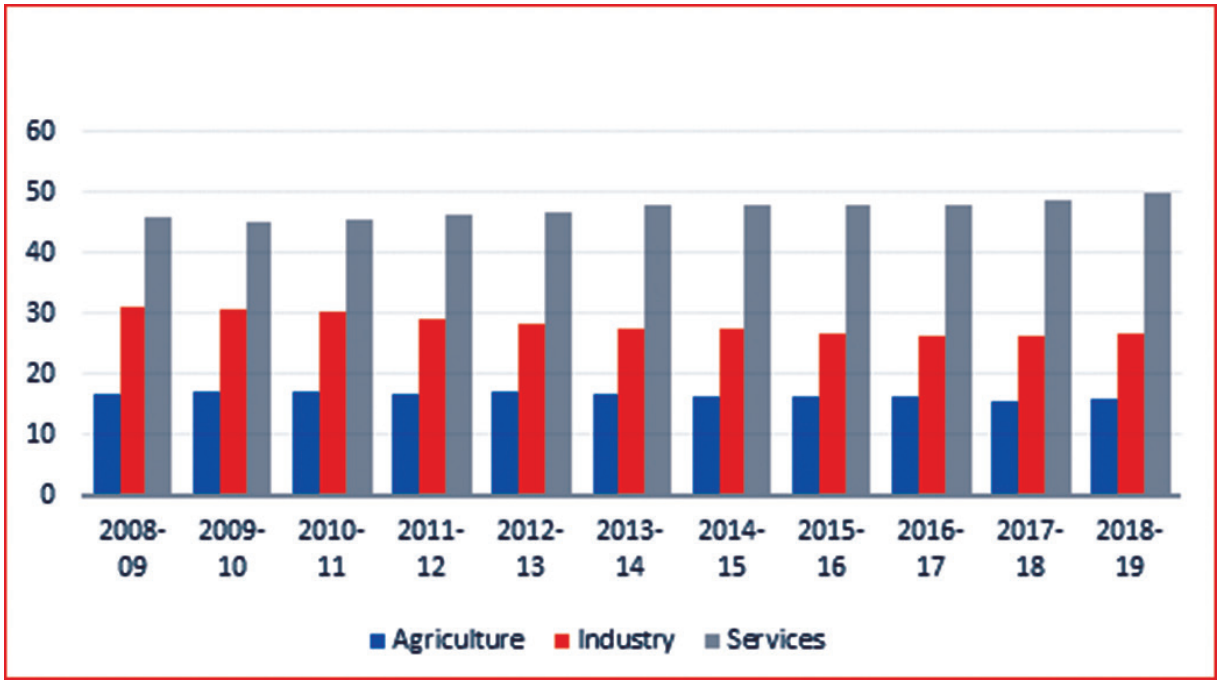

Figure 1: India: GDP distribution across various sectors 2009-2019

Source: World Bank @stats 2020

The aforementioned graph unequivocally demonstrates the declining GDP contribution of agriculture. Increased relative growth in non-agricultural sectors like industry and services was a major factor in this drop. From 1950 to 1961, the proportion of workers employed in agriculture decreased progressively from 75.9 percent to 59.9 percent, and from 2004 to 2005, it decreased again to 56.7 percent, a 19.2 percentage point decrease altogether. As a result, the labour productivity of agricultural workers increased little as compared to non-agricultural workers. Perhaps as a result of technological advancements made in non-agricultural industries. Other factors that prevent farming from being a feasible choice include an inefficient agricultural supply chain, high transaction costs, and high input expenses. By reducing the involvement of traders and trade intermediaries and establishing direct connections between farmers and consumers through agri-markets, these issues can be resolved (middlemen).

Agriculture Growth in India

India had an agrarian economy at first. Since 1950, or for nearly 70 years, the average annual growth rate in agriculture has been seen at 2.7 percent. Although agriculture was the primary focus of the first five-year plan, slower agricultural growth was observed, which is one of the factors contributing to India's delayed reduction in poverty. After 1991–1992, when the Indian markets were open, there was a minor increase in rates (figure 2). At that time, the reforms were mostly focused on non-agricultural sectors. The continued underperformance of this industry presents a number of challenges. The agriculture sector's targeted 4 percent growth rate is essential for a sustained total growth rate to exceed 9 percent. "Regaining agricultural dynamism" is a result of this. (Plan approach Paper, by Surabhi Mittal)

In the NSSO Situation Assessment Survey from 2002–2003, 40% of farmers said that, given the choice, they would choose to give up farming. In a similar vein, a microlevel study demonstrates that young people are not lured to employment related to agriculture (Himanshu et al. 2016). Agriculture needs to develop in order to increase the incomes of people who depend on it, by intertwined agriculture and non agricultural enterprises.

The theory of uneven growth discusses sectorial linkages and contends that agriculture's weak backward ties prevented it from becoming a leading sector (Hirschman, 1958). India's agriculture has changed dramatically in recent decades. Several factors have contributed to the rise of this sector, including increased household income, the expansion of the food processing industry, and an increase in agricultural exports. However, the bigger questions are related to equity, sustainability, and efficiency.

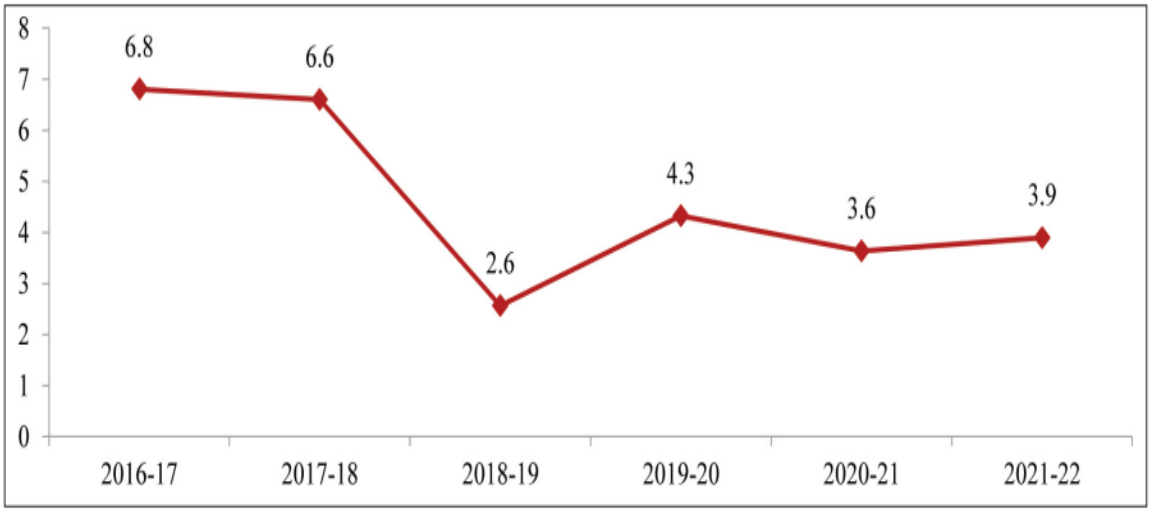

Figure 2: Agricultural growth (in percentage)

Source:Chapter7EconomicSurvey 2021-22https://www.prsindia.org/policy/discussion-papers/state-agriculture-india

One of the objectives of the Twelfth five-year plan targeting 4 percent agriculture growth and to lower the poverty rate by 10 percent by 2017. The key goal of this plan is to accomplish more inclusive, faster, and sustainable growth that can be achieved only by strengthening the agriculture sector. Accelerating economic growth in agriculture will increase the wage rates which in turn reduces unemployment among the rural poor.

The share of agriculture with respect to total workers dropped gradually from 1950 to 1961 from 75.9 percent to 59.9 percent whereas there was a further decline to 56.7 percent from 2004 to 2005, overall, 19.2 percentage points decline. This increases the labor efficiency in agriculture increased marginally compared with non-agriculture workers. This may be due to technological innovations happening in the non-agricultural sector.

Over 40% of the workforce in the country currently depends on agriculture for their livelihood, contributing over 14% of the country's GDP. However, the nation was able to grow in the secondary and tertiary sectors more quickly than the primary sector because of significant expenditures in infrastructure and human capital. Understanding the sector's poor growth rates and taking action to boost agriculture production is clearly necessary.

The agriculture growth has been fluctuating regularly from year to year; it went from a negative 0.2% in 2014–15 to 6.3% in 2016–17 before once more falling to 2.8% in 2019–2020. Though, there have been differences in performance amongst states. The researcher explored the reasons for these sectoral performance differences among states.

Maharashtra is regarded as one of the most economically developed and rapidly expanding states, with a growth rate of 9%, however, the agriculture industry is not doing well. The state's agriculture sector has numerous difficulties in balanced regional growth, including irregular precipitation, climate change, soil erosion and degradation, high input costs, market volatility, etc. The sector of agriculture and allied activities is one of the main pillars of the state economy. About half of the people residing in the state depend on this sector for their livelihood. The sector of agriculture and allied activities normally makes up 11.9% of the State's economy. The government is implementing a number of programs to better the lives of farmers in order to solve these challenges.

Maharashtra had remarkable potential in this sector and the above table shows that the Primary (agriculture) and tertiary sectors' growth is above the Indian average. The below table highlights the performance of Maharashtra in agriculture is slightly higher than India's average not up to the full potential of the state. The reason for the declining agriculture growth rates is potentially a lack of policy support for the last six decades. The other reasons like shifting the cultivable land to other uses, increasing fragmented land holdings, and shifting the occupation from farm to non-farm activities mainly due to affordability issues. These concerns can be addressed with farmer-centric policy support and make farming becoming an economically viable option, that incentivizes the farmers and others to take up this occupation in future. The below table reflects the state-wise targets fixed under the 11th plan.

Table-1.31 Sector wise targets for 11th plan

S. No.	State/UT	Targets fixed by Planning Commission for 11th Plan(2007-12)			
		Primary	Secondary	Tertiary	Total
1	**Uttarakhand**	3.0	12.0	11.0	9.9
2	**Bihar**	7.0	8.0	8.0	7.6
3	**Gujarat**	5.5	14.0	10.5	11.2
4	**Jharkhand**	6.3	12.0	8.0	9.8

S. No.	State/UT	Targets fixed by Planning Commission for 11th Plan(2007-12)			
		Primary	Secondary	Tertiary	Total
5	**Haryana**	5.3	14.0	12.0	11.0
6	**Maharashtra**	4.4	8.0	10.2	9.1
7	**Madhya Pr.**	4.4	8.0	7.0	6.7
8	**Rajasthan**	3.5	8.0	8.9	7.4
9	**Kerala**	0.3	9.0	11.0	9.5
10	**Andhra Pr.**	4.0	12.0	10.0	9.5
11	**Himachal Pr.**	3.0	14.5	7.5	9.5
12	**Tamil Nadu**	4.7	8.0	9.4	8.5
13	**Chattisgarh**	1.7	12.0	8.0	8.6
14	**West Bengal**	4.0	11.0	11.0	9.7
15	**Karnataka**	5.4	12.5	12.0	11.2
16	**Odisha**	3.0	12.0	9.6	8.8
17	**Uttar Pradesh**	3.0	8.0	7.1	6.1
18	**Assam**	2.0	8.0	8.0	6.5
19	**Punjab**	2.4	8.0	7.4	5.9
20	**J & K**	4.3	9.8	6.4	6.4
21	**Sikkim**	3.3	8.0	7.2	6.7
22	**Delhi**	4.1	12.0	11.1	11.2
23	**Mizoram**	1.6	8.0	8.0	7.1
24	**Goa**	7.7	15.7	9.0	12.1
25	**Tripura**	1.4	8.0	8.0	6.9
26	**Arunachal Pr.**	2.8	8.0	7.2	6.4
27	**Meghalaya**	4.7	8.0	7.9	7.3
28	**Manipur**	1.2	8.0	7.0	5.9
29	**Nagaland**	8.4	8.0	10.0	9.3
U.T.					
30	**A & N Islands**	6.4	5.0	5.4	5.4
31	**Chandigarh**	0.0	15.0	10.4	13.0
32	**Puducherry**	0.0	17.0	12.3	13.5
	ALL INDIA	**4.1**	**10.5**	**9.9**	**9.0**

Source-*Economic statistical Organisation Punjab, Central Statistical Organisation, New Delhi*

Punjab was much below the national average, the reason is that Punjab's agriculture is highly cross-subsidized with the industry. Hence the industries were shifted (migrated) to neighboring states had an adverse impact on the economy. It was one of the few regrettable instances where agricultural prosperity did not lead to more extensive structural change, due to the substantial union subsidies that have served to maintain the current quo's inefficiency. Punjab can be considered to be under a sort of foreign aid curse. Since Punjab now has a new government with a fresh perspective on policy, eliminating this crippling aid could act as a catalyst for the province to implement long-overdue reforms in its agriculture.

The motivation of the present research is to analyze and look at the reasons why some states grew faster than India's average growth. It is evident that agriculture in the major seven larger states (Gujarat, Maharashtra, Rajasthan, Madhya Pradesh Andhra Pradesh, and Orissa) grew faster between 2000-01 to 2007-08 after the growth rates become stagnant. The present research evaluates potential growth aspects of agriculture trade to the framers in India in various states.

Share of Agriculture in India's Foreign Trade

India ranks 15 among the top exporters of agricultural products in the global market. India has arisen as a key exporter of a few agricultural items like rice, cotton, sugar, coffee, and tea. According to the WTO's Trade Statistics, India's share in agricultural export and import in the world was 2.46 percent and 1.46 percent and the same were 43.47 USD and 27.31 USD billion terms, respectively. Understanding the significance of the agriculture sector in the Indian economy and the contribution of the sector to India's foreign trade is one of the key objectives of the present research.

The trade to GDP ratio in 1990-91 was around 11 percent which has increased to more than 30 percent in 2008-09 in India. There was a surge in India's agricultural exports after the economic liberalization, this obviously shows a greater degree of openness in the Indian Economy.

As per the recent economic survey India has continuously stayed as a key Agri-products exporter, amounting to 2.7 lakh crores and 1.37 lakh crores in exports and imports respectively in 2018-2019. USA, Bangladesh, Iran, Saudi Arabia, and Nepal are the main export destinations. However, India occupied an important place in global trade in Agri-exports still much more to achieve in the food processing industry and Agri-supply chains.

Global economic crises in the international economic environment after the establishment of WTO increased domestic competition in India. Average India's Agricultural product exports were 82.34 Billion rupees from 1991 until 2020 and reached an all-time high of 284.83 Billion rupees in March 2019. According to trading economics data.

"From 1991 to 2020, exports of agricultural products in India totaled 82.34 billion INR on average, with a record high of 284.83 billion INR in March 2019 and a record low of 4.95 billion INR in October 1991. The historical statistics for India's agricultural product exports is shown in the chart below. Exports of agricultural products from India" The following graph shows the trend line for agricultural exports from 1996 to 2020.

Figure 3: India's Agricultural Exports from 1996 -2020

Source:https://tradingeconomics.com/india/exports-of-agricultural-products

Agriculture and Economic Development Strategies

Given the importance of the agricultural sector and it continues to underperform due to many structural problems. A key concern in the agricultural sector development itself is not a pressing issue to the policymakers because there was a paradigm shift in the theory of development at the international level and certain developments in India refer agriculture to as an issue of secondary importance however, there is another view that in a large size country like India demand stimulus for industrialization would come from agriculture only. Increasing agricultural productivity, reducing rural poverty, and making agriculture a growth to factor in food security. World bank identified these as important challenges faced by the Indian agriculture sector which need to be addressed on priority.

In addition to the above, there are other goals for the implementation of agricultural policies to achieve specific outcomes in domestic agricultural product markets namely price stability, product quality guaranteed supply, employment, and land use. In order to achieve these objectives the government usually uses some basic tools like subsidies, price controls, and import barriers, however, any government intervention leads to a welfare loss.

The above problems also offer some opportunities to promote agricultural growth. Capital formation in this sector plays a critical role.

- Money saved from the reduction in agricultural subsidies (input subsidy, fertilizer subsidy) should be utilized for capital formation.
- Interstate variations in capital formation need to be reduced by steeping up investments in backward regions.

- Avoid deals in the disbursement of funds under the Rural Infrastructure Development Fund(RIDF).
- Enhancing the institutional support in the felid of agricultural credit with help of NABARD will address the important supply-side factors which contribute to agricultural production.

Reducing The Rural Poverty

Agriculture remains the largest key contributor to the livelihoods of the world's poor who lives predominantly in rural areas. A high growth target is an important aspect of agriculture policy. Hence there is a greater need for encouraging sustainable agriculture growth by developing sound and enduring rural non-farm sector. designing policies to help the farm sector and enhance the synergies between the farm and non-farm sectors should focus on efficient supply chains.

India witnessed high growth rates after economic liberalization in the 1990s, but it is clearly noted that slower growth rates in agriculture were one of the main reasons for slower poverty reduction. Agricultural policy changes occurred only at later stages, even then they were partial. So, the evidence suggests that successful agriculture-led reforms reduce poverty faster.

Knowing the Reasons for Regional Indifferences

Exploring the reasons and understanding the implications of the persistent regional disparity is very important for economic development. Rising inequality should not lead to the worsening of income levels for farmers in low-productivity regions. There is a need for measures to promote balanced regional development in the form of policy responses countering regional productivity differences. Encourage more investments in institutions and technology enhancements, especially in low-productivity regions. The unfolding regional nature of Indian Agriculture is likely to be more balanced if there is a contented coincidence of more investments, technology distribution, and empowering policies in low-productive and backward regions.

Impact of Economic Reform Process on Indian Agriculture

The reforms led to impressive rates of economic growth in the 1990s, but since reforms were largely focused on non-agricultural sectors they have limited impact on overall economic development.

What factors will push India to adopt a more liberal approach to international trade?

India places more importance on domestic political factors than on external ones. Reforms will continue to be hampered by the need to protect local entrenched interests, jobs, and revenue sources. India's economic worldview will eventually need to shift if it is to take a more open stance toward international trade. It is crucial that Indian authorities see trade liberalization as a driver of economic progress that increases both personal and societal wealth. There are new forces that might propel such a change.

The agricultural sector calls out for major strategic reforms mostly on the following:

- India's comparative advantage
- Developing efficient domestic and global markets for agri- products
- Environmental sustainability

Twelfth Five Year Plan (2012-2017) agriculture is considered as uppermost in the reform agenda and mainly focussed on inclusive growth. The agricultural sector is the foundation of the rural Indian economy around which socioeconomic privileges and deficiencies would turn around. Any changes to its structure will have a greater impact on the well-being of the people. Sustained agricultural development is a key strategy for the success of economic reforms which are critical for the growth process. One of the major reforms is to remove the hurdles to growth.

- Reducing poverty
- Increasing Living standards
- Guaranteeing Food Security
- Significant contribution to the national economic growth
- Creating a resilient market for the development of industry and services

To accomplish the aforementioned objectives, encourage both the public and private sectors to invest in agriculture. Although the private sector is motivated by incentives (earnings), the government must permit and control the process as a free referee to ensure that farmers benefit sensibly from new technologies. This is where the issue of a lack of trust between the various participants in this sector (government, businesses, and farmers) arises. These difficulties will pose important topics that are worth exploring. How may the Indian agricultural sector's growth be accelerated? Is India prepared for the second wave of reforms to address the sector's challenges? What role does the private sector play in Indian agriculture?

Our nation's problems, such as poverty and unemployment, have not been helped by these measures. The lack of governmental investment in the agricultural industry is the cause of the agricultural sector's sluggish growth. Unexpectedly, economic changes have helped Indian markets become more accessible to foreign players than vice versa, which is clearly demonstrated by the trade deficit. Additionally, regional inequities have not been reduced by economic changes.

In order to achieve equitable and balanced growth across all sectors and regions, second-generation reforms are an additional critical development and condition. In contrast to the first-generation reforms, which were plagued by crises, the second-generation reforms are purposefully focusing on improving the current infrastructure and removing barriers to development.

Innovation, science, and technology are crucial public policies that can improve the outcomes of rural-urban links. It is important to remember that public research and extension had been envisioned as the only sources of innovation capable of spurring growth in the agricultural industry. Knowledge may grow as a result of investments in research and technology, but innovation culture may not necessarily spread throughout the entire system. Incorporating farmer innovation into agricultural knowledge systems is necessary. An understanding of the innovation process, the roles of science and technology, and an emphasis on wider stakeholder participation, links, and the institutional context within which innovation occurs will therefore be made possible by a more holistic and comprehensive framework. After finding the results of the research demonstrated the public agencies' market intervention activities, institutional and structural reforms and Technology Mission plays a significant role. Also, this shows that there is some potential to increase agricultural output through improvements in technological efficiency.

Conclusion

The agricultural sector is crucial for creating both forward and backward linkages because it supplies raw materials for agro-based industries like sugar, textiles, processed ood, food products, paper, and jute. It also serves as a market for equipment like trackers, pump sets, other machinery, and inputs like fertilizers, pesticides, insecticides, and light consumer goods. In terms of investment subsidies and minimum support prices, India has been pouring a lot of money into the agricultural industry. Investments in agriculture and technology have made India autonomous and a leading producer of several agricultural goods worldwide. The impact of agricultural research is amply demonstrated by the green revolution in crops, the yellow revolution in oil seeds,the white revolution in milk production, the blue revolution in fish production, and the golden revolution in horticulture. However, this did provide any edge in global agricultural markets, due to the institutional and technological variables, which are the key causes of this lopsided growth. Lack of irrigation services, insufficient fertilizer application, sparing use of seeds with high productivity, insufficient plant growth, incorrect harvesting methods, and a lack of farm mechanization. Regarding institutional issues including the failure of land reforms, the fragmentation of land holdings, inadequate commercial infrastructure, the lack of financial and credit support for reinvestment in agriculture, and the web of rural debt. These are a few of the causes that are still present and continue to have a detrimental impact on agricultural productivity.

Agriculture productivity in India is unstable, as seen by the recent rise in farmer suicide cases and the serious reliance of this industry on the monsoons. Lack of irrigation has inculcated a huge degree of resource deficiency and has spelled clearly a need for alternative resource accentuation, especially in the area of integrated watershed development. Sustained efforts to be made by the policymakers and government agencies for the establishment of technology and infrastructure.

The main policy areas for the second generation of reforms are the establishment of a comprehensive safety net system, the expansion of rural credit, debt-waiver policies, risk hedging and mitigation, the setting of market support prices, agricultural marketing, and dealing with issues relating to agriculture at the WTO. Recent policy changes, including the doubling of farmer income and the introduction of three farm bills, demonstrated India's commitment to agricultural reforms. Therefore, regional and micro level studies are necessary to investigate and analyze the reasons behind this severe agricultural distress and regional inequities.

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A Critical Analysis of the Deviation between Budgetary Allocations and Actual Spending of Agriculture and Allied Activities

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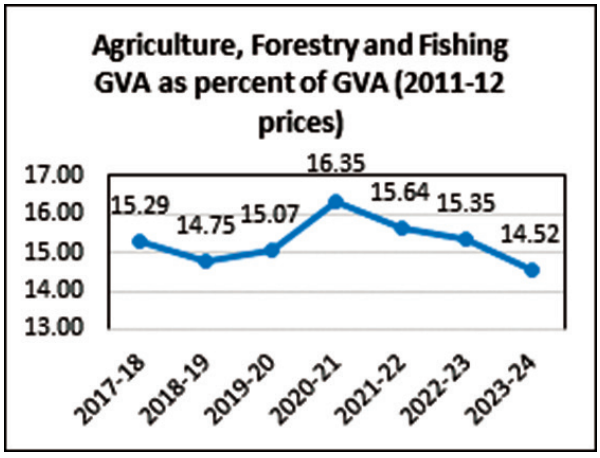
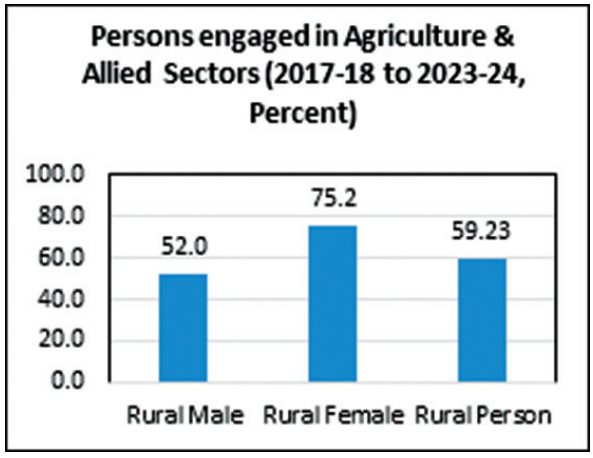
Introduction

The significance of agriculture and allied sectors in the Indian economy cannot be undermined as the thrust of these sectors includes promotion of inclusive growth, enhancement of rural incomes, providing employment and ensuring food security (https://mospi.gov.in/sites/default/files/Statistical_year_book_india_chapters/Ch_8_SYB2017.pdf). The share of agriculture and allied sectors in overall GVA since 2017-18 has been around 14-15 percent; PLFS data, however, over the same period indicates that these sectors provide employment to 59.2 percent of the rural workforce. The nuanced implications of employment in these sectors is crucial since on an average during 2017-18 to 2023-24, 75.2 percent of rural females and 52 percent of rural males were employed in agriculture and allied sectors (Figure 1).

Figure 1: Sectoral Share in GVA and Employment: Agriculture & Allied Sectors



Source: *Author calculation based on Reserve Bank of India, Handbook of Statistics (various issues)*



Source: *Author calculation based on Periodic Labour Force Survey (various issues)*

Given the substantial employment and more so, female employment provided by these sectors, understanding their budgetary allocation and utilization becomes pertinent. The budgets of the agriculture and rural sector are focused on the farmer and on farmer welfare and addressed by an umbrella of ministries viz. Ministry of Agriculture and Farmers Welfare, Ministry of Cooperation, Ministry of Fisheries, Animal Husbandry and Dairying, Ministry of Food Processing and Ministry of Rural Development.

The central government, further, implements different central sector schemes and centrally sponsored schemes that address a range of concerns that spans credit, insurance, income support, infrastructure, crops including horticulture, seeds, mechanization, marketing, organic and natural farming, farmer collectives, irrigation, extension, procurement of crops from farmers at minimum support prices, digital agriculture https://www.indiabudget.gov.in/ II. Performance Analysis

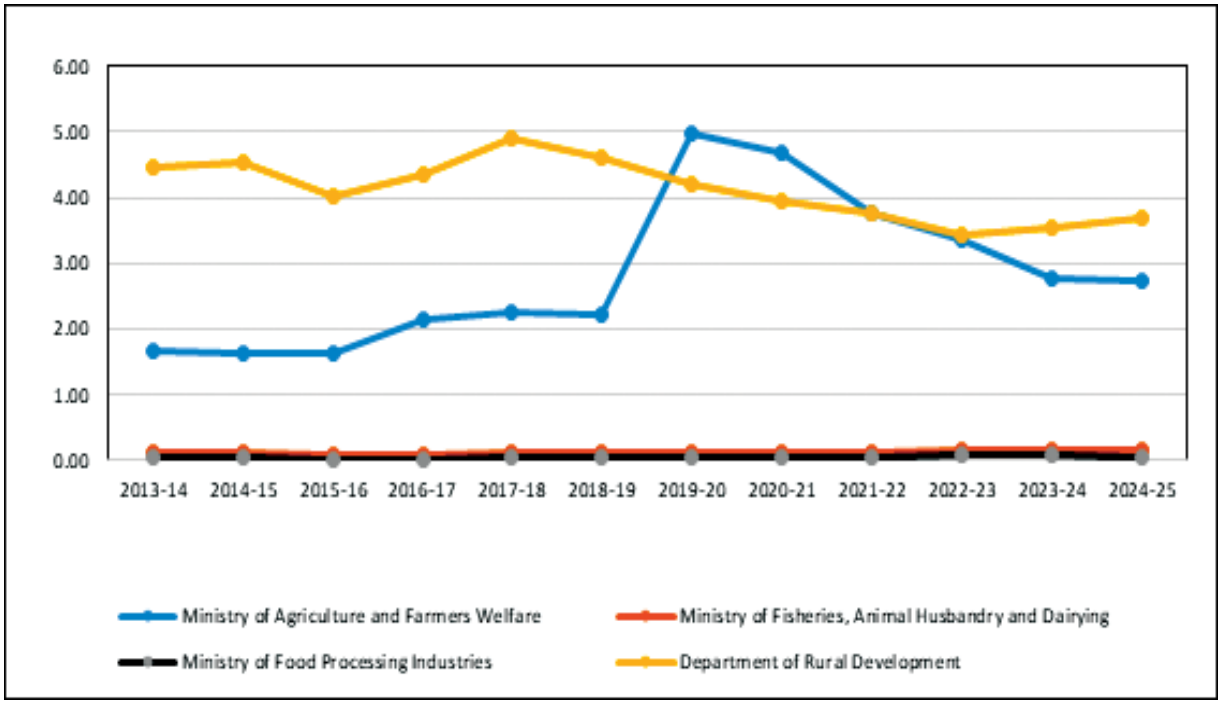
The funding of the agriculture and allied sectors in India is primarily through budgetary allocations and central sector as well as centrally sponsored schemes. The focus of performance assessment is on the budget allocations and its utilization by four union ministries viz. Ministry of Agriculture and Farmers Welfare, Ministry of Fisheries, Animal Husbandry & Dairying, Ministry of Food Processing and Ministry of Rural Development for the period 2013-14 to 2023-24 while performance of central sector schemes and centrally sponsored schemes (CSS) of these four ministries are examined for the time span 2016-17 to 2023-24. The performance has been examined using Public Expenditure and Financial Accountability [PEFA] (2016) Assessment framework.

Figure 2 plots the budgetary expenditure allocations and the actual expenditure incurred from these allocations by each of these ministries for the years 2013-14 to 2024-25.

1 WPR = (Number of Persons Employed/Total Population) ×100

Figure 2: Ministry wise Expenditure Budget as a percent of Total Expenditure

(Budget Estimate)

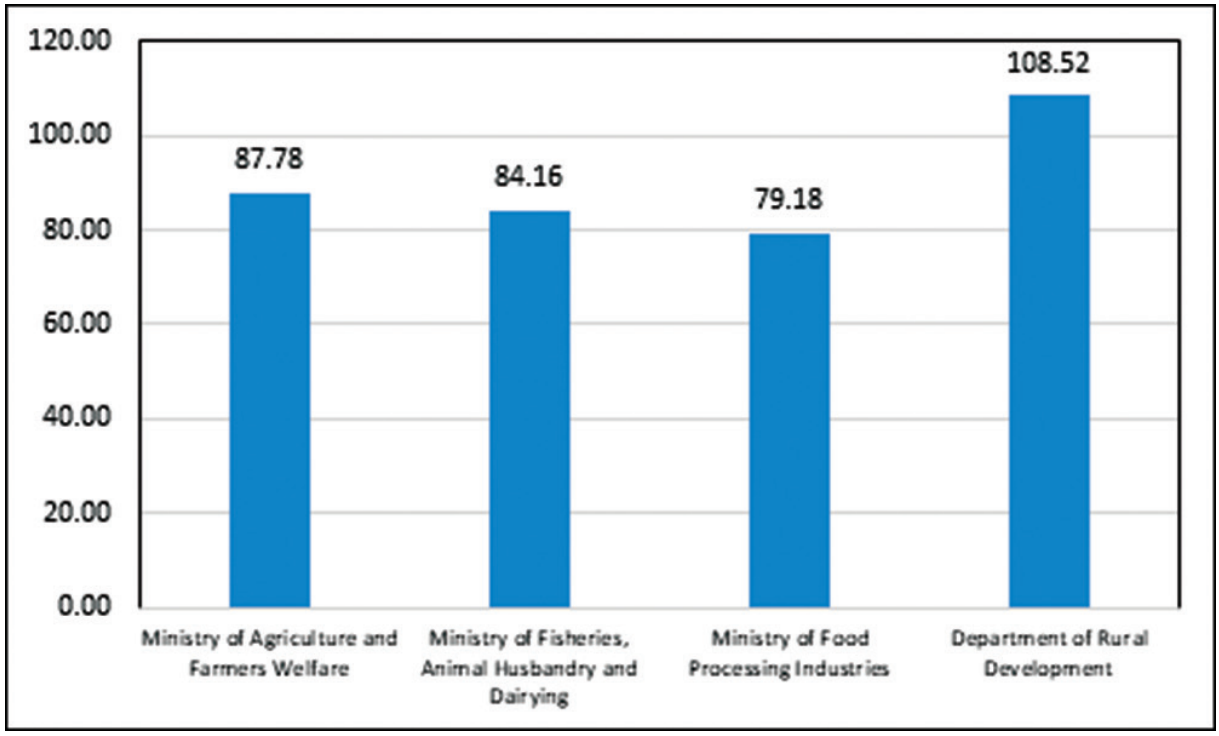


Source: Author Calculations based on data from Union Budget.

It can be observed that the budgetary allocation to the main Ministry of Agriculture and Farmer's Welfare has declined consistently since 2019-20 where the actual expenditure incurred by this ministry while that of the Ministry of Rural Development declined from 2017-18 until 2022-23 after which it has shown an increase. The share in total expenditure of the other two ministries namely, Ministry of Fisheries, Animal Husbandry and Dairying is miniscule and ranges between 0.13-0.15 percent and that of Ministry of Food Processing constitutes a mere 0.03-0.07 percent of total government expenditure respectively.

From the view point of performance, examining the utilization of budget allocated funds becomes pertinent and hence the utilization percentage for each of these ministries has been computed. The utilization percentage is computed as actual expenditure incurred as a ratio of budgetary provision. Figure 3 graphs the average utilization percentage for the years 2013-14 to 2024-25 and one can infer that all ministries related to agriculture and allied activities are lagging in the utilization of budgetary allocations. The Ministry of Agriculture and Farmers Welfare has the highest utilization of 87 percent while the Ministry of Food Processing Industries has a utilization percentage of less than 80 percent. The Ministry of Rural Development has shown greater utilization and its expenditure incurred has been higher than the budgetary allocation.

Figure 3: Average Utilization of Funds Allocated to Agriculture and Allied Activities 2013-14 to 2023-24, Percent



Source: Author Calculations based on data from Union Budget.

The Public Expenditure and Financial Accountability [PEFA] (2016) Assessment framework also provides insights into government budget reliability and helps assess the extent to which actual expenditure has deviated from the budget estimates (Table 1). This framework categorizes expenditure performance into four categories A, B, C and D depending on the extent of deviation between actual and budgeted expenditure. The analysis using the PEFA Framework requires that the entire time span from 2013-14 to 2024-25 be divided into three year compartments and consequently for comparison of performance across the entire time period has been categorized into four sub periods - 2013-14 to 2015-16, 2016-17 to 2018-19, 2019-20 to 2021-22 and 2022-23 -2024-25 (Table 2) and this analysis brings out that the consistent better performance in utilization of funds by the Ministry of Rural Development in this last decade.

Table 1: Categories of Performance under PEFA Framework

A	Actual expenditure is between 95% and 105% of budgeted expenditure in at least two of the last three years.
B	Actual expenditure is between 90% and 110% of budgeted expenditure in at least two of the last three years.
C	Actual expenditure is between 85% and 115% of budgeted expenditure in at least two of the last three years.
D	Performance is worse than in "C".

Table 2: Performance of Ministries Related to Agriculture and Allied Sectors under PEFA Framework

	Ministry of Agriculture and Farmers Welfare	Ministry of Fisheries, Animal Husbandry and Dairying	Ministry of Food Processing Industries	Department of Rural Development
2013-14 to 2015-16	**D**	**C**	**D**	**C**
2016-17 to 2018-19	**A**	**A**	**C**	**A**
2019-20 to 21-22	**D**	**B**	**C**	**A**
2022-23 to 24-25	**A**	**D**	**D**	**A**

Source: Author Calculation based on figures from the budget documents of different ministries

Another major source of funds to the agriculture and allied sectors comes from central sector schemes (CS) and centrally sponsored schemes (CSS). Central sector schemes address national priorities are fully funded by the union government and the responsibility of implementation of these schemes also is with the union government ministries. Centrally sponsored schemes on the other hand, can be funded entirely by the union government and/or have a shared funding between the union and state government contributions and are implemented by the State governments. These schemes often cover areas under the State list and are implemented to have an alignment of national priorities coupled with State level implementation.

Since there was a major consolidation of centrally sponsored schemes in 2015-16, the focus of the analysis on the allocations and utilization of funds under central sector and centrally sponsored schemes is for the period 2016-17 to 2024-25.

Table 3: Growth in Budgetary Allocations and Utilization for Central Sector and Centrally Sponsored Schemes: 2016-17 to 2024-25 (CAGR)

	Ministry of Agriculture and Farmers Welfare	Ministry of Fisheries, Animal Husbandry and Dairying	Ministry of Food Processing Industries	Department of Rural Development
CS	19.96	12.31	16.17	-11.08
CSS	0.34	7.79	15.16	8.46
Utilization Percentage of Funds				
CS	-0.90	-6.55	0.01	4.94
CSS	0.74	-1.57	11.33	-5.40

Source: Author Calculation based on figures from the budget documents of different ministries

Table 3 brings out interesting facts when growth in budgetary allocations are compared vis-a-vis the utilization for the ministries related to the agriculture and allied sectors. With the exception of Ministry of Rural Development which has seen a decline in budgetary allocations all other ministries have seen an increase in allocation of central sector as well as CSS funds. It is pertinent to note the decline (negative growth) in utilization of central sector schemes with the exception of Rural Development. The Ministry of Rural Development has seen a decline in its allocation under central sector schemes, it has outperformed other Ministries related to agriculture in the utilization of funds even as other ministries including the primary Ministry of Agriculture and Farmers Welfare has witnessed a growth in allocations by almost 20 percent whereas there has been a decline (negative growth) of almost 1 percent in utilization of funds.

Focusing on centrally sponsored schemes (CSS) all ministries have witnessed substantial growth in allocations but whilst comparing with utilization of funds, the performance has not been remarkable with the exception of Ministry of Food Processing Industries where increase of allocations and utilization has been more or less commensurate. The 8.5 percent growth observed in allocation of CSS funds to the Ministry of Rural Development may be attributed to its flagship scheme MGNREGA but the Ministry's utilization of funds has shown a negative growth which is surprising and needs more exploration.

This performance is reflected and summarized in the PEFA framework and the time period 2016-17 to 2024-25 has been divided into 3 sub periods of three years each – (i) 2016-17 to 2018-19 (ii) 2019-20 to 2021-22 and (iii) 2022-23 to 2024-25 (Table 4).

Table 4: Performance of Ministries Related to Agriculture and Allied Sectors for Central Sector and Centrally Sponsored Schemes under PEFA Framework

	Ministry of Agriculture and Farmers Welfare	Ministry of Fisheries, Animal Husbandry and Dairying	Ministry of Food Processing Industries	Department of Rural Development
Central Sector Schemes				
2016-17 to 2018-19	A	D	C	C
2019-20 to 21-22	D	D	D	D
2022-23 to 24-25	A	C	D	D
Centrally Sponsored Schemes				
2016-17 to 2018-19	D	A	--	A
2019-20 to 21-22	D	A	--	A
2022-23 to 24-25	D	D	A	A
--- indicates that there was no CSS in those years for the relevant ministry as per budget documents				

Table 4 highlights superior performance of the Ministry of Rural Development under CSS and underperformance of the Ministry of Agriculture and Farmers Welfare. The performance of all ministries for central sector schemes has not been very satisfactory.

It is important to note that analysing capital expenditure in this sector would be provide an understanding of the investment in these sectors, data on capital expenditure incurred through the budgetary documents is scare and not available as a continuous series for the period under study.

Conclusion

The comparison of budgetary allocations with their utilization for the umbrella of ministries related to the agriculture and allied sectors along with rural development brings to fore the rather lackadaisical performance in the utilization of funds and the average utilization percentage of budgetary allocations has been around 80 - 85 percent of budget allocations. A comparison of the performance of central sector and centrally sponsored schemes also reinforces the insipid performance and is reflected in the rankings under the PEFA framework. The need for better utilization of funds by the ministries related to agricultural sector can have an impact on rural livelihoods and is underscored by its the large employment dependence (on average 59 percent

of the overall rural workforce and 75 percent of the female rural workforce during 2017 to 2024 have been engaged in the agriculture and allied sectors). The comparison of performance of central sector versus centrally sponsored schemes from a policy perspective also leads us to speculate whether the implementation of schemes in the agriculture and allied sectors should be by the States rather than by the central government.

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Appendix I

Expenditure of Ministries Related to Agriculture & Allied Sectors

(Budget Estimates and Actuals)

Years	Ministry of Agriculture and Farmers Welfare		Ministry of Fisheries, Animal Husbandry and Dairying		Ministry of Food Processing Industries		Ministry of Rural Development	
	Budget Estimate	Actuals	Budget Estimate	Actuals	Budget Estimate	Actuals	Budget Estimate	Actuals
2013-14	27662.67	23653.33	2110.16	1826.01	708.00	541.20	74429	58666.28
2014-15	28796.64	24095.11	2266.30	1822.10	785.86	584.35	80093.33	67310.61
2015-16	28972.25	20682.30	1585.43	1410.12	505.00	499.75	71695.08	77369.17
2016-17	42603.69	42641.74	1881.51	1857.98	636.02	713.00	86055.8	95069.39
2017-18	48655.00	44339.64	2371.00	2022.10	800.00	684.07	105447.88	108559.63
2018-19	54500.00	53620.44	3100.00	3170.80	1400.00	716.70	112403.92	111841.88
2019-20	138563.97	101774.99	3737.00	3363.11	1196.60	830.00	117647.19	122098.19
2020-21	142762.35	115826.60	4114.13	3346.17	1232.94	1145.52	120147.19	196416.71
2021-22	131531.19	122835.57	4322.82	3943.08	1308.66	1146.40	131519.08	160433.46
2022-23	132513.62	108276.73	6037.31	3609.99	2941.99	1409.94	135944.29	176837.39
2023-24	125035.79	118146.55	6576.62	4487.92	3287.65	2262.68	159964.23	161931.60
2024-25*	132469.86	131195.21	7137.68	5505.72	3290.00	2796.79	177566.19	173912.11

Note: 1. Figures have been obtained from Government of India Budget Documents (https://www.indiabudget.gov.in/)

2. Figures for 2024-25 are Revised Estimates and not Actuals

Allocations to Ministries Related to Agriculture & Allied Sectors: Central Sector Schemes

(Budget Estimates and Actuals)

Years	Ministry of Agriculture and Farmers Welfare		Ministry of Fisheries, Animal Husbandry and Dairying		Ministry of Food Processing Industries		Ministry of Rural Development	
	Budget Estimate	Actuals	Budget Estimate	Actuals	Budget Estimate	Actuals	Budget Estimate	Actuals
2016-17	20580.00	24594.37	1384.78	0.00	563.96	700.79	720.80	285.32
2017-18	24199.30	23165.86	2034.70	0.00	725.00	605.59	400.18	355.14
2018-19	28200.00	31379.25	2862.50	0.00	1313.08	591.63	429.10	653.19
2019-20	113800.00	81342.71	500.00	811.02	1101.00	818.00	475.62	240.87
2020-21	116490.00	95779.92	1300.00	858.00	1081.00	667.05	367.47	215.61
2021-22	105018.81	105368.88	1753.00	1163.88	700.00	204.83	364.39	204.83
2022-23	105710.00	910045.75	2315.00	1037.05	1922.00	1057.75	212.00	201.36
2023-24	98980.03	95306.46	2689.71	2480.72	2453.24	1319.90	113.49	90.23
2024-25*	105856.67	116598.32	3936.00	3470.01	2173.02	2703.38	250.53	153.00

Allocations to Ministries Related to Agriculture & Allied Sectors: Centrally Sponsored Schemes

(Budget Estimates and Actuals)

Years	Ministry of Agriculture and Farmers Welfare		Ministry of Fisheries, Animal Husbandry and Dairying		Ministry of Food Processing Industries		Ministry of Rural Development	
	Budget Estimate	Actuals	Budget Estimate	Actuals	Budget Estimate	Actuals	Budget Estimate	Actuals
2016-17	14899.90	11978.98	1384.78	1597.31	0.00	0.00	85300.00	85300.00
2017-18	17141.00	13733.94	2034.70	1826.74	0.00	0.00	105000.00	105000.00
2018-19	17908.92	14168.69	2862.50	2857.16	0.00	0.00	111925.00	111925.00
2019-20	16060.55	12335.11	2800.00	2154.37	0.00	0.00	117024.00	117024.00
2020-21	17317.77	11960.52	2233.95	2166.31	0.00	0.00	119506.96	119506.96
2021-22	17408.19	8170.09	2192.04	2451.37	500.00	500.00	130977.61	130977.61
2022-23	17616.00	8267.85	2572.40	2128.36	900.00	900.00	135538.73	135538.73
2023-24	14675.82	11607.42	3430.93	1607.98	639.05	639.05	157252.49	157252.49
2024-25*	15365.64	13206.36	2721.00	2721.00	879.50	879.50	177199.40	177199.40

Agriculture Budgeting

ABSTRACT

Success in agriculture, beside many other factors relies on effective agricultural budget too. It is prepared in various formats such as complete budget, enterprise budget, monthly budget and cash-flow budget. It facilitates financial planning, risk management, resource optimization and enabling the farmers to make informed decisions. Farmers and agri-enterprises need to understand strategies useful to cut the cost without compromising yield. ICMAI as a statutory body playing crucial role in regulating the profession of cost management and fostering expertise in cost within various sectors, including agriculture. This article elaborates the above concepts in detail.

Key Words: Agriculture Budget, Farm Budget, Sustainability, ICMAI, CMAs

In addition to factors such as timely and adequate rainfall, farmers' technical expertise, access to modern machinery and equipment, and efficient marketing systems, success in agriculture also relies on making effective budgets for agriculture / agri-businesses.

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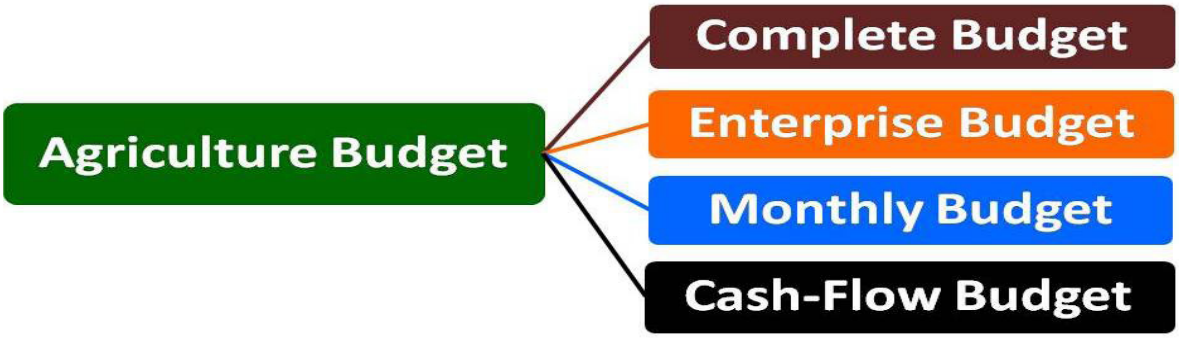
1.0 Agriculture Budget

Agricultural budget refers to the process by which farmers and agri-enterprises develop financial plans to manage farm operations through the estimation of income and expenses to achieve specific financial objectives. This task includes the analysis of potential income, variable costs such as seeds and fertilizers, and fixed overhead costs such as rent and salaries etc. that facilitates informed decision making in agriculture.

1.02 Types of Agriculture Budget

Agricultural budget can be categorized as complete budget, enterprise budget, monthly budget and cash-flow budget.



1.02.1. Complete Budget:

Complete or whole-farm budget represents a comprehensive financial plan that aggregates all farm income and expenses over the course of a year, providing an overview of the financial sustainability of farmers and agri-enterprises. This approach is particularly relevant when making long-term investments, seeking financing or evaluating overall profitability.

i. When to use?

- You're planning for expansion or transition.
- You want a year-end profitability snapshot.
- You're applying for loans or support programs.

ii. How to use?

Capital budget conducted prior to significant investments in eco-friendly farm equipment, renewable energy sources, or organic farming techniques typically falls within this category. Complete budgets enable the farmers and agri-enterprises to make informed decisions that benefit the environment and promote sustainable agricultural practices. For example, a large-scale grain farm, like one growing corn or soybeans over 500+ acres, can use a whole-farm budget to map total revenue from crop sales against expenses like seed, fertilizer, labour, and equipment. This would show the overall financial health, making it easier to secure loans for buying new machinery or additional farm land.

1.02.2. Enterprise Budget:

Not each activity of a farmer / agri-enterprise incurs equal expenses and yields equal returns. For farm businesses involved in diversified operations, it would be critical to know where to invest more and where to reduces the expenses. Enterprise budget in agri-business breaks things down by crop, herd, or product line with an objective to indicate the stakeholders that which parts are profitable and which are not, and thereby facilitates optimum decision making.

i. When to use?

- You manage multiple crops or livestock units.

- You want to compare returns between enterprises.
- You're debating whether to expand or retire an activity.

ii. How to use?

Enterprise budget provides a detailed breakdown of the revenue and expenses associated with each enterprise, aiding farmers in identifying the most profitable aspects of their operations. A diversified farm, combining crops like wheat and livestock like poultry or cattle, can use an enterprise budget to compare profitability across each operation.

For example, a mid-sized farm (100–300 acres) can analyze whether poultry feed costs outweigh profits compared to other species or crop types. This would help the farmers / agri-enterprises to decide whether to expand a profitable crop, reduce a loss-making herd, or adjust inputs to improve margins, ensuring resources focus on what drives returns.

1.02.3. Monthly Budget:

This kind of budget is simple, fast, and very effective. It gives a close look helping farmers /agri-enterprise to catch issues early, before they become full-fledged round the year problems. Monthly budget works better for small or medium-sized farms that want regular control without building complex forecasting models.

i. When to use?

- You prefer a hands-on, short-term view.
- Your costs and income vary frequently.
- You want better visibility without heavy tracking.

ii. How to use?

A small organic farm, like a 5-20 acre berry or vegetable operation, can use a monthly budget to monitor fluctuating costs, such as fuel for deliveries or seasonal labor. By checking monthly expenses against projections, the farm can quickly spot overruns and adjust, like optimizing worker schedules or cutting non-essential costs, to keep the season's budget on track.

1.02.4. Cash Flow Budget:

Cash flow budget is a forward-looking tool that estimates the cash inflows and outflows of a farm operation to manage liquidity and ensure fund availability for expenses, loan payments, and family living. Sometimes the profit margins can look good on paper, but still, the businesses may run dry in real time.

A cash flow budget helps farmers / agri-enterprises to track the maximum possible timing and quantity of money inflow and outflow, so they are not facing any money crunch during the peak time of money requirement. It's useful especially for those farms / agri-enterprises struggling with seasonal income, rising input costs, or heavy debt liabilities.

i. When to use?

- You need to time input purchases or labor.
- You have gaps between income and expense cycles.
- You're trying to avoid last-minute borrowing.

ii. How to use?

A small vegetable farm, such as one selling at farmers' markets over 10–50 acres, can benefit from a cash flow budget by tracking spring planting costs (seeds, labour) against summer sales revenue. This ensures that they do not overspend early in the season. Also, they can plan for negotiating delayed payments with suppliers to manage cash shortages.

iii. Steps to Prepare a Cash-flow Budget

a. **Define Goals and Objectives:** The first step in preparing a cash-flow budget is to identify the farm's goals and financial targets for future.

b. **List out the Resources:** The next step is to list all resources available for agricultural production such as land, labour, inputs, and capital.

c. **Estimate the Expenses:** Identify the variable cost items that change with the volume of production, such as hired labour, seeds, fertilizers, etc. Also, find out the fixed cost items and overheads that do not change with the scale of production, such as rent, salaries, electricity charges, insurance, and transportation expenses.

d. **Estimate the Incomes:** Optimistically list out all possible income sources, such as crop sales, livestock sales, government subsidies, and other income possibilities from the farm activities.

e. **Estimate the Net-Income:** Calculate the net income from the farm by subtracting the total estimated expenses (variable and fixed) from the total estimated income.

f. **Review and Revise the Budget:** Review the budget, adjust numbers, and explore different scenarios to ensure the plan aligns with the farm's financial goals.

2.0 Importance of Agriculture Budget

Agriculture budget is essential for financial planning, risk management, resource optimization, goal setting, and facilitating communication and decision-making. It plays a pivotal role in ensuring the economic viability and sustainability of agricultural operations. Its importance is discussed below;

i. **Financial Planning:** Agriculture budget is crucial for effective financial planning for farms. By outlining the anticipated revenues and expenses, farmers / agri-enterprises can gain a comprehensive understanding of their financial position. It helps them make a strategic approach to managing finances, covering expenses, meeting loan obligations, and achieving long-term financial stability. This allows

them to make informed decisions about resource allocation, investment, and risk management, ultimately pushing the farm towards economic sustainability.

ii. **Risk Management:** Agriculture is inherently subject to various risks and uncertainties such as weather conditions, market fluctuations, and unexpected expenses. A well-prepared budget serves as a risk management tool by helping farmers identify potential financial challenges and devise strategies to mitigate them. This proactive approach enhances the farm's resilience to unforeseen events.

iii. **Resource Optimization:** Agriculture budget meticulously analyzes the cost-benefits of the resources used, enabling the farmers / agri-enterprises to ensure efficient allocation of inputs like seeds, fertilizers, labor, and capital. By forecasting expenses and income, farmers can allocate resources efficiently, ensuring that inputs are used judiciously to maximize yields and profits. Such careful planning is especially critical in the face of fluctuating commodity prices and production costs.

iv. **Goal Setting and Evaluation:** Agriculture budget provides the farmers / agri-enterprises a framework for setting financial goals and objectives. Whether it's expanding operations, purchasing new equipment, or reducing debt, a well-structured budget helps them to articulate and work towards their financial targets. Regularly comparing the actual performance against the budget allows for ongoing evaluation and adjustments to control the budget drifts.

v. **Informed Decision-Making:** Agriculture budget facilitates communication and collaboration among farm stakeholders, including family members, business partners, and financial institutions. A clear budget provides a shared understanding of the financial goals and constraints, fostering effective communication. Having a budget in place enables the farmers/ agri-enterprises to make better decisions about production strategies, resource allocation, and investments. It allows them to evaluate the financial implications of various choices and make strategic decisions that align with their overall objectives.

3.0 Roles and Functions of CMAs in Agricultural Budgeting

i. **Budget:** CMAs play a critical role in preparing and implementing operational budgets for various agricultural operations to control farm expenses and help attaining the financial goals. Their budget preparation is generally participatory in nature, where farmers, employees, and managers at all operational levels are involved in the process.

ii. **Cost Analysis:** CMAs use their expertise to meticulously classify costs into direct (seeds, fertilizers, etc) and indirect costs (rent, depreciation, etc) for further analysis. Indirect costs not directly traceable to a specific crop or farm activity (administrative expenses, record-keeping expenses, etc) are classified as overheads.

iii. **Resource Optimization:** CMAs ensure optimum allocation of scarce resources such as land, labour, and capital ensuring their efficient utilization in farms, minimizing their wastage and maximizing their returns.

iv. **Strategic Decision-Making:** CMAs help farmers / agri-enterprises in making informed decisions by providing them with financial information and insights to maximize farm revenue and long term sustainability.

v. **Performance Management:** CMAs monitor costs against budgets and identify variances, if any, to

enhance performance and assist the farmers/ agri-enterprises in conveniently achieving their financial goals.

vi. **Cost Reduction without Compromising the Yield:** Role of CMAs is significant in application of cost reduction techniques without compromising the farm yield. Given below are some strategies:

a. **Calculate the Input Returns:** Find out the items in which maximum expenses are incurred and compare them to know if the returns are higher than the investments. It's not about cutting down the investments on labour, seed, or fertilizer; instead, it's about justifying the expenses incurred with proportionately higher returns. If the returns are lower, figure out an alternative way of doing things with cheaper cost and higher returns.

b. **Calculate the Equipment Returns:** Make sure that the mechanization of the farm activities is justified with adequate need, utilization and monetary returns. For example, investing a huge amount of Rs. 5 lakh for buying a tractor which can be hardly used for 4 weeks a year is not a good decision, as such minimum works could be completed using custom hiring or leasing. It's not about losing independence; it's about reviewing whether the capital tied up to this less-utilized equipment could be used better somewhere else.

c. **Watch for Suitable Timings:** Remember the proverb 'a stitch in time, saves nine' and always watch for the most suitable timings for doing things, not only for sales but also for procurement and farm operations. Initiating timely actions is one of the most overlooked ways to control costs in agriculture. See if you can negotiate early purchases from suppliers, ensuring price locks. Check if you are applying nitrogen at the best uptake season or just when labor is free? Aligning the application with biological demand, not calendar habits, can improve yield while cutting the input waste.

d. **Catch the Budget Drift Early:** Many farmers / agri-enterprises finalize agriculture budgets in December and never look at them in between. For example, they could be making decisions in September based on the data collected in February without realizing the fact that the costs have already shifted by July. If the farmers / agri-enterprises do not check the actual and projected costs and returns in between their budget, it could turn into a failure.

e. **Apply VED Analysis when Cash Gets Tight:** At times, farmers / agri-enterprises may find that cash flow gets increasingly tighter. Then they may apply the Vital-Essential and Desirable (VED) Analysis. Vital items are crucial and their absence stops production; Essential items are important but alternatives exist, and Desirables only improve the products or processes which can be paused if cash is tight. This framework avoids panic-cutting in-season and protects output when it matters most.

4.0 Conclusion

Understanding agriculture budget and its types is essential for every farmer/ agri-enterprises striving to achieve long-term sustainability and profitability. By incorporating natural ways into complete, enterprise, monthly and cash-flow budget, farmers not only enhance their financial viability but also contribute to a healthier and more sustainable agricultural industry. The Viksit Bharat 2047 vision of the Government is based on 4 pillars, namely Yuva (Youth), Gareeb (Poor), Mahila (Women), and Annadata (Farmers). Its noble objectives of attaining zero poverty and farmers making our country the food basket of the world are possible

only when agriculture is systematically approached with time-tested tools that can control the farm cost and enhance the farm returns. No doubt, agriculture budget is one such inevitable success tool.

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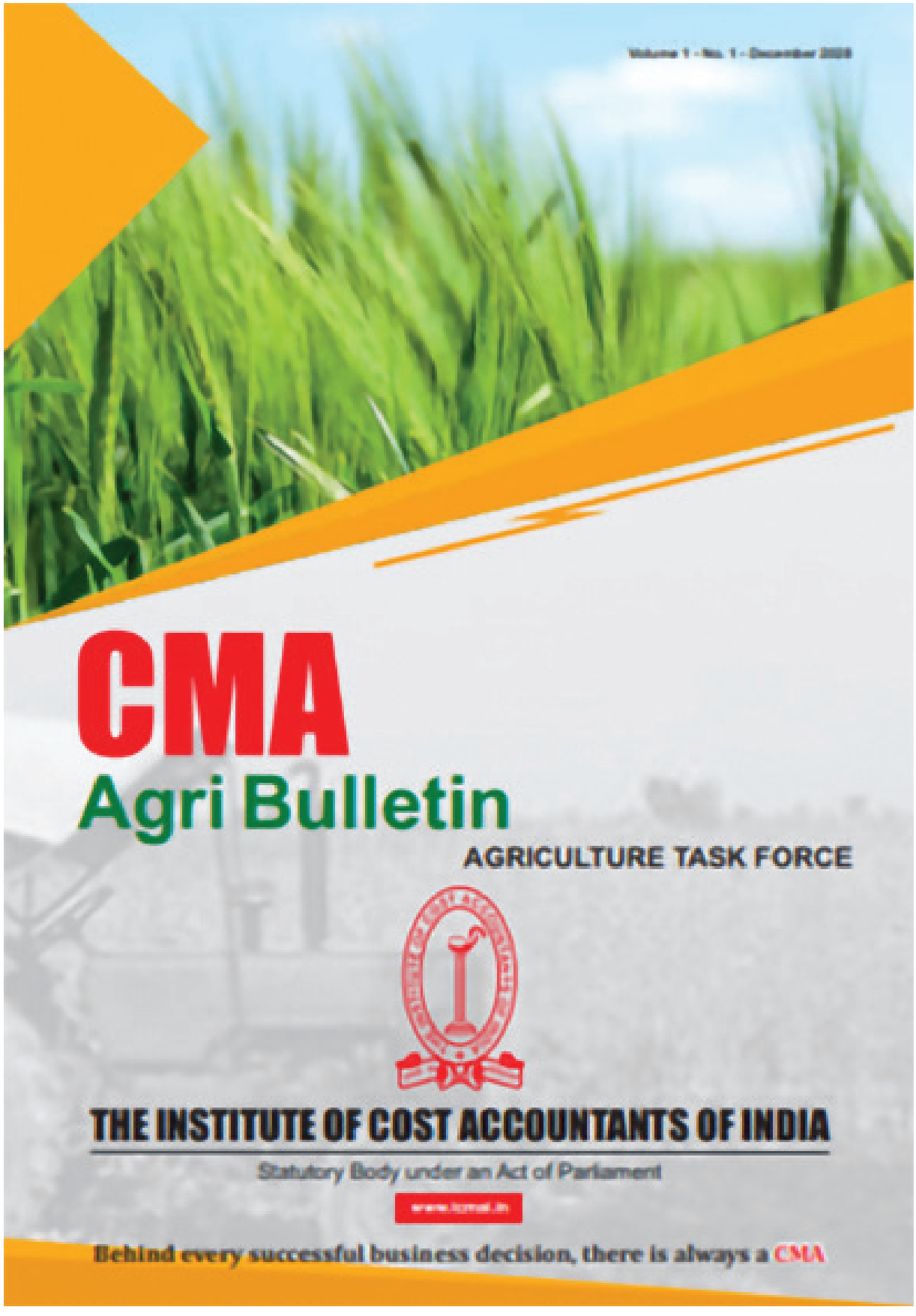

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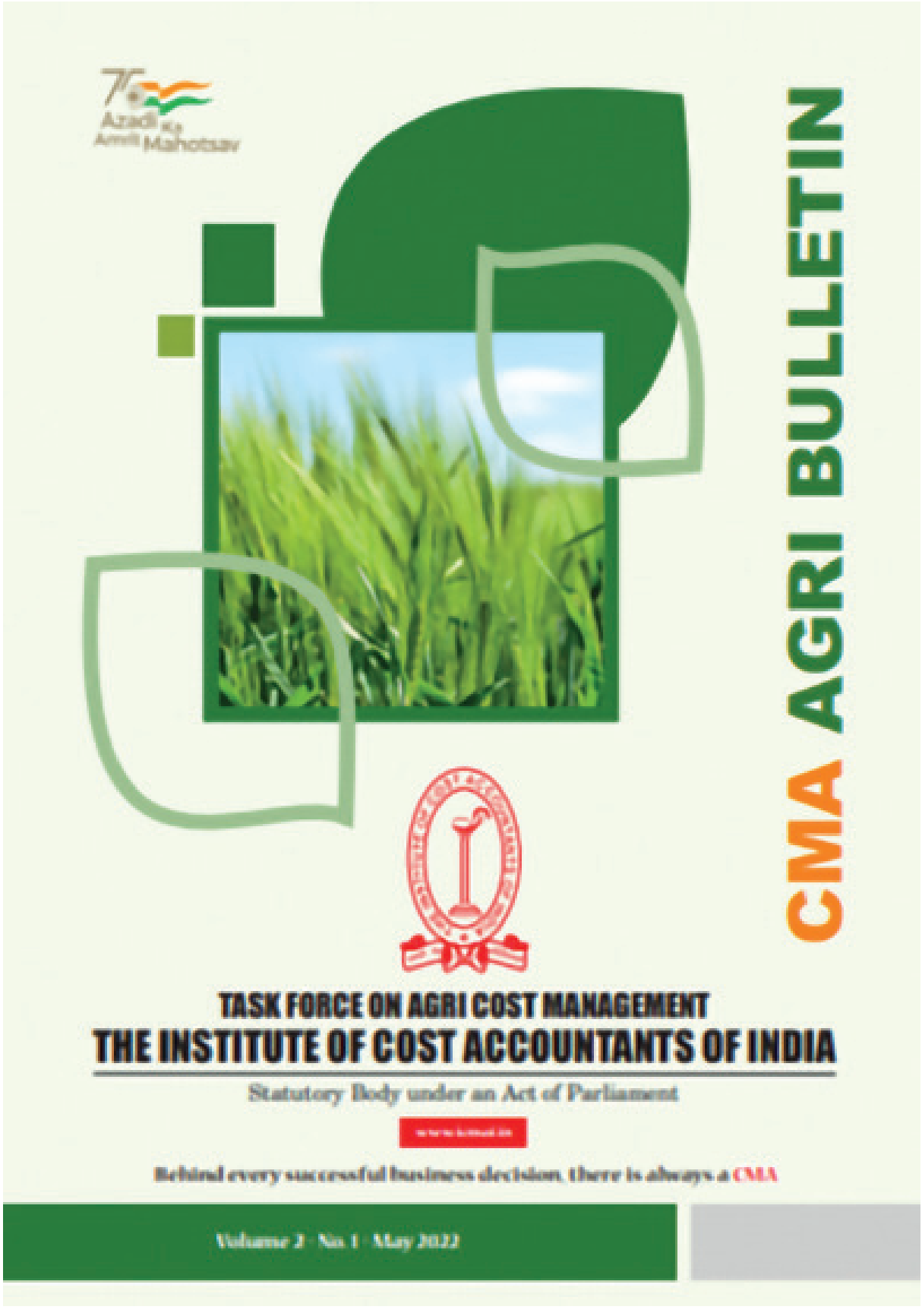

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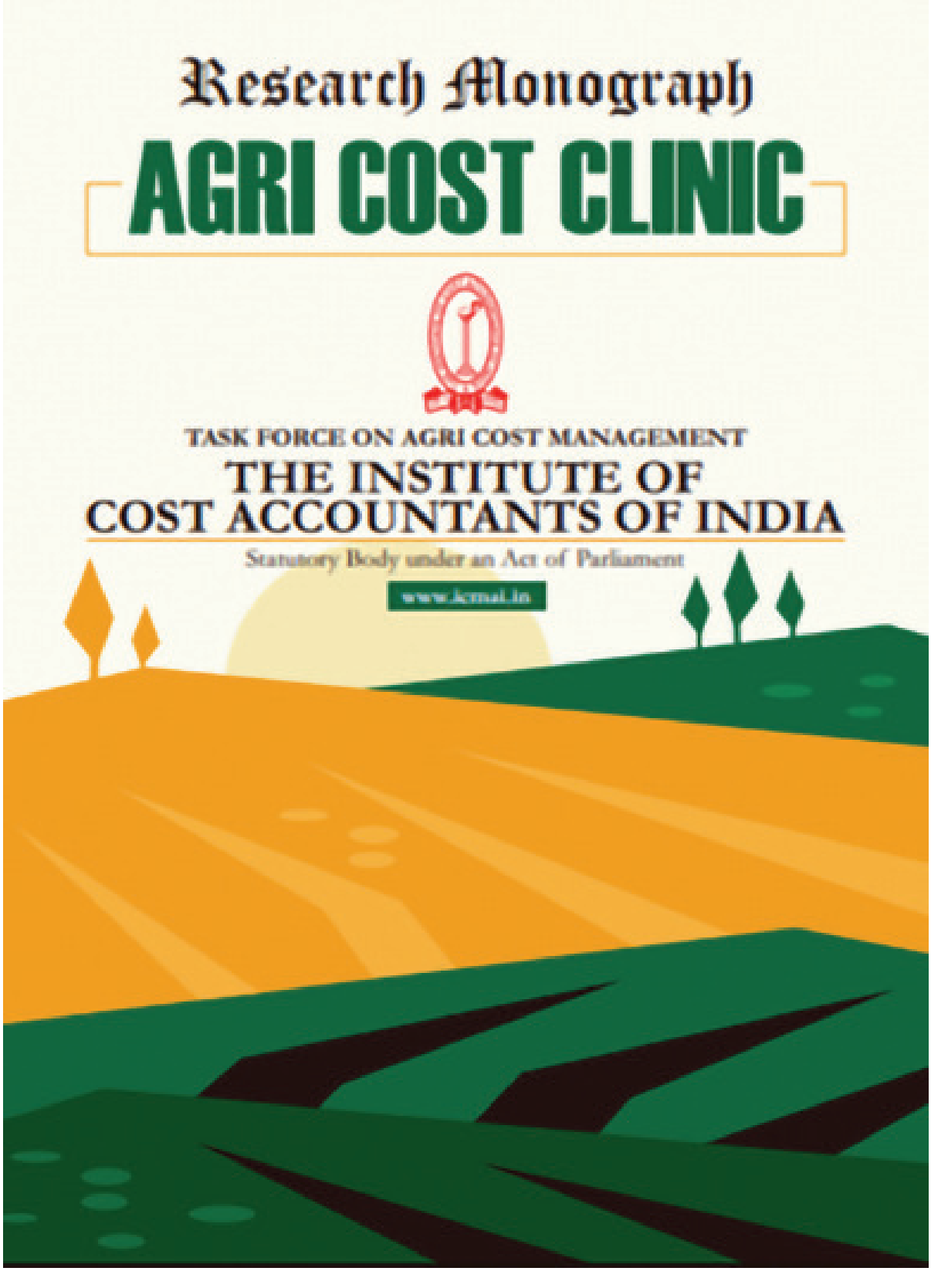

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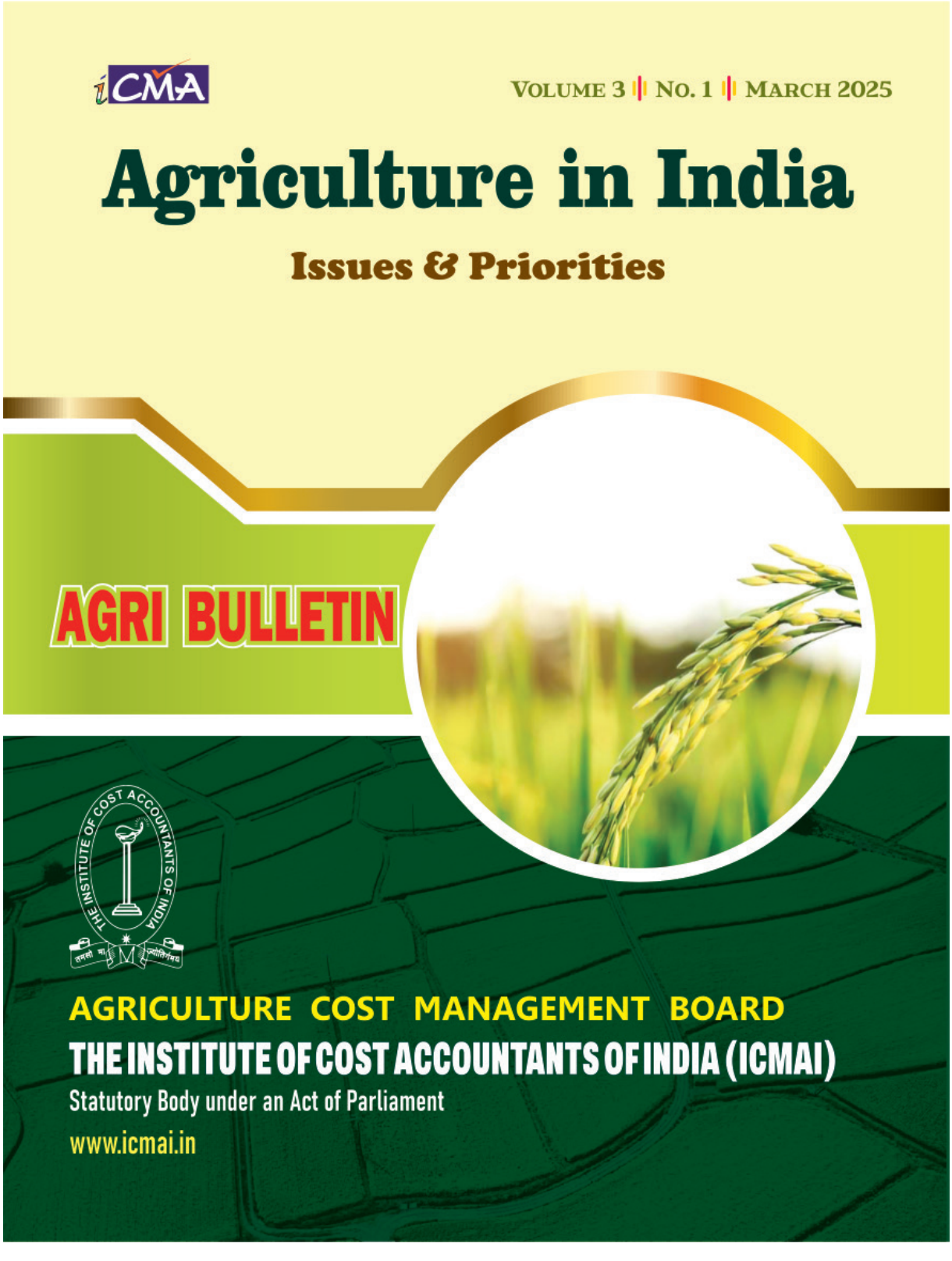

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