NATIONAL POLICY INTERFACE OF SDGS AND SUSTAINABLE AGRICULTURE

Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

To ensure food security, agricultural systems must adapt to global influencing factors such as population expansion, shifts in dietary preferences, and the effects of climate change (Hinz et al., 2020). Attaining this objective will entail improving food accessibility and promoting sustainable farming practices on a large scale. This involves enhancing the efficiency and earnings of small-scale farmers by advocating equitable availability of land, technology, and markets, as well as promoting sustainable methods of food production and resilient agricultural techniques to maintain ecosystem integrity (Department of Economic and Social Affairs, UN, 2016). However, increasing agricultural production and affordability of low-nutrient, energy-rich foods can contribute to macro and micronutrient deficiencies. Farmers have been using fertilizers and pesticides and expanding agricultural land to keep up with the growing population, which has resulted in an increase in agricultural emissions (Hofstra and Vermeulen, 2016).

In India, out of the total net sown area of 139.3 million hectares, rainfed agriculture covers about 69.7 million hectares (Ministry of Agriculture and Farmers Welfare, 2022). This accounts for about 51% of India's net sown area, contributing to nearly 40% of the total food production (Ministry of Agriculture and Farmers Welfare, 2022). This data underscores the vital role that rainfed agriculture plays in ensuring food security in India. However, the condition of rainfed agriculture is precarious as it is highly diverse and prone to various risks. A few of the challenges are low cropping intensity, substantial cost of cultivation, limited adoption of modern technology, unpredictability in crop yields, subpar productivity levels, a rising number of farmer suicides, insufficient access to institutional credit, inadequate public investments, and a high prevalence of rural poverty. Another persistent challenge in Indian agriculture is the practice of monocropping. While India is the second-largest producer of wheat, rice, and groundnuts and also leads in jute production, over 85% of smallholder farmers predominantly engage in monocropping, focusing on crops such as rice, wheat, pulses, spices, vegetables, and various cereals (Mayank, 2021). This heavy reliance on monocropping renders these farmers highly vulnerable to the adverse effects of climate change. Monoculture practices not only affect food production but also contribute to the decline of traditional plant varieties, such as nutrient-rich pulses.

Research conducted under the All India Coordinated Research Project on 'Long Term Fertilizer Experiments' spanning five decades at specific locations has revealed that the exclusive application of nitrogenous fertilizers has adversely affected soil quality and crop yields. This highlights the importance of other essential macro and micronutrients. From 2017 to 2020–21, the utilization of chemical fertilizers (such as Urea and Di-Ammonium Phosphate) in the country amounted to 54.38 million tonnes. Unfortunately, the indiscriminate use of fertilizers and agro-chemicals in agriculture has resulted in the degradation of soil quality, water resources, and biodiversity. As a result, the focus in agriculture is progressively shifting from production to prioritizing the preservation of resources, the restoration of soil health and fertility, and the reduction of negative impacts on both soil and the environment (Ministry of Agriculture and Farmers Welfare, 2023).

The agricultural sector in India has achieved significant success by meeting government-set production targets and establishing new production records for various crop commodities.

However, this success has come at a cost as it has led to the degradation of natural resources and adverse environmental impacts. As a result, there has been a decline in overall productivity, depletion of natural resources, stagnant farm incomes, lack of regional ecological approach, diminishing and fragmented landholdings, agricultural trade liberalization challenges, limited job opportunities in non-farm sectors, and the pressing issue of climate change (Singh, 2022). These concerns have emerged as prominent challenges in the growth and development of agriculture in India.

National Policy and Stakeholder Mapping

Policies/Schemes	Stakeholders	Pre-production	Production	Post-production
National Mission for Sustainable Agriculture (Rainfed Area Development and Soil Health Management)	• Ministry of Agriculture and Farmers Welfare • Indian Council of Agricultural Research (ICAR) • National Centre of Organic Farming (NCOF) • Central Fertilizer Quality Control and Training Institute (CFQC&TI)	X	X	
Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	• Ministry of Water Resources, River Development and Ganga Rejuvenation • Ministry of Rural Development • Ministry of Agriculture and Farmers Welfare	X	X	
Deendayal Antyodaya Yojana (DAY) — National Rural Livelihoods Mission	• Ministry of Rural Development	X		
Pradhan Mantri Kisan Sampada Yojna (PMKSY)	• Ministry of Agriculture and Farmers Welfare			X
Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM)	• Ministry of Agriculture and Farmers Welfare	X	X	
Paramparagat Krishi Vikas Yojana (PKVY)	• Ministry of Agriculture and Farmers Welfare	X	X	
Rashtriya Krishi Vikas Yojana (RKVY)	• Ministry of Agriculture and Farmers Welfare			X

Policies/Schemes	Stakeholders	Pre-production	Production	Post-production
Pradhan Mantri Kisan Samman Nidhi (PM-KISAN Scheme)	• Ministry of Agriculture and Farmers Welfare	X	X	X
Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seed	• Ministry of Agriculture and Farmers Welfare	X		
National Food Security Mission	• Ministry of Agriculture and Farmers Welfare	X		
National Horticulture Mission	• Ministry of Agriculture and Farmers Welfare	X	X	X
Agri Nutri Garden Project [Initiative under Deendayal Antyodaya Yojana - National Rural Livelihood Mission (DAY-NRLM)]	• Ministry of Rural Development		X	
Nutrient-based Subsidy	• Ministry of Chemicals and Fertilizers	X		
Urea-based Subsidy	• Ministry of Chemicals and Fertilizers	X		
Biotech-Krishi Innovation Science Application Network	• Department of Science and Technology		X	
Agriculture Infrastructure Fund	• Ministry of Agriculture and Farmers Welfare		X	X
Crop Diversification Programme [Sub-scheme of Rashtriya Krishi Vikas Yojana (RKVY)]	• Ministry of Agriculture and Farmers Welfare		X	
Pradhan Mantri Fasal Bima Yojana (PMFBY)	• Ministry of Agriculture and Farmers Welfare	X	X	X
Sub-mission on Agriculture Mechanization under National Mission on	• Ministry of Agriculture and Farmers Welfare		X	

Policies/Schemes	Stakeholders	Pre-production	Production	Post-production
Agricultural Extension and Technology				
Gramin Bhandaran Yojna (GBY)	• Ministry of Agriculture and Farmers Welfare			X
Promotion of National Agriculture Market (NAM)	• Ministry of Agriculture and Farmers Welfare			X
Integrated Post-Harvest Management – National Horticulture Mission	• Ministry of Agriculture and Farmers Welfare • National Horticulture Board			X
PM Kisan Sampada Yojna (PKSY)	• Ministry of Food Processing and Industries			X
National Innovation on Climate Resilient Agriculture	• Ministry of Agriculture and Farmers Welfare	X	X	

Synergies and Trade-offs

Improving agricultural productivity is critical for addressing both hunger and poverty. It not only increases the amount of food available but also stimulates economic growth by creating jobs, both on- and off-farm. This can raise people's incomes and enable them to purchase food (Uphaus, 2008). Agricultural approaches influence the underlying determinants of various socio-economic and environmental outcomes. They can improve food availability and access, enhance household food security, dietary quality, income, natural resource management, and women's empowerment (Ruel, Quisumbing, and Balagamwala, 2018). Apart from an increase in yield, diversification towards high-value agriculture (fruits, vegetables, fisheries, and livestock) will ensure a diversified food basket, which will also ensure better nutrition (Gulati, Roy, and Saini, 2021). By enhancing technology and capacity-building, agriculture's capacity to adapt to climate change, extreme weather, drought, flooding, and other disasters can also be strengthened (International Council for Science, 2017).

Some of the trade-offs in agriculture are that the government's primary focus is channelled towards maximizing agricultural output, and relatively little attention is devoted to undertaking new research aimed at innovative approaches for efficient utilization of natural resources such as crop diversification and other post-harvest activities such as storage, warehousing, preservation methods, and advancing marketing (Raj, 2018). Additionally, farmers use fertilizers and pesticides, and try to expand agricultural land for agricultural production to keep pace with the growing population, which has resulted in an increase in agricultural emissions as well as depletion of natural resources (Hofstra and Vermeulen, 2016). Further, small and marginal farmers encounter several challenges, primarily stemming from a limited understanding of sustainable farming practices, agro-technologies, and their adoption. The current emphasis on soil carbon sequestration and increased agricultural output, primarily aimed at attracting private investment may have detrimental consequences for small and

marginalized farmers in the least developed and developing nations. In countries like India, where most farmers (over 80%) own less than 2 hectares of land, the pursuit of sequestration could result in them forfeiting their land and loss of control over their agricultural output, freedom of choice, and methods of production to profit-driven private project developers. In terms of agricultural trade, some policies developed to improve food security for the poor, such as price controls, may have perverse impacts, such as depressing farm income (International Council for Science, 2017).

Targets	Synergy	Trade-off
Target 2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round		
Target 2.2: By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons		
Target 2.3: By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment		
Target 2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality		
Target 2.5: By 2020, maintain the genetic diversity of seeds, cultivated plants, and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional, and international levels, and promote access to fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed		
Target 2.a: Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries		
Target 2.b: Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round		
Target 2.c: Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility		

Gaps and Barriers

Remote areas often lack access to sufficient or readily available information regarding new seed or plant varieties that farmers require. Farmers are largely unaware of government-supported schemes that support sustainable practices (Alwang et al., 2019; University of Agricultural Science, 2016). Agricultural research, development, and policy continue to place a strong emphasis on increasing production of the three main staple crops (rice, wheat, and maize) while public and private investment in other crops remains low (Grovermann et al., 2018). Furthermore, investment in the agriculture sector continues to be skewed towards the traditional strategy as it primarily focuses on food and fertilizer subsidies and grants (Kumar and Thangaraj, 2022). Although the government is working towards maximizing agricultural production, less emphasis has been given to conducting new research for developing new marketing, storage, warehousing, and preservation techniques (Raj, 2018; Kumar and Thangaraj, 2022). Also, there is an implementation gap in strategies as the framing of targets could lead to a variety of interpretations due to the vagueness of terms such as 'sustainable' or 'fair'. Additionally, there is a lack of specificity regarding the scale of enforcement and monitoring or the boundaries of 'food systems' (Gil et al., 2018).

Emerging Policy Solutions

Strengthening the National Mission for Sustainable Agriculture (NMSA) to enhance crop system

- **Integration of Crop Diversification Programme (CDP) in NMSA:** Highlighting the CDP within the NMSA will lead the government to prioritize and focus on it, as NMSA falls under the purview of the National Action Plan for Climate Change.
- **Adequate focus on research and development and capacity building in NMSA:** Allocation of significant funds and emphasis on research and development (R&D) and capacity-building within NMSA will help address issues related to adaptation and implementing coping strategies for crop production systems.

Strengthen Reporting on Metrics for Policy Design and Implementation: Some proposed metrics that could be monitored include:

- Crop diversification index in areas of monoculture.
- Percentage of agricultural policies in India that have a component of sustainable agriculture.
- Percent of budget allocated for sustainable agriculture.
- Number of beneficiaries who participate in the schemes dedicated to sustainable agriculture.

Incentivizing Farmers for Sustainable Agricultural Practices

- **Higher MSP for other crops:** By providing higher MSPs for a broader range of crops, farmers can be incentivized to cultivate a more diverse set and, thus, move away from the rice–wheat cycle and address the market demand as well.
- **Addressing budget constraints:** Budget constraints pose a significant barrier to farmers adopting sustainable agriculture practices. Farmers adopting sustainable agricultural practices, especially when these practices are linked **to subsidies**, should be provided greater incentives.
- **Challenges with insurance schemes and loans:** Farmers often do not support insurance schemes that are provided along with loans. Many farmers are unaware of these schemes and struggle to understand how to access or claim the insurance benefits.
- **Enhancing markets for non-chemical farming practices:** Chemical-based agricultural methods are often more profitable, which discourages farmers from embracing organic farming. It must be ensured that incentives and markets are directed towards farmers who use non-chemical-based inputs.
- **Inclusion of smallholder and tenant farmers:** The plight of smallholder farmers, who lack support to survive market competition, underscores the necessity of incentive mechanisms and equitable distribution. It is crucial to define and recognize farmers, including tenant farmers, who often remain invisible in policy discussions.
- **Information asymmetry:** Policymakers should prioritize rationalizing existing schemes and assessing the impacts on farmers' lives. Empowering district officers and promoting convergence among different departments are potential solutions.
- **Contextualizing policies:** Examples of empowering district officers to directly address the needs of the poorest of the poor demonstrate the potential for more effective, ground-level policy implementation. Long-term policies should aim to converge different departments, creating a one-window approach for farmers. State governments should have the discretion to adapt policies to their specific contexts.
- **Challenges in data consistency:** Data consistency is a significant challenge. For policy synergy, it is crucial to identify the entitlements the farmers receive from different SDG policies and recognize the trade-offs impacting farmers' lives. Agricultural policies should acknowledge local realities.
- **Decentralization in implementing policies:** There is a need to establish more decentralized policies that offer farmers a range of options to choose from rather than rigidly controlling schemes at the state and central levels. The current policies involve subsidies and MSPs, which incentivize specific actions. It is crucial to question whether these policy constraints are in line with the preferences and needs of farmers, both politically and economically.
- **Policy piloting:** Evaluating the effectiveness of existing institutional structure in realizing the SDGs is crucial, along with identifying and addressing potential policy obstacles. The process of policy piloting is essential and initiatives like those undertaken by the Indian Council of Agricultural Research (ICAR) can help promote agricultural systems related to crop diversification plans.
- **Highlighting ecosystem services**: There is a growing need to shift from the traditional focus on yield per hectare and instead emphasize mainstreaming ecosystem services in agriculture, thereby strengthening the agricultural value chain. Policymakers are encouraged to move beyond productivity-focused debates and consider broader, farmer-centric solutions that address economic well-being. It is important to take into account the diverse cultures and farming practices and ensure inclusivity and sustainability.

Promoting Community-led Practices for Efficient Implementation of Sustainable Farming Activities

- **Issues in landholdings:** Fragmentation of land is another issue that poses a challenge for farmers to engage in sustainable farming practices. Hence, aggregating farmers and encouraging community-led adaptation of farming practices can help address the issue of small landholdings.
- **Non-uniformity in farmers' income levels:** Addressing the issue of disproportionate land sizes and different crop diversification programmes should prioritize farmers based on their income levels. For example, affluent farmers in states like Punjab and Haryana may have different needs.
- **Recognizing women in farming operations:** Recognizing the joint household nature of farming and the contributions of women in agriculture can inform policy formulation that better serves communities. Thus, efforts should be made to aggregate small women farmers and engage them in community-led adoption of sustainable farming practices. This can be actively promoted and encouraged by SHGs and women's empowerment through initiatives like 'Mahila Sashaktikaran'.
- **Promotion of agro-forestry:** Approximately 86% of the farmers in India are small and marginal farmers. Hence, leveraging community-led initiatives like Gram Sabha, which sells non-timber forest products (NTFP), can also be applied to agricultural products. This brings the promotion of agro-forestry as a promising agricultural practice.
- **Misalignment between crop choices in comprehensive development plans:** Agro-forestry should be incorporated into comprehensive development plans and involve community participation. Since there is a misalignment between crop choices in comprehensive development plans and the agro-ecological conditions, the challenge is to reconfigure agricultural practices to ensure food security is not compromised.

Capacity-Building and Awareness Campaigns for Ensuring Last-Mile Implementation of Well-Informed Practices

- **Limited farmer awareness:** Farmers often lack awareness of government provisions and learning programmes, necessitating capacity-building and awareness campaigns that encompass policy-related information.
- **Substantial representation of farmers in policy discussions:** It is crucial that farmers become aware of sustainable practices and the importance of profitability in policies. The importance of integrating SDG indicators into policies considering ecology and economy are intertwined, along with information dissemination and market access for farmers will help in the effective implementation of policies.
- **Leveraging initiatives like *KISAN Mela*:** Farmers often lack awareness of policy provisions and available resources. There is a strong call for awareness campaigns that focus not only on agro-technical aspects but also on policy benefits and learning programmes. *KISAN Mela* is an example of effective government efforts.
- **Platforms to increase awareness amongst farmers:** Farmers involved in Agricultural Technology Management Agency (ATMA) programmes from different states can benefit, ensuring that every village reaps the advantages of government policies. For example, in Rajasthan active farmer WhatsApp groups are utilized to disseminate information to farmers. Thus, community-led approaches, such as *Gram Sabhas* and farmer WhatsApp groups, can play a significant role in disseminating information, promoting sustainability, and aggregating smallholder farmers.

NMSA for Tailor-made Solutions to Farmers

- **Bridging the gap between theory and practice:** The true benefits of NMSA policies will materialize when they are implemented in the field with clear information. Geographical factors and farmers' preferences should be considered in policy design.
- **Focus on crop diversification in NMSA:** The focus on crop diversification should be strengthened in NMSA, which can lead to wider adoption of crop diversification by farmers.

Intake of Technology in Agriculture

- **Adoption of technology-enabled services:** Mere delivery of technology-enabled services will not solve all the problems of farmers. It is also important to ensure that farmers adopt these services. This calls for capacity building, which should be viewed from the farmers' perspective and not merely from the supply side.
- **Accurate dissemination of information:** Utilizing technology for capacity building is vital, and advertising weather forecasts on television can increase farmers' awareness of weather conditions. It is crucial to provide accurate weather information to farmers so that they are able to make informed decisions.

Shifting Focus from Farm Economy to Farmers' Economy

- **Emphasis on choice of crops:** When designing policies, it is essential to consider their impact not just on the overall farm economy but also on individual farmers. Policymakers should evaluate how these policies benefit farmers, what incentives they provide for crop cultivation, and why farmers would choose to grow particular crops.
- **Balance in ecology and economy:** For any policy solution to be delivered, it must align with the economic interests of farmers. It is crucial to strike a balance between ecology and the economy, with a primary focus on the well-being of farmers.