



SUSTAINABLE FARMING IN CENTRAL INDIA: SOCIO-ECONOMIC IMPACT AND POLICY INTERVENTIONS IN MADHYA PRADESH AND RAJASTHAN

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ABSTRACT

Indian society and economy are primarily agriculture-based because it is a major contributor to employment generation and livelihood. Around 43% of India's land is used for agricultural purposes. Industry gets food, feed, and raw materials from here. Based on these statistics, the Indian government has initiated various national and regional initiatives to promote sustainable growth in agriculture. In spite of this, the share of GDP from agriculture has slowly come down in recent times. Several issues ail Indian farmers, such as input costs being too high, low returns, depleting water tables, soil degradation, and climate change risks.



I. INTRODUCTION

Sustainable farming practices are important in the entire world of agriculture and in most parts of Central India, where people earn their living as farmers. They are important in both Madhya Pradesh and Rajasthan where agriculture provides income and employment for a sizable portion of the population, as well as economically benefit the region. As is the case elsewhere, traditional farming methods, which often involve excessive use of water, chemicals, and manual labor, have led to numerous environmental challenges. The impacts of soil erosion, water scarcity, and other forms of environmental degradation is experienced first-hand by many people and so there is an urgent need to adapt farming practices that are not only environmentally friendly but also economically sound and socially just. Sustainable agriculture or eco-agriculture as it is called takes into account the socioeconomic needs of the area, combines economic and social dimensions with positive social outcomes. It has a significant bearing on the social and economic aspects of farming in Central India including the productivity and income of farms as well as the health and welfare of the people. It can help restore the balance of nature in rural areas, improve biodiversity, avail of conservation opportunities, increase economic activity and in turn improve the standard of living of farmers.

The two states at the center of India-Madhya Pradesh and Rajasthan- have agricultural sustainability challenges that are both dissimilarly similar. As the heart of India, Madhya Pradesh largely relies on rain-fed agriculture. This makes it vulnerable to erratic rainfall, droughts, and dry spells. The vast agricultural base alongside the extensive growth of crops like wheat, rice, soybeans, and pulses is both a boon and a curse to the state's agriculture. Farmers here have long suffered from the adverse impacts of monoculture farming and the over-application of synthetic fertilizers, along with poor water management practices, unsustainable madding management, and untamed water resources. Compared to Rajasthan, which has a semi-arid dry climate, the state has even less water alongside soil erosion issues. This part of the landscape is characterized by scant surface water and an over-dependence on groundwater for irrigation. The increasing distress and unsustainable practices economically alongside socially has severely crippled the socio-economic structure of these states alongside soaring rural and urban poverty, food deficiency, and a mounting count of frail farmers.

One of the primary socio-economic effects of the stagnation of agriculture in these states is the increasing gap between the urban and rural populations. In particular, small and marginal farmers face ever-deepening debts because their cash flows, due to falling yield levels, rising input costs, and climate volatility, are insufficient to sustain a reasonable standard of living. This has led to extreme distress in the countryside, widespread farmer suicides, and a bleak future for the posterity willing to take up farming as their career. There is a growing trend of rural youth migrating towards cities in search of better employment opportunities, and this trend is becoming more pronounced in both Madhya Pradesh and Rajasthan. This is making the situation even more critical for the agricultural economy. However, the scenario is not straightforward: sustainable farming practices offer a silver lining as they not only protect the ecosystem but also enhance the economic well-being of the community and overall resilience.

The promotion of sustainable agriculture in these areas needs strong policy measures that can support this change. State and national policies have acknowledged the role of sustainable agriculture, but their implementation is often hampered by a lack of co-ordination, inadequate financing, and poor awareness. The government, under schemes such as the National Mission for Sustainable Agriculture (NMSA) and the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), has set the foundation for enhancing sustainable agriculture, with an emphasis on water conservation, soil health management, and organic cultivation. But the true test is in implementing these policies at the grassroots level, where farmers are not aware of government schemes or lack access to resources needed to adopt them.

State governments in Madhya Pradesh and Rajasthan have also initiated efforts to encourage sustainable agriculture, emphasizing organic farming, water management, and agroforestry. Rajasthan has, for instance, implemented the 'Watershed Development Program' and 'Rajasthan Organic Farming Policy' with the objective of enhancing water management and encouraging the use of organic farming techniques. Madhya Pradesh has emphasized enhancing soil health with the 'Soil Health Management Campaign' and promoting agroecological practices supportive of biodiversity. Although these policies are promising, there is still a wide gap between policy documents and ground-level implementation. There is an urgent need for more training and extension services to inform farmers about sustainable practices, stronger market linkages to guarantee remunerative prices for organic products, and financing support mechanisms to facilitate the transition.



Farmers in these states are increasingly adopting practices like crop diversification, intercropping, rainwater harvesting, and organic farming as part of the larger move towards sustainability. These measures contribute to water conservation, soil fertility enhancement, and a decrease in reliance on chemical inputs. Crop diversification, for example, minimizes risks of market volatility and supports climatic uncertainty, while organic farming improves soil health and increases biodiversity. In addition, the utilization of indigenous crops and traditional knowledge has been found useful in ensuring food security and climate change resilience. Farmer producer organizations (FPOs) and cooperatives have also helped in encouraging sustainable agriculture through training, collective marketing, and resource access. These organizations provide a platform for farmers to exchange information, share resources, and gain better markets, hence enhancing their socio-economic status.

Even with these encouraging trends, challenges persist in scaling up sustainable practices. Limited credit availability, high initial investments in adopting new technologies, and the requirement of long-term investments in education and infrastructure still keep widespread adoption out of reach. Additionally, the political economy that governs agricultural policy tends to favor short-term remedies over long-term sustainability, rendering it tough to maintain substantial change. There is a requirement for a more integrated policy approach that not only encompasses enhancing agricultural practice but, for instance, also addresses wider issues like rural employment, healthcare access, and education.

The implementation of sustainable agriculture in Madhya Pradesh and Rajasthan has tremendous potential to redefine the socio-economic geography of these states. While several obstacles have to be crossed, the dividends of sustainable agriculture as a strategy to conserve environment, ensure economic stability, and promote social equity are evident. The policy interventions in supporting these practices are key, but their implementation depends on implementation quality, farmer participation, and availability of sufficient resources. With the global consequences of climate change, shifting towards sustainable agriculture in Central India is an opportunity to create a robust and thriving agricultural future for millions of farmers and local populations. By paying attention to both socio-economic and environmental sustainability, such states can be models for other areas facing similar issues.

II. CONCEPT OF SUSTAINABLE FARMING

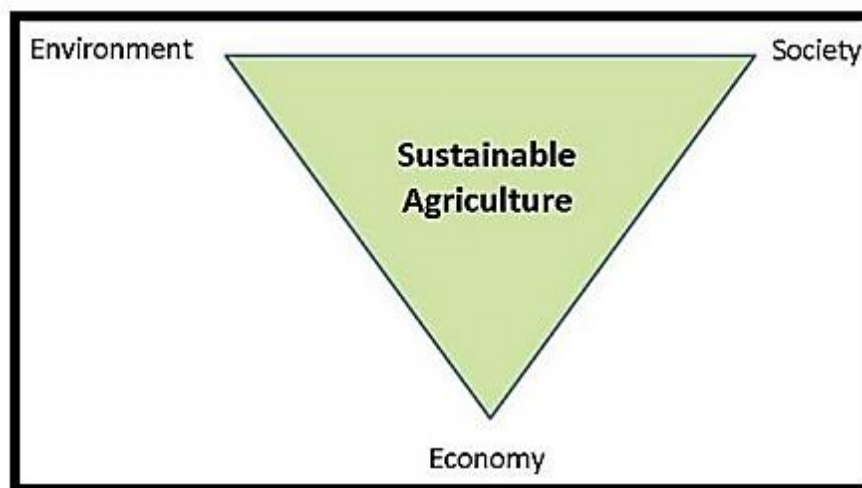
The idea of "sustainable agriculture" is based on the same sustainability premise as the rest:

that we should provide for our current needs without compromising those of future generations. The agriculture industry and all life on Earth depend on the preservation of natural resources.

"Sustainable agriculture" refers to agricultural practices that not only provide food and fiber but also safeguard public health, the environment, and the well-being of both humans and nonhuman animals. Using the least amount of energy and hazardous substances feasible, it combines a number of eco-friendly agricultural practices that keep output and profit levels high. Crop rotation, organic farming, mixed farming, diversified cropping, and strip farming are a few examples of such agricultural approaches. Among these methods, organic farming has been the most popular and fruitful. A growing number of people have been speaking out against the need for these high fees and proposing new, more reasonable options for the previous forty years.

More and more, the sustainable agricultural movement is finding a home in our food production systems these days. Social justice, financial gain, and ecological health are the triad of objectives that comprise sustainable agriculture (Figure 1). Most definitions of sustainable agriculture include comparable ideas and concepts, despite the fact that they have been

achieved via
variety of
beliefs, laws,
practices.



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Figure 1: Environmental, social, and economic concerns are given equal weight in sustainable agriculture

Sustainable agriculture is based on the premise that current demands must not be satisfied at



the expense of future generations' capacity to do the same. Consequently, long-term management of natural resources is just as important as short-term management of human resources. Human resource management takes into account societal responsibilities including workers' living and working circumstances, the requirements of rural communities, and consumers' present and future health and wellbeing. Proper land and resource management entails preserving or improving their condition and making use of them in a way that permits regeneration down the road. While evaluating stewardship, it is important to keep animal welfare in mind as it pertains to agricultural farming operations that involve animals. Agroecosystems and food systems must be examined in order to grasp sustainability.

Any given field, farm, or Eco zone may be considered part of a larger agro ecosystem. Everyone from individual farmers to whole global populations is a part of the food chain. Agroecosystems, food distribution, and consumption are all parts of food systems. Focusing heavily on a systems approach allows us to understand our agricultural production and distribution activities, how they impact human society and the environment, and more thoroughly. On the flip side, systems thinking also provides us with the means to evaluate the impact of human institutions on agricultural practises and ecological preservation. Action, education, and research are the three pillars upon which agroecosystem and food system strategies rest. All parties involved in our food and agricultural systems, including researchers from many fields, farmers, farm laborers, merchants, customers, and legislators, must work together to make agriculture more sustainable. Last but not least, there is no one result that defines sustainable agriculture. What constitutes environmental, social, and economic sustainability is a notion that is continuously shaped by the effect of current events, different viewpoints, and ethical considerations within the scientific community. For instance, there has been a marked increase in interest in the topic of agricultural resilience in adapting to climate change in the last twenty years, despite the fact that this was not a central worry twenty years ago. What makes a sustainable system may also vary according to ideology, culture, and environmental factors (soil types, climate, labor costs, etc.). So even the term "sustainable" has become politically charged. Therefore, it is more helpful and acceptable to think of agricultural systems as functioning on a spectrum from very unsustainable to very sustainable, rather than placing them in a sustainable vs. unsustainable juxtaposition.

Natural Resource Management and Sustainable Agriculture



The depletion of natural resources due to food and fiber production will make future generations less able to provide for themselves. The collapse of ancient civilizations in Mesopotamia, the Mediterranean, the pre-Columbian southwestern US, and Central America is said to have been caused in large part by the depletion of natural resources as a result of too productive forests and agricultural practices. While improving the productive capacity of natural resources, sustainable agriculture seeks to decrease the adverse consequences on ecosystems outside of a field's perimeter. To this end, farmers use a number of different tactics. One is to think about ways to improve upon already-established natural processes. Another is to build their production systems so that they include essential ecosystem activities. An economically productive system may be maintained with fewer potentially detrimental interventions via the development of biologically-integrated agro ecosystems that rely more on the internal cycle of nutrients and energy. For instance, in order to reduce their use of harmful pesticides, farmers who are committed to environmental sustainability may look at ways in which insect populations might be managed via natural processes. To do this, one may plant a variety of crops that either confuse or repel pests, or one can develop ground cover or hedgerows along rows to attract insects and birds that hunt on pests. Preserving as many different kinds of crops and animal breeds as possible not only provides more genetic material for developing pest and disease resistance, but it also allows for a higher degree of genetic variety. Another way to preserve the resources needed for agricultural production is to keep the soil in good condition so that it doesn't degrade. Soil is a complex and diverse entity made up of mineral particles, organic materials, water, air, and living creatures.

Sustainable farmers prioritize soil health since it directly affects the health of their animals and crops. Keeping soil organic matter at a constant level, or even increasing it, is often necessary to keep soil functioning. Soil organic matter serves both as a nutrition supply and sink, in addition to its many other important roles as a substrate for microbial activity and a buffer against changes in pH, water content, contaminants, and so on. In addition, organic matter deposition in soil may reduce the effects of climate change by reducing the rise in atmospheric CO₂. Soil organic matter plays an essential role in reducing wind and water erosion by improving the soil's structure via improved water infiltration, decreased runoff, better drainage, and higher stability.

3.2.2 Agriculture and Society for Sustainability.

The ability to sustain agro ecosystems over time relies on having the technical know-how, labor skills, and specialized understanding to tend to them properly. Since agriculture is a dynamic



and site-specific industry that relies on both the formal, experimental science and the farmers' own first-hand knowledge of the area, a diverse and flexible body of information is necessary for sustainability. Improving agricultural output and sustainability over the long run is possible via social institutions that teach scientists and farmers together, encourage innovation, and permit cooperation between the two. When discussing sustainable farming, questions of social justice often arise. Most industrialized nations rely heavily on migrant labor from less developed nations for agricultural output due to the very low pay offered to farm laborers. There will be greater strain on public social services and farmers will be more susceptible to changes in immigration policy as a result of this. In addition to poor earnings, low living standards, and limited prospects for job stability, career progression, and exemption from occupational safety requirements that are common in other sectors, the precarious legal statuses of the majority of these workers are major contributors to these problems. Farmers have less economic clout due to the concentration of food producers and distributors, making it harder for them to demand better terms and safer working conditions. Farmers may increase their economic clout by building direct marketing channels, searching for niche markets, growing specialist crops, processing their own products, or joining a cooperative.

III. INDIA'S APPROACH AND INITIATIVES BY GOVERNMENT

Climate change, global warming, environmental degradation, population growth, and widespread food insecurity are all global issues. In light of this, in an effort to fulfill its obligations under international accords such as the Paris Climate Change Agreement of 2015, India has initiated a comprehensive plan to protect the environment and ensure the well-being of its citizens. In order to revitalize the agricultural business and foster the growth of sustainable agriculture, India has taken a multipronged strategy.

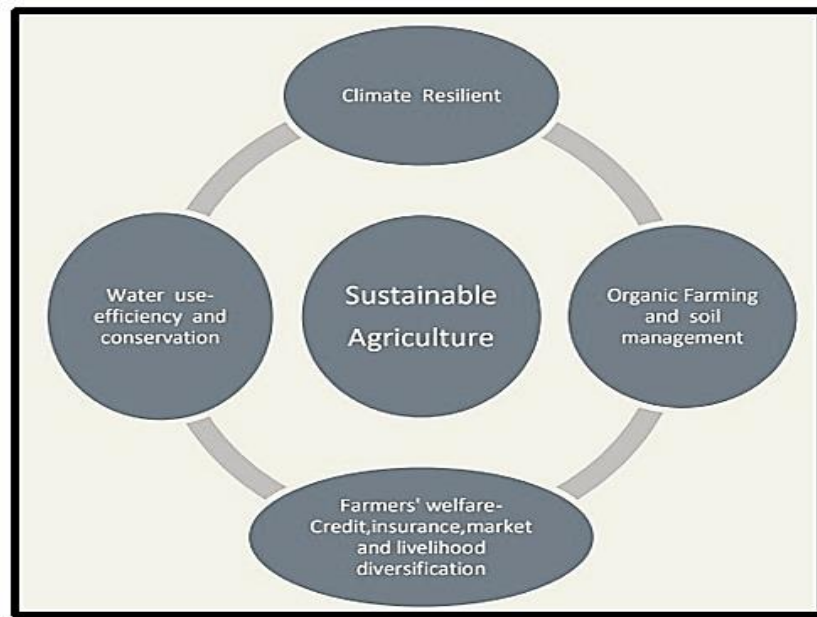


Figure 2: Key Areas of India's Approach

Important considerations in India's approach include the topography, local climate, accessibility of technology, and availability of water supplies. Reviving time-honored agricultural practices like crop rotation, organic farming, and mixed farming while making them climate-resilient is its principal goal. Its secondary objective is to maximize the benefits of rain-fed agriculture in India, which occurs on dry soil. Other than this, the Indian government has placed a premium on encouraging micro-irrigation techniques and guaranteeing the environmentally responsible expansion of irrigation infrastructure. The government also encourages farmers to expand their businesses into related but distinct industries, such as raising goats and chickens, weaving, beekeeping, and forestry. Sustainable horticulture is made possible via financial assistance for farmers residing in mountainous locations, particularly in the states of the West Himalayas and Northeastern India. Efforts to improve infrastructure, process food, and increase dairy production lessen farmers' reliance on agriculture.

- **Pradhan Mantri Krishi Sinchai Yojna(PMKSJ):**

On July 1, 2015, the Union Government unveiled this initiative with the motto "Har Khet Ko Paani." Under PMKSJ, many existing programs are set to merge, including the Integrated Watershed Management Program, the On Farm Water Management Program, the Accelerated Irrigation Benefit Program, and others. All the way from farm-level applications to

distribution networks and water resources, it aims to provide end-to-end solutions for the irrigation supply chain. Producing protective irrigation by the micro-level collection of rainwater utilizing "Jal Sanchay" and "Jal Sinchan" is another priority, in addition to offering sources of assured irrigation. The primary goal of PMKSY is to decrease water loss by improving on-farm water usage efficiency, increasing the amount of arable land that can be irrigated with certainty, and bringing irrigation investments closer together at the field level. It also aims to replenish aquifers, implement sustainable water usage conservation practices, and increase the use of precision irrigation and other water saving technology (Per Drop, More Crop).

- **National Micro:**

A Mission on Irrigation Developing and disseminating micro-irrigation systems was the original motivation. From 3.09 million hectares in 2005 to 6.14 million hectares in 2012, the area covered by micro-irrigation almost quadrupled under this effort. As a total, labor, water, and power costs may be reduced with micro-irrigation since it employs a variety of methods to improve water usage efficiency, which in turn increases crop output. Sprinklers and drip irrigation are two methods that are used in micro-irrigation. As a result, micro-irrigation is yet another tool for promoting sustainable agriculture.

- **Soil Health Card Scheme:**

The government of India began the Soil Health Card initiative in 2015 with the goal of revitalising the country's worn-out soils. Soil health cards with crop-specific nutrient and fertilizer recommendations are sent to participating farmers. Its goal is to improve soil health and production via integrated nutrient management (INM) by the prudent use of chemical fertilizers, including micro- and secondary-nutrients, in conjunction with organic manures and biofertilizers.

- **Pradhan Mantri Fasal Bima Yojna:**

To assist farmers in dealing with crop loss, the Indian government introduced this flagship program in 2016. It is designed to assist farmers continue farming even if they experience crop loss due to weather-related events, natural catastrophes, or climate change by providing them with a consistently low premium. The mission of PMFBY is to encourage long-term

agricultural production by providing financial aid to farmers who experience crop damage or loss as a result of unforeseen circumstances. To further the goals of sustainable agriculture and financial stability for farmers, it pushes them to use cutting-edge agricultural practices.

- **Role of Organic Farming:**

The rise of organic farming in India is a response to growing concerns about food safety and environmental impact, as well as a viable economic choice for rural residents. The idea of sustainability is constantly called into question when chemical fertilizers and pesticides are used excessively. It has negative effects on ecosystems and the food web. When it comes to farming, organic methods steer clear of anything that might harm the agro-ecosystem. As an added bonus, it helps maintain a healthy ecosystem, which in turn reduces the likelihood of insect infestations and increases soil fertility. India has all the necessary human and environmental resources for the development of organic farming. In light of this, the government is putting effort into organic farming as a means to encourage sustainable agricultural practices.

- **Parampragat Krishi Vikas Yojna (PKVY):**

This is a cluster-based plan to encourage organic growing among farmers. Fifty or more farmers, each with fifty acres or more to tend, will band together to practice organic farming for this undertaking. By following this method, 10,000 clusters might be established on 5 lakh acre areas dedicated to organic farming within three years. Organic farming will gain popularity via the eco-conscious use of time-honored techniques.

IV. SOCIO-ECONOMIC IMPACT OF SUSTAINABLE FARMING IN MADHYA PRADESH AND RAJASTHAN

Sustainable agriculture in Madhya Pradesh and Rajasthan has had significant socio-economic consequences, altering rural livelihoods, improving food security, and ensuring inclusive development in historically agricultural regions.

These two states, with heterogeneous agro-climatic conditions and large rural communities, have experienced a dramatic change in their paradigms of agriculture—away from high-input, resource-reliant models towards more environmentally friendly and economically efficient farming systems. This shift has not only enhanced the ecological resistance of



agriculture but also has resulted in significant changes in the socio-economic lives of the agricultural communities.

1. Income Diversification and Rural Livelihoods

One of the most apparent socio-economic effects of sustainable agriculture is diversification of the source of income for farm families. Conventional mono-cropping has been replaced by diversified cropping with crops such as pulses, oilseeds, vegetables, fruits, and medicinal plants. In Madhya Pradesh, for example, development of organic soybean and lentil production has resulted in opening doors to quality markets, thereby raising farm revenue. Likewise, in Rajasthan, the growing of drought hardy crops such as pearl millet and guar under conservation and organic farming practices has yielded steadier incomes, even during irregular rainfall years. Sustainable agriculture also promotes agroforestry and allied enterprises like beekeeping, dairy, and poultry, generating income throughout the year and less reliance on a single crop.

2. Employment Generation and Labor Engagement

Sustainable farming has resulted in rising labor intensity in certain situations, particularly in organic cultivation and mixed farming systems, which are less mechanized and human labor-intensive. This has generated new employment in rural sectors, particularly for landless laborers and marginal farmers. Furthermore, the increased demand for trained manpower in organic certification, input management, and water harvesting methods has provided opportunities for young people's involvement in agriculture services.

3. Empowerment of Women and Marginalized Groups

Sustainable agriculture in Madhya Pradesh and Rajasthan has empowered women and marginalized groups from a socio-economic perspective. Women have an important role in organic cultivation, seed saving, composting, and kitchen gardening. Self-help group (SHG) and women-led cooperative programs have helped women gain access to microfinance, training, and market networks. This not only raised family incomes but also improved the social standing of rural women. Targeted interventions and inclusive land-use schemes favoring sustainable agriculture have also benefited Scheduled Castes and Scheduled Tribes, who earlier had restricted access to productive resources.

4. Food Security and Nutritional Improvement

Sustainable farming has contributed favourably towards food security in these states. Through diversified cropping, such as healthy indigenous grains like millets, lentils, and leafy vegetables, farm households have enhanced their dietary diversity. Sustainable agriculture decreases the reliance on chemical inputs, such that produced food is healthier and safer. Further, increased water and soil fertility also lead to stable yields, resulting in household-level food security even in unfavorable climatic conditions.

5. Access to Markets and Value Chains

Madhya Pradesh and Rajasthan's sustainable farmers are increasingly being connected to niche markets, such as organic and fair-trade markets, both globally and nationally. Certification processes have been made easier for farmers by government schemes and NGOs, as well as supported market linkages and branding. Cooperatives and farmers' producer organizations (FPOs) provide smallholders with an opportunity to aggregate produce, enhance bargaining power, and acquire better prices. Market access not only increases incomes but also promotes additional take-up of sustainable practices.

6. Reduction in Input Costs and Debt Burden

One of the most important economic benefits of sustainable agriculture is the less dependence on expensive chemical inputs like synthetic fertilizers and pesticides. Through the use of organic inputs, composting, and integrated pest management, farmers drastically minimize production costs. In an area where farmer indebtedness is a serious issue, particularly in Rajasthan's drought-affected regions, these cost savings minimize the risk of debt loops and ensure financial stability.

The socio-economic effect of sustainable agriculture in Rajasthan and Madhya Pradesh is far-reaching, impacting income, employment, food security, gender equality, and community resilience. Through its role in establishing a more inclusive, equitable, and environmentally conscious rural economy, sustainable agriculture is a potent instrument for poverty as well as ecological degradation alleviation in Central India. The success seen here highlights the need to replicate such models on a large scale in other regions with well-supported policy



environments, institutions, and community engagement.

V. CONCLUSION

Government of India has a clearly defined set of schemes to address nearly all the requirements and problems associated with the development of sustainable agriculture. But the success and solution also lie in the smooth implementation of the programmes. Agriculture is a state subject in India which resulted in politicization and division of actions and solutions pertaining to it. At the national level there is a necessity to shape a consensus with the states for implementing a national agenda of sustainable agriculture. Additionally, higher education institutions can make their contribution to ecologically sustainable agriculture by training and enabling farmers to switch to sustainable farming practices. The advancement of sustainable agriculture relies more on the establishment of organic farming. It's time for taking strategic and constructive measures to bridge the hurdles in the path of organic farming. There is a need for an exhaustive framework that combines organic farming with bottom-up reactions. It must also tackle technology diffusion with two-way knowledge flow from farmers' institutions.

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