

Role of Women and Youth in Promoting Multi-Layered Organic Farming in Rural Bengal

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DOI: <https://doi.org/10.51584/IJRIAS.2026.11080035>

Received: 19 August 2026; Accepted: 24 August 2026; Published: 01 September 2026

ABSTRACT

The crisis of fragmented holdings also reflects in the declining profitability of traditional mono-cropping patterns. High reliance on chemical fertilizers and pesticides has increased costs without ensuring long-term soil fertility, while erratic monsoons and climate shocks have further disrupted production cycles. In this context, the challenge before rural Bengal is not merely to sustain agriculture, but to reimagine it in a way that maximizes output from small plots, reduces external input dependence, and builds ecological resilience. This is where **Multi-Layered Organic Farming (MLOF)** emerges as a potential game-changer.

Key Words: Multi-Layered Organic Farming, Relevance for Bengal's Agro-Ecological Context, Advantages of Multi-Layered Organic Farming, Organic Farming Experiences in Bengal, Broader Policy and Cultural Significance

INTRODUCTION

Agriculture has always been the backbone of West Bengal's rural economy, but it faces unique structural challenges that demand innovative solutions. The state is one of the most densely populated regions in India, with nearly 1,029 persons per square kilometer according to the Census of 2011, far higher than the national average. This demographic pressure translates into extreme fragmentation of landholdings; as agricultural plots are subdivided over generations to accommodate family divisions. The Agriculture Census (2015–16) highlights that more than 82 percent of Bengal's farmers fall under the category of small and marginal farmers, with the average landholding size at just 0.77 hectares compared to the national average of 1.08 hectares. Such limited access to cultivable land restricts economies of scale, limits mechanization, and makes farmers vulnerable to both input cost inflation and climatic variability. These conditions contribute to low productivity, high input dependency, and ecological stress, creating a cycle of insecurity that compels many rural youths to migrate in search of non-farm employment.

Multi-Layered Organic Farming combines the principles of vertical and horizontal cropping with integration of allied enterprises such as livestock rearing, fisheries, poultry, beekeeping, and mushroom cultivation. Unlike conventional mono-cropping, it encourages farmers to cultivate multiple crops on the same piece of land in different layers—fruit trees in the top canopy, creepers or vegetables in the middle, and root crops or mushrooms closer to the ground. This system not only makes better use of space and resources but also diversifies risks, ensuring that the failure of one crop does not jeopardize household income. Further, integration with livestock and organic input generation—such as composting and vermiculture—reduces reliance on costly chemical fertilizers and pesticides. The result is lower input costs, higher per-unit productivity, and year-round food and income security. Studies conducted by Krishi Vigyan Kendras (KVKs) in Nadia, Bankura, and South 24 Parganas have shown how small farmers adopting banana–papaya–brinjal–spinach layering systems or integrated rice–fish–vegetable models could improve both nutritional availability and market returns. Such innovations align with global arguments for sustainable agriculture, as highlighted by Jules Pretty in his influential work *Regenerating Agriculture* (1995), which advocates practices that balance productivity with ecological stability.

The effectiveness of MLOF, however, depends on human capital as much as on technical design. In rural Bengal, women and youth constitute the two most crucial groups in this regard. Women already account for a substantial share of agricultural labour, ranging between 40 and 45 percent according to the FAO's 2011 report *Women in Agriculture* and the NSSO's surveys of agricultural households. Their contributions, often invisible in statistics, include seed preservation, compost preparation, transplanting, weeding, and managing small livestock and mushroom sheds. Women's role in ensuring household-level food security and their familiarity with diversified cropping make them natural custodians of organic and layered farming systems. Empowering them through Self-Help Groups (SHGs) under the National Rural Livelihood Mission (NRLM) has already demonstrated success in micro-credit access and collective action, paving the way for scaling up MLOF models.

Equally important is the role of rural youth, who make up nearly 27 percent of Bengal's population aged 15 to 29 years, according to the Census of 2011. While youth migration to cities has been a persistent trend due to the low prestige and profitability associated with agriculture, initiatives that align farming with entrepreneurship and technology can alter this perception. Young farmers bring digital literacy, openness to innovation, and energy for collective mobilization. Their ability to use mobile applications for soil testing, marketing platforms such as e-NAM, and social media for branding organic produce complements the traditional knowledge systems maintained by women. Youth clubs under the Nehru Yuva Kendra Sangathan (NYKS) and training platforms provided by KVKs already demonstrate how rural youth can take the lead in spreading sustainable models like multi-layered farming. Moreover, government schemes such as the **Paramparagat Krishi Vikas Yojana (PKVY)** specifically encourage organic clusters where youth and women are prioritized as beneficiaries.

Thus, in the context of fragmented landholdings and ecological strain, MLOF provides a sustainable agricultural pathway for rural Bengal. But its true promise lies not just in the technical benefits of layered cropping systems—it lies in the synergy of women's traditional agrarian knowledge with the innovative capacities of rural youth. Recognizing and harnessing their roles is critical for transforming Bengal's smallholder agriculture into a resilient, inclusive, and future-ready system.

Multi-Layered Organic Farming: Concept & Relevance in Bengal

Definition of Multi-Layered Organic Farming

Multi-Layered Organic Farming (MLOF) has emerged as an innovative response to the structural challenges of small and fragmented landholdings in India, particularly in states like West Bengal. The system is based on the principle of cultivating multiple crops in vertical and horizontal layers to maximize land use, resource efficiency, and ecological resilience. In a typical model, tall tree crops such as papaya, banana, or guava form the top layer, creepers like bitter melon or beans make up the second, medium-sized crops such as brinjal or spinach spread across the ground layer, and root crops like turmeric, ginger, or radish form the lowest tier. To enhance the efficiency of resource cycling, allied enterprises such as poultry, duckery, fish ponds, beekeeping, and mushroom cultivation are integrated into the system. Unlike mono-cropping, which ties farmers to a single harvest and exposes them to high risks, multi-layered systems distribute risks and ensure year-round income.

Relevance for Bengal's Agro-Ecological Context

The relevance of MLOF in Bengal lies in its ability to adapt to diverse agro-climatic zones. The Old Alluvial Zone, which covers districts like Nadia and Murshidabad, possesses fertile soils with good water retention capacity, making it suitable for fruit-vegetable combinations in layered farming. The New Alluvial Zone, spread across Hooghly and Howrah, benefits from riverine deposits, ideal for quick-cycle vegetables, leafy greens, and creeper crops alongside mushroom cultivation in shaded areas. In contrast, the Coastal Saline Zone of South 24 Parganas is challenged by salinity and waterlogging, but here farmers have successfully integrated saline-tolerant rice with fish culture in ponds and vegetables on raised bunds. The Red and Lateritic Zones of Bankura and Purulia, with their less fertile and drought-prone soils, have seen adaptations involving mango, pulses, creepers, and indoor mushroom sheds to stabilize household incomes. West Bengal's climatic profile, marked by high rainfall between 1,500 and 2,500 millimetres annually and a humid subtropical environment, further supports MLOF by enabling rapid crop cycles. However, this same climate often brings erratic monsoons and unseasonal

rainfall, making reliance on single crops precarious. Layered systems, by contrast, create ecological and economic buffers against such shocks.

Advantages of Multi-Layered Organic Farming

One of the foremost advantages of MLOF is the significant increase in cropping intensity. Multiple crops can be harvested from the same piece of land across different layers, raising per-hectare output and maximizing productivity on fragmented plots. Another advantage is nutritional security, since families cultivating a mix of vegetables, fruits, pulses, mushrooms, and fish are less dependent on external markets and enjoy access to diverse foods within their farms. This has direct implications for combating malnutrition and ensuring household food sovereignty in rural Bengal. The model also offers risk diversification, as damage to one crop due to pests or climatic stress can be compensated by other components in the system. Additionally, the approach is inherently compatible with organic farming practices. Organic composting, vermiculture, and the recycling of crop residues into bio-fertilizers strengthen soil fertility and reduce external input costs. Diverse cropping also disrupts pest cycles, lessening the need for chemical pesticides. This ecological sustainability resonates with arguments put forward by Jules Pretty in *Regenerating Agriculture* (1995), which emphasized the balance between productivity and ecological health in smallholder systems.

Organic Farming Experiences in Bengal

Experiences across different districts of West Bengal demonstrate the localized adoption of MLOF. In Nadia, the Krishi Vigyan Kendra (KVK) has pioneered models where papaya serves as the canopy crop, banana occupies the middle layer, spinach grows at the ground level, and brinjal is intercropped. Farmers have reported improved incomes and better soil utilization, and many Self-Help Groups (SHGs) under the National Rural Livelihood Mission (NRLM) have replicated these models. In the Sundarbans, where salinity intrusion has made paddy cultivation increasingly difficult, integrated systems combining saline-tolerant rice with fish ponds and vegetables on bunds have proven highly resilient. This not only strengthens food security but also provides a buffer against cyclonic disruptions that are frequent in the region. NGOs such as the Development Research Communication and Services Centre (DRCSC) have documented such transformations, underscoring the role of community-led adaptation. Similarly, in Bankura and Hooghly, mushroom cultivation has been integrated into MLOF frameworks, particularly by women's SHGs. With minimal land requirements and year-round market demand, mushrooms have become an effective supplement to vegetable and fruit-based layers. Reports from Bankura KVK reveal that SHGs engaged in oyster and milky mushroom production have significantly boosted household earnings while improving dietary diversity. In peri-urban Hooghly, proximity to urban markets has further enhanced the viability of mushroom–vegetable clusters.

Broader Policy and Cultural Significance

The success of MLOF is not only technical but also institutional and cultural. The West Bengal Agriculture Department's State Agriculture Plan (2017–20) identified diversification, organic farming, and women's participation as critical areas of intervention, and schemes like the Paramparagat Krishi Vikas Yojana (PKVY) have supported organic clusters. NABARD and KVKs have also promoted collective farming and cluster-based training, often targeting women's SHGs and rural youth groups. Academic work by the Agro-Economic Research Centre, Visva-Bharati (Biswas, Majumder, Sinha, 2011), highlighted the economic promise of organic farming despite infrastructural constraints, and pointed to the importance of integrated and diversified systems for smallholders. Beyond policy frameworks, the approach resonates with Bengal's cultural heritage. Rural households have historically relied on mixed farming systems—paddy with fish ponds, homestead gardens with fruit trees, and seasonal vegetables in courtyards. Multi-Layered Organic Farming can therefore be seen as a modernization of traditional practices, blending local wisdom with scientific innovations.

Taken together, the evidence suggests that MLOF holds immense potential for rural Bengal. It enables small and marginal farmers to increase output, improve nutrition, reduce vulnerability to climate shocks, and align with the growing demand for organic produce. Its flexibility is its strength—whether in Nadia's papaya–banana–vegetable layering, Sundarbans' rice–fish–vegetable integration, or Bankura's mushroom clusters, MLOF adapts

to local soil and climatic conditions while mobilizing women and youth as primary agents of change. It is not merely a farming technique but a holistic model of livelihood resilience, ecological sustainability, and socio-economic empowerment for the agrarian communities of Bengal.

Labour Distribution in Layered Farming Systems

Gendered Labour Roles

The distribution of labour in multi-layered organic farming (MLOF) reflects both the strengths and the inequalities embedded in Bengal's rural society. Women play a pivotal but often under-acknowledged role in sustaining the system. They are the custodians of **seed selection and storage**, a practice rooted in traditional knowledge passed down generations. Women carefully identify healthy seeds, preserve them using indigenous techniques, and ensure varietal continuity, which is crucial for organic farming that avoids hybrid and genetically modified seeds. Alongside seed management, women are also the primary actors in **composting activities**. Whether through traditional cow dung-based compost, vermicomposting, or the preparation of organic sprays, women's labour ensures a steady supply of soil fertility enhancers for multi-layer systems.

Women are also heavily involved in **weeding, transplanting, and nursery management**, which demand precision and regular attention. These tasks are labour-intensive and align with women's long-standing role in vegetable cultivation and small-plot management. In recent years, women's Self-Help Groups (SHGs) have taken leadership in **mushroom cultivation**, which requires less land, low capital, and can be undertaken indoors. Mushroom farming thus offers a crucial livelihood stream compatible with women's household responsibilities. Furthermore, women manage **small livestock, poultry, and ducks**, which integrate seamlessly with multi-layered farming, providing manure for crops while generating eggs and meat for household nutrition and markets.

By contrast, men's participation is concentrated in tasks requiring heavier physical effort or involving market exposure. Men are primarily responsible for **land preparation**, such as ploughing, irrigation setup, and initial sowing, which involve machinery or draught power. They also handle the **maintenance of tree crops** like papaya, banana, or mango in the upper layers, which often require climbing, pruning, or pesticide spraying. Finally, men dominate the domain of **market linkages and transportation**, selling the produce at rural haats or wholesale mandis, and interacting with traders. This gendered division not only reflects social norms but also highlights the invisibility of women's substantial contribution, which remains undervalued in official statistics and policy discourses (Agarwal, 2018; FAO, 2011).

Youth Labour Roles

The role of youth in layered farming systems has acquired new significance with the spread of digital technologies and agri-entrepreneurship opportunities. Rural youth often manage the **digital interface of farming**, including marketing produce through WhatsApp groups, Facebook Marketplace, or Farmer Producer Organization (FPO) e-platforms. This is particularly important in connecting organic and diversified farm produce to peri-urban and urban consumers who demand chemical-free food but are otherwise difficult to reach through traditional market systems.

Young farmers also take the lead in operating **small farm machinery and spraying devices**, which improve efficiency and reduce drudgery for older farmers. Their comfort with technology extends to using **mobile applications for soil testing, weather forecasting, and nutrient management**, which are increasingly offered by government agencies and agri-tech startups. Beyond operational roles, youth are also the primary drivers of **innovation in cropping systems**. They experiment with **short-cycle vegetables**, aquaponics, hydroponic creepers, and integrated start-ups combining farming with value-added enterprises such as food processing or online delivery. The NITI Aayog's (2018) report on youth in agriculture emphasizes this transformative role, highlighting that young farmers can blend traditional farming with modern entrepreneurship, a feature visible in several FPO clusters in West Bengal.

Seasonal and Layer-Based Distribution of Labour

The distribution of labour also varies across the vertical layers of MLOF and across agricultural seasons. In the **top layer of fruit trees**, intensive labour is required during the initial stages of planting, manuring, and pruning, which are generally undertaken by men due to the physical demands and the cultural association of men with “tree farming.” These tasks, however, are periodic rather than continuous, requiring concentrated effort at particular times of the year.

The **middle layer, consisting of vegetables and creepers**, demands constant care—regular weeding, irrigation, pest control, and harvesting throughout the cropping cycle. Labour here is more evenly shared between men and women, although women often shoulder the greater part of daily maintenance. Since vegetables also form the bulk of household consumption, women’s involvement ensures direct nutritional benefits.

The **bottom layer, involving root crops, creepers close to the ground, or mushrooms**, requires daily, meticulous labour, and is overwhelmingly managed by women. Mushroom sheds, in particular, need continuous humidity control, harvesting at precise intervals, and hygienic handling—tasks that women’s SHGs have successfully adopted in Bankura and Hooghly. Poultry and small livestock at the base layer also fall within women’s domain, linking seamlessly to crop layers through nutrient recycling.

This layered labour distribution illustrates a complex system where men, women, and youth contribute differently, but women remain central to the everyday functioning of multi-layered farms. Their labour, though less visible in public markets, forms the backbone of the system’s ecological and economic sustainability.

Challenges in Labour Distribution

Despite the strengths of this labour arrangement, several challenges persist. One pressing issue is the **migration of rural youth**, particularly young men, in search of non-farm employment. Migration creates a dual effect: it reduces the availability of male labour for land preparation and tree maintenance, while simultaneously increasing the **feminization of agriculture**, with women taking on even more responsibilities. While women are capable and often efficient, this shift adds to their already heavy workload without necessarily improving their access to income or decision-making authority.

Women also face the problem of **time poverty**, as they balance farm labour with household responsibilities such as cooking, child care, and elder care. This dual burden often restricts their ability to participate in training sessions, marketing activities, or decision-making forums. Gendered norms further limit their presence in public markets, keeping them excluded from higher-value chains.

Another major challenge is the **lack of recognition of women’s labour** in agricultural statistics and policy frameworks. Women are often classified as “helpers” rather than farmers, which excludes them from formal entitlements such as credit, subsidies, and insurance. This invisibility perpetuates a cycle where women contribute substantially to farming systems like MLOF but remain marginalized in terms of rights and recognition. Scholars like Bina Agarwal (2014, 2018) have repeatedly highlighted this structural gap, while FAO (2011) stressed that closing the gender gap in agriculture could raise overall productivity by up to 30 percent.

These challenges underline that labour distribution in multi-layered farming is not just a technical or economic issue but also a **social and gendered concern**. Addressing them requires policies that reduce women’s drudgery through technology, acknowledge their roles through official recognition, and create incentives for youth to remain engaged in agriculture through entrepreneurship and market linkages.

In sum, labour distribution in layered farming systems in Bengal demonstrates a clear division of roles: women dominate seed preservation, composting, mushroom cultivation, and small livestock management; men handle land preparation, tree crop care, and marketing; while youth introduce digital innovation, mechanization, and entrepreneurial approaches. The seasonal and vertical structuring of labour adds further complexity, ensuring that all family members have roles suited to their skills and social positions. Yet, the persistence of gender bias, migration pressures, and the invisibility of women’s contributions remain barriers. Unless these issues are

addressed through recognition, training, and support systems, the promise of MLOF as an inclusive and sustainable model may be limited. The evidence from KVK demonstrations, SHG-led mushroom clusters, and youth-driven FPO marketing suggests, however, that with the right institutional backing, these challenges can be transformed into opportunities for more equitable and resilient agricultural futures in Bengal.

Role of SHGs and Rural Youth Clubs in Driving Adoption

Self-Help Groups (SHGs)

Self-Help Groups (SHGs) form the backbone of rural collectivization in West Bengal and have been instrumental in the spread of sustainable farming practices, including multi-layered organic farming (MLOF). Under the **National Rural Livelihood Mission (NRLM)**, known locally as the **Anandadhara project**, the state has built a strong network of more than 10 lakh SHGs, comprising predominantly rural women. These groups are not only platforms for savings and credit but also engines of social empowerment and agricultural transformation.

The primary function of SHGs in the context of MLOF is the creation of **collective savings and access to micro-credit**. Through pooling small contributions, SHG members gain access to loans that are otherwise inaccessible to individual smallholders. These micro-credits are often used to finance low-cost agricultural infrastructure such as vermicompost pits, mushroom sheds, or small irrigation units. Such investments are essential for organic layered farming, which thrives on compost-based soil fertility and allied enterprises like mushroom cultivation.

SHGs also play a critical role in **training and knowledge dissemination**. Many groups, in collaboration with Krishi Vigyan Kendras (KVKs) and NGOs like DRCSC, receive training in **nutrition gardens and multi-layered farming models**, enabling members to experiment with diversified cropping in their homesteads or small plots. Training also extends to aspects of value addition, pest management using organic inputs, and maintaining soil health. The peer-learning environment within SHGs ensures that once one member adopts a successful practice, others quickly replicate it.

An equally significant contribution of SHGs lies in **collective marketing through women-led cooperatives and federations**. Individually, women farmers often face barriers in reaching markets due to social norms, lack of transport, and small volumes of produce. However, through SHG federations, women can aggregate surplus produce and negotiate better prices at local haats or even supply to urban organic outlets. Collective branding of organic vegetables or mushrooms by women-led groups in Hooghly and Nadia has shown that small producers can command higher value when they market jointly.

Concrete examples illustrate these roles vividly. In Purulia, for instance, tribal SHGs supported under NRLM have taken up **cultivation of creeper vegetables under tree crops**, a form of multi-layered farming adapted to the region's red and lateritic soils. These SHGs have not only ensured food security for their members but also supplied local markets with surplus produce, thereby creating a revenue stream. NABARD's reports and NRLM evaluations repeatedly highlight such success stories, where women's collectives make multi-layered farming financially viable.

Rural Youth Clubs

While SHGs empower women, rural youth clubs provide a parallel platform for mobilizing the younger generation. In Bengal, youth clubs associated with **KVKs (Krishi Vigyan Kendras)**, **NYKS (Nehru Yuva Kendra Sangathan)**, and Farmer Producer Organizations (FPOs) have become important drivers of MLOF adoption.

KVKs, functioning as the district-level extension arms of ICAR, play a vital role in **training rural youth in multi-layered farming models**. Demonstrations of crop combinations such as papaya with spinach and brinjal, or banana with creepers and root crops, are often organized on KVK farms or on the fields of progressive farmers. Youth are encouraged to participate in these demonstrations, ask questions during farmer–scientist interactions, and experiment with new models on their own plots. By providing hands-on training, KVKs reduce the

knowledge gap and create confidence among rural youth that farming can be profitable if diversified and integrated.

NYKS complements this process by focusing on **mobilization and community awareness**. As one of the largest grassroots youth organizations in the world, NYKS has been involved in promoting eco-clubs, environmental campaigns, and agricultural awareness programs in rural Bengal. Through these forums, youth are encouraged to view farming not as a backward occupation but as a field for innovation and social leadership. NYKS also links youth with SHGs and Panchayats, creating opportunities for them to engage in decision-making processes related to agriculture and sustainability.

In addition, youth play a crucial role in **managing Farmer Producer Organizations (FPOs)** and agri-startups. Many FPOs in Bengal, supported by NABARD and state agencies, have young leaders who handle **supply chains, digital marketing, and organic branding**. Their familiarity with online platforms allows them to connect local produce with broader markets, whether through e-NAM (the electronic National Agricultural Market), social media marketing, or urban organic food chains. In Hooghly, for instance, youth-led FPOs have successfully marketed mushrooms and leafy vegetables cultivated by SHGs to Kolkata's organic outlets, creating win-win linkages between women's production and youth's entrepreneurial skills.

Institutional Linkages

The strength of SHGs and youth clubs is enhanced through institutional linkages with agencies like NABARD, NRLM, and state departments. **NABARD** provides financial and capacity-building support to SHGs, often linking them with formal banking systems to scale their micro-credit operations. NABARD has also promoted **state-level farmer clubs**, which act as platforms for farmer-to-farmer knowledge exchange and community-based problem solving.

The integration of **NRLM–SHG clusters with the Paramparagat Krishi Vikas Yojana (PKVY)** has been a critical intervention in promoting organic clusters. Under this convergence, SHGs receive both financial and technical assistance to adopt chemical-free farming, often in the form of multi-layered crop models. These clusters enable collective certification under Participatory Guarantee Systems (PGS), reducing the cost and complexity of organic certification for small farmers.

Furthermore, the collaboration of youth organizations with government schemes has expanded opportunities. KVKs implement training modules under the Atma Nirbhar Krishi schemes, while NYKS youth clubs are often involved in mobilizing communities for agricultural exhibitions and awareness campaigns. Together, these institutional linkages ensure that both women's groups and youth collectives are not isolated but embedded within a larger ecosystem of policy support and knowledge dissemination.

D. Constraints and Opportunities

Despite their contributions, SHGs and rural youth clubs face several constraints in promoting MLOF. For SHGs, the **availability of credit remains limited**. While micro-credit provides small loans sufficient for basic inputs, larger investments required for irrigation, storage, or mechanization often remain out of reach. The absence of adequate collateral also prevents many women-led SHGs from accessing formal bank loans.

Youth face a different challenge—**aspirations for non-farm employment**. With education and exposure, many rural youths seek jobs in urban centres or aspire for white-collar careers, often perceiving farming as less prestigious. This aspiration gap reduces the pool of young people willing to commit to agriculture, even though their skills in digital literacy and entrepreneurship are crucial for MLOF's success.

However, these constraints are counterbalanced by significant opportunities. The growth of **e-commerce platforms, organic food markets, and agritech startups** provides avenues for both SHGs and youth collectives to scale their activities. Linking SHGs and youth groups with platforms like e-NAM, organic e-commerce networks, and government-supported farm-to-fork models could bridge the market access gap. Youth involvement in branding, logistics, and digital marketing can complement women's production strengths,

creating a holistic supply chain. Moreover, policy emphasis on sustainable farming and carbon-neutral agriculture at both state and national levels positions Bengal to benefit from climate finance and organic farming subsidies.

The experience of Bengal shows that SHGs and rural youth clubs are not peripheral but central to the promotion of multi-layered organic farming. Women's SHGs provide the foundation through savings, micro-credit, training, and collective marketing, while youth organizations add value through digital literacy, innovation, and entrepreneurial management of FPOs. Institutional support from NABARD, NRLM, PKVY, and KVKs strengthens this ecosystem, creating pathways for adoption and scaling. Though challenges of credit, aspirations, and recognition persist, the opportunities for linking these groups with agritech, e-commerce, and climate-smart policies are immense. By harnessing the complementary strengths of SHGs and rural youth, Bengal can transform its fragmented smallholder agriculture into a resilient, inclusive, and sustainable model that not only addresses food and income security but also empowers its rural communities socially and economically.

Empowerment Case Studies and Gender-Sensitive Analysis

A. Case Studies

1. Bankura Mushroom SHGs

One of the most successful illustrations of empowerment through multi-layered organic farming comes from **Bankura district**, where women's Self-Help Groups (SHGs) have taken the lead in mushroom cultivation. Supported by Krishi Vigyan Kendras (KVKs) and local NGOs, women were trained in cultivating **oyster and milky mushrooms**—crops well-suited to Bengal's humid climate and requiring minimal land. Mushroom farming, integrated as a bottom-layer enterprise within larger multi-layer systems, provided steady incomes without disrupting women's household responsibilities. Each member of these SHGs reported earning between **₹5,000 and ₹8,000 per month**, a significant supplement to household earnings. This additional income reduced the dependence of families on male migration to urban centers for wage labour, thereby keeping family units intact. Bankura's mushroom SHGs also demonstrate how women's collective action can establish resilient micro-enterprises: while individual farmers lacked the capital and knowledge to begin mushroom cultivation, group training and pooled savings allowed them to set up sheds, maintain humidity, and collectively market the produce. The case shows that when women gain both skills and financial access, they can transform small-scale organic enterprises into sustainable livelihood options.

Sundarbans Integrated Model

A very different but equally compelling case study comes from the **Sundarbans**, where ecological fragility has forced communities to innovate. Salinity intrusion, frequent flooding, and recurring cyclones such as Aila and Amphan have made mono-crop paddy cultivation increasingly unsustainable. Here, youth groups supported by NGOs like the Development Research Communication and Services Centre (DRCSC) and local KVKs have promoted **integrated models** that combine **saline-tolerant paddy, fish ponds, and vegetables on raised bunds**. This model exemplifies multi-layered organic farming adapted to coastal ecosystems. Youth collectives play a crucial role in mobilizing households, digging ponds, and experimenting with saline-resistant varieties. The resilience of these models is striking: even when cyclones destroy paddy crops, fish culture and vegetables provide fallback income and nutrition. More importantly, youth involvement in such projects has created a sense of ownership and responsibility, turning agriculture into an arena of innovation rather than drudgery. The Sundarbans case highlights not only ecological adaptation but also how collective youth action fosters community resilience.

Nadia KVK Multi-Layer Demonstrations

In the fertile alluvial plains of **Nadia district**, Krishi Vigyan Kendra has pioneered multi-layer demonstrations that have been widely replicated by local women's SHGs. One of the most popular models involves **papaya as the top canopy crop, banana in the middle, spinach on the ground, and brinjal intercropped**. The model

provides multiple harvests across the year and optimizes land use in small plots averaging less than one hectare. Women's SHGs, supported by micro-credit from NRLM's Anandadhara project, adopted these models to improve both income and nutritional diversity at the household level. Reports from Nadia KVK indicate that families practicing this multi-layered system earn significantly more compared to those continuing with mono-cropping, while women farmers gain greater control over the income generated. These demonstrations have also created peer-learning environments where successful women farmers train others in neighbouring villages, multiplying the impact of KVK's initial interventions. Nadia's case thus underscores how scientific institutions, when aligned with women's collectives, can drive rapid adoption of multi-layered organic farming.

B. Gender-Sensitive Empowerment

The case studies above reflect broader patterns of empowerment for rural women. **Economic empowerment** is perhaps the most visible dimension. Women who once contributed unpaid labour in family farms now generate direct income through SHG-led enterprises such as mushrooms or vegetable cultivation. This shift improves their **bargaining power within households**, enabling them to influence decisions regarding children's education, healthcare, and household investments. Studies such as Agarwal's *Gender Challenges in Agriculture* (2018) argue that income ownership is the most significant factor in shifting gender dynamics in rural households, and Bengal's SHG experiences validate this claim.

The empowerment is also **social and collective**. SHG federations and women's cooperatives provide platforms for women to collectively voice their concerns in Panchayats, agricultural fairs, and government forums. Women who were previously excluded from decision-making processes now negotiate prices with traders, participate in Gram Sabha meetings, and advocate for better agricultural infrastructure. This social visibility challenges patriarchal norms and gradually changes community perceptions of women's roles.

Finally, there is a **psychological empowerment** that comes with recognition. Women who were once considered "helpers" in farming are increasingly acknowledged as **farmers in their own right**. This recognition not only boosts their confidence but also motivates younger women to see agriculture as a viable career. Such recognition is crucial, as the FAO's *Women in Agriculture* (2011) stresses that closing the gender gap in agricultural recognition and access could significantly boost overall productivity.

C. Youth Empowerment

While women gain empowerment through income and collectives, youth empowerment in MLOF stems from leadership, entrepreneurship, and reverse migration. **FPO leaders under the age of 30** have begun managing collective marketing operations, often using digital tools to connect with urban markets. These young leaders play a critical role in branding organic produce, negotiating with retailers, and ensuring quality control—functions traditionally beyond the scope of smallholder farmers.

An emerging trend is that of **reverse migration**, especially in Nadia and Hooghly. With limited opportunities in cities and growing awareness of agribusiness potential, some educated youth have returned to their villages to start organic enterprises. By investing in multi-layered farming systems, these youths create modernized models of agriculture that are economically viable and socially prestigious. They also inspire peers to view farming not as a fallback option but as a domain of innovation. This shift aligns with NITI Aayog's (2018) observations that youth involvement in agriculture can be revitalized through entrepreneurship and technology.

D. Intersectionality

The story of empowerment is not uniform, however; it is shaped by **intersectional factors** of caste, class, ethnicity, and household type. **Tribal women in Jangalmahal** (covering parts of Purulia, Bankura, and West Midnapore) face unique barriers to market access. Even when they adopt multi-layer models, their remote location and weak transport networks restrict them from accessing remunerative markets, leaving them dependent on middlemen.

Caste and class also influence access to SHG loans. Upper-caste women or those from economically stronger backgrounds are better positioned to leverage SHG credit for investments in mushroom sheds or vermicompost units. In contrast, landless or marginalized caste women often remain at the margins of these initiatives. **Women-headed households** benefit differently, too: widows or women with migrant husbands often find SHGs a lifeline, but they also shoulder disproportionate workloads in balancing household and farm responsibilities. These intersectional dynamics caution against viewing women as a homogenous category, reminding us that empowerment outcomes vary across social locations.

E. Challenges

Despite the positive impacts, empowerment through MLOF faces serious **structural challenges**. The foremost barrier is **land ownership**, with nearly 80 percent of agricultural land in Bengal formally registered in men's names (Agriculture Census, 2015–16). This denies women direct access to institutional credit, insurance, and government subsidies. Even when women manage farms effectively, their lack of legal ownership keeps them dependent on male relatives for formal entitlements.

A second challenge is **market bias against women-led enterprises**. Traders and buyers often undervalue produce marketed by women's groups, forcing SHGs to accept lower prices than male-dominated cooperatives. Overcoming this bias requires strong institutional linkages and dedicated market channels for women-led collectives.

The third challenge relates to **youth perceptions of farming**. Despite examples of successful FPO leaders and returnee entrepreneurs, many rural youths continue to view farming as less prestigious compared to white-collar jobs. Social aspirations, combined with limited rural infrastructure, fuel migration, leaving behind an aging farming population. Unless agriculture is made more lucrative and socially respected, sustaining youth engagement in MLOF will remain difficult.

The case studies of Bankura, Sundarbans, and Nadia demonstrate that multi-layered organic farming can be a vehicle of empowerment for both women and youth in rural Bengal. Women gain economic independence, social visibility, and recognition as farmers, while youth find opportunities for entrepreneurship and leadership. Yet, these gains are uneven and constrained by structural issues such as skewed land ownership, market bias, and youth aspirations for urban careers. Intersectional analysis further reveals that empowerment outcomes differ for tribal women, marginalized caste groups, and women-headed households.

Nonetheless, the synergy between women's collective strength through SHGs and youth's innovation through FPOs and startups holds transformative potential. If supported by enabling policies, gender-sensitive extension services, and stronger market linkages, multi-layered organic farming can become not just a technique of sustainable agriculture but a **social movement for empowerment and equity** in rural Bengal.

V. Policy Implications & Recommendations

Strengthening SHG–KVK Partnerships

One of the most important policy directions for promoting Multi-Layered Organic Farming (MLOF) in rural Bengal lies in strengthening the partnership between **Self-Help Groups (SHGs)** and **Krishi Vigyan Kendras (KVKs)**. SHGs already function as platforms for women's collective action, while KVKs serve as local hubs of agricultural research and extension. Policies that foster stronger linkages between these two institutions can create localized training ecosystems where women farmers learn practical models of MLOF tailored to their agro-ecological contexts. For example, Nadia KVK's papaya–banana–spinach–brinjal model, adopted widely by SHGs, demonstrates how targeted training can catalyze adoption. Expanding this model across other districts requires systematic collaboration, where SHG federations are not just beneficiaries but active partners in designing training content and dissemination.

Gender-Sensitive Extension Services

Another critical recommendation is the development of **gender-sensitive extension services**. Historically, agricultural training has been delivered through male household members, reinforcing the invisibility of women's roles in farming. To make MLOF adoption equitable and effective, policies must ensure that women are trained **directly**, rather than through their husbands or male relatives. This involves scheduling training sessions at times convenient for women, using local languages, and incorporating women trainers as role models. FAO (2011) and Bina Agarwal (2018) both emphasize that when women receive direct training and recognition, farm productivity increases significantly. In Bengal, where women are central to composting, nursery raising, and mushroom cultivation, gender-sensitive extension will not only enhance technical outcomes but also strengthen women's agency as independent farmers.

Youth Entrepreneurship in Agri-Startups

Youth engagement is equally essential for scaling MLOF, and policies must foster **entrepreneurship among rural youth**. With nearly 27 percent of Bengal's population in the 15–29 age group (Census 2011), this demographic represents both a challenge and an opportunity. Many young people migrate in search of non-farm jobs, but targeted support can make agriculture attractive as a business. Policies should therefore prioritize **incubation programs for agri-startups**, where youth can experiment with value addition, organic branding, and e-commerce for farm produce. Credit support through NABARD, startup capital under government schemes, and mentorship from agricultural universities can help rural youth develop scalable enterprises. Success stories of youth-led Farmer Producer Organizations (FPOs) in Hooghly and Nadia—where young leaders manage marketing, logistics, and digital outreach—prove that rural youth can anchor agriculture in new market systems when given adequate institutional support.

Integrating Government Schemes for Convergence

A multi-layered farming system requires a multi-pronged policy approach that integrates existing schemes. First, the **Paramparagat Krishi Vikas Yojana (PKVY)** should be leveraged to provide organic inputs such as composting units, bio-fertilizers, and certification support for SHGs and youth groups. Second, the **PM Formalisation of Micro Food Processing Enterprises (PMFME) scheme** should be integrated to support mushroom and vegetable processing units, enabling SHGs to move up the value chain from raw produce to packaged goods. Third, the **National Rural Livelihood Mission (NRLM)** should continue strengthening women's SHG federations, ensuring their access to financial resources and convergence with organic farming initiatives. By bringing these schemes together, policymakers can create an enabling ecosystem where production, processing, and marketing of MLOF produce are supported simultaneously.

Localized Crop-Layer Models for Bengal's Zones

Policy must also recognize that Bengal's agro-climatic diversity requires **localized crop-layer models** rather than a one-size-fits-all approach. In the fertile alluvial plains of Nadia and Murshidabad, models combining **papaya, creepers, and leafy vegetables** have shown high productivity. In the coastal saline belt of South 24 Parganas, models integrating **saline-tolerant paddy, fish, and vegetables on bunds** are more relevant. In the lateritic soils of Bankura and Purulia, crop combinations of **mango with pulses and creepers** supplemented by mushrooms have proven resilient. Developing district-specific blueprints through KVKs, and disseminating them through SHG networks, will ensure that MLOF models are ecologically sustainable and socially viable. This localized strategy also aligns with FAO's recommendations for context-specific agroecology and can prevent the mismatch between training modules and local realities.

In summary, the future of MLOF in Bengal hinges on policy measures that empower women through SHG–KVK partnerships, recognize their roles through gender-sensitive extension, and create entrepreneurial pathways for rural youth. At the same time, the integration of PKVY, PMFME, and NRLM offers a holistic framework where production, processing, and marketing are supported together. By tailoring crop-layer models to the specific needs of Bengal's agro-climatic zones, policymakers can maximize the ecological and economic benefits

of MLOF. If these recommendations are implemented effectively, multi-layered organic farming can become a cornerstone of sustainable agriculture in Bengal—strengthening livelihoods, empowering women and youth, and ensuring food and nutritional security for rural communities.

CONCLUSION

MLOF as a Socio-Economic Empowerment Model

Multi-Layered Organic Farming (MLOF) in rural Bengal represents far more than a technical solution to fragmented landholdings. It is increasingly evident that MLOF must be understood as a **socio-economic empowerment model** that reshapes both production systems and community dynamics. By allowing farmers to cultivate crops in vertical and horizontal layers—integrating fruits, vegetables, root crops, mushrooms, and livestock—it optimizes the use of scarce resources while aligning with organic principles. Yet, its true significance lies in its potential to alter power relations in rural society: it gives women access to income and recognition, offers youth avenues for entrepreneurship, and creates collective structures that reduce dependence on exploitative market intermediaries. The transition from mono-cropping to multi-layered systems is therefore not only an agronomic shift but also a step toward inclusive development and rural resilience.

Women's Continuity Through Traditional Skills

Women are at the heart of this transformation, providing continuity and stability through their traditional skills and household-based knowledge. Their expertise in seed selection, compost preparation, vegetable transplantation, and poultry management ensures the daily functioning of MLOF systems. As the case studies from Bankura and Nadia show, women's Self-Help Groups (SHGs) have transformed small-scale ventures like mushroom sheds and multi-layer gardens into sustainable sources of livelihood. These contributions extend beyond economics; they strengthen women's **household bargaining power**, enhance their participation in Panchayat-level decision-making, and affirm their identities as farmers rather than invisible helpers. Policies that provide women with direct training, access to credit, and collective platforms amplify these impacts. In this sense, MLOF is a vehicle for **gender justice**, enabling women to move from the margins to the centre of rural development.

Youth Innovation and Technology

Equally critical is the role of rural youth, who bring innovation, energy, and digital technology into the fold of farming. Youth-led Farmer Producer Organizations (FPOs) in Hooghly and Nadia exemplify how young leaders manage digital marketing, supply chains, and branding for organic produce. The Sundarbans' integrated models further demonstrate how youth collectives adapt to ecological challenges by experimenting with saline-tolerant rice, fish, and vegetables, showcasing their ability to innovate under stress. These examples reveal that youth participation can counter the narrative of agriculture as a low-status occupation. By linking farming to entrepreneurship, technology, and sustainability, MLOF provides a dignified livelihood pathway for the next generation. However, this will require stronger institutional support through incubation centres, access to startup credit, and mentorship, ensuring that rural youth remain motivated to invest in agriculture rather than migrate permanently to urban areas.

Transforming Bengal's Smallholder Agriculture

The combined contributions of women and youth hold the power to transform Bengal's smallholder agriculture into a **sustainable, resilient, and inclusive model**. Women provide the cultural continuity and ecological wisdom rooted in household farming practices, while youth infuse innovation, market access, and organizational skills. Together, they create an ecosystem where fragmented landholdings are no longer a liability but an opportunity to experiment with intensive, diversified, and ecologically sound systems. If supported by gender-sensitive extension, SHG–KVK partnerships, youth-focused incubation, and the integration of government schemes like PKVY, PMFME, and NRLM, MLOF can evolve into a model for other states in India facing similar challenges of fragmentation and ecological stress.

Final Reflection

In conclusion, MLOF is not merely an agricultural technique but a **holistic approach to empowerment and sustainability**. It offers food and nutritional security, strengthens rural livelihoods, empowers marginalized groups, and builds ecological resilience against climate shocks. By centering women's traditional skills and youth's technological potential, Bengal has the chance to redefine the future of its smallholder agriculture. The challenge now lies in scaling these models equitably across different agro-climatic zones, ensuring that tribal, marginalized caste, and women-headed households are not left behind. If this can be achieved, MLOF will stand as a model of inclusive agricultural transformation—one where the synergy of women and youth turns challenges into opportunities for sustainable growth in rural Bengal.

REFERENCE LIST

International Reports & Academic Works

1. FAO. (2011). Women in Agriculture: Closing the Gender Gap for Development. Food and Agriculture Organization of the United Nations, Rome.
2. FAO. (2014). Youth and Agriculture: Key Challenges and Concrete Solutions. Rome: FAO.
3. Pretty, J. (1995). Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance. Earthscan Publications, London.
4. UNDP India. (2019). Gender and Sustainable Development in India. New Delhi: UNDP.
5. World Bank. (2018). Enabling the Business of Agriculture. Washington, DC: World Bank.

Indian Academic Literature

6. Agarwal, Bina. (2014). Gender and Green Governance: The Political Economy of Women's Presence Within and Beyond Community Forestry. Oxford University Press.
7. Agarwal, Bina. (2018). Gender Challenges in Agriculture. Oxford University Press.
8. Biswas, Ranjan K., Majumder, Debanshu, & Sinha, Ashok. (2011). Impacts and Constraints Evaluation of Organic Farming in West Bengal. Agro-Economic Research Centre, Visva-Bharati University, Santiniketan.
9. Mandal, Subhasis, et al. (2021). Agricultural Production and Marketing of Major Food Crops: Policy Paper for West Bengal. Central Soil Salinity Research Institute (CSSRI), Karnal.
10. Academic case studies on organic agriculture and PGS (Participatory Guarantee Systems) in West Bengal: Organic Agriculture in India and Participatory Guarantee Systems: A Case Study from West Bengal (Vikas Kendra project), SEVA/Vikas Kendra.

Government Reports & Data (National)

11. Census of India. (2011). Primary Census Abstract: West Bengal. Office of the Registrar General & Census Commissioner, India.
12. NSSO. (2019). Situation Assessment of Agricultural Households and Land Holdings of Households in Rural India, 2015–16. Ministry of Statistics & Programme Implementation, Government of India.
13. Agriculture Census. (2015–16). All India Report on Number and Area of Operational Holdings. Department of Agriculture & Farmers Welfare, Government of India.
14. NITI Aayog. (2018). Youth in Agriculture: Opportunities and Challenges. New Delhi: NITI Aayog.
15. Ministry of Rural Development. (2011). National Rural Livelihood Mission (NRLM) Framework. Government of India.
16. Ministry of Agriculture & Farmers Welfare. (2016). Paramparagat Krishi Vikas Yojana (PKVY) Guidelines. Government of India.
17. Ministry of Food Processing Industries. (2020). PM Formalisation of Micro Food Processing Enterprises (PMFME) Scheme Operational Guidelines. Government of India.

Government Reports & Plans (West Bengal)

18. Government of West Bengal, Department of Agriculture. (2017–2020). State Agriculture Plan (SAP): West Bengal. Available via RKVY Portal.
19. West Bengal Gender Budget Statements (various years). Finance Department, Govt. of West Bengal.
20. West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP). (2018). Case Studies: Multi-tier Agriculture in Purulia.

Institutional & Local Sources

21. ICAR–Krishi Vigyan Kendras (KVKs) Annual Reports – Nadia, Hooghly, Bankura, South 24 Parganas (various years).
22. ICAR–ATARI Kolkata. (2021). Annual Report. Kolkata: ICAR-ATARI.
23. Ramakrishna Ashram Krishi Vigyan Kendra, Nimpith. (2022). Annual Report. South 24 Parganas, West Bengal.
24. Development Research Communication & Services Centre (DRCSC). (2018). Organic Farmers and Farms in West Bengal. Kolkata: DRCSC.
25. NABARD. (2022–23). Annual Report. National Bank for Agriculture and Rural Development, Mumbai.
26. NABARD. (2019). SHG-Bank Linkage Programme: Status Report. NABARD, Mumbai.

Local & NGO Sources (Regional Context)

27. Nadia KVK. (2019–2022). Reports and Plans. Nadia, West Bengal.
28. DRCSC (Development Research Communication & Services Centre). (2016–2020). Case documentation on sustainable farming in Sundarbans and Jangalmahal (Pamphlets and field notes).
29. Banglar Krishi Mancha. (2019). Reports on Community-Led Organic Practices in Bengal.
30. West Bengal State Rural Livelihood Mission (WBSRLM – Anandadhara). (2021). Annual Progress Reports on SHGs and Federations. Government of West Bengal.