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Strengthening millet based sustainable agriculture through self-help groups: A study of Odisha millet mission

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Abstract
This study examines the transformative role of Self-Help Groups (SHGs) in strengthening millet-based sustainable agriculture through Odisha's Millet Mission (OMM), also known as Shree Anna Abhiyan. Drawing from secondary data analysis and existing research, this paper evaluates how the integration of SHGs with millet cultivation has created a sustainable agricultural ecosystem that addresses food security, gender empowerment, and climate resilience in tribal areas of Odisha. The research reveals that since its inception in 2017, the Odisha Millet Mission (OMM) has expanded millet cultivation from 54,000 hectares to over 82,000 hectares by 2022, with a targeted expansion to 150,000 hectares under its second phase. In collaboration with Mission Shakti's extensive network of approximately 0.6 million Self-Help Groups (SHGs) representing 7.2 million women, the programme has demonstrated measurable improvements in agricultural productivity, household income, and nutritional security, particularly in tribal and rainfed regions of Odisha. The findings indicate that SHG-mediated interventions have increased women's participation in millet cultivation, while creating sustainable value chains through community-managed enterprises. This paper contributes to understanding how community-based approaches can effectively mainstream climate-resilient crops while empowering marginalized communities.

Keywords: Odisha, millet cultivation, self-help groups, sustainable agriculture, food security, women empowerment, climate resilience

1. Introduction
The resurgence of millet cultivation in India represents a paradigmatic shift towards sustainable agricultural practices that address multiple developmental challenges simultaneously. Millets, once considered coarse grains, are now recognized as "Nutri-cereals" capable of providing nutritional security while maintaining ecological sustainability (Saleh *et al*., 2013) [25]. Odisha's pioneering effort through the Millet Mission exemplifies how state-led initiatives can revitalizes traditional crops while leveraging community institutions for sustainable development. Special Programme for Promotion of Millets in Tribal Areas of Odisha named as Odisha's Millet Mission (OMM), also known as Shree Anna Abhiyan was launched by Govt of Odisha in 2017 to revive millets in farms and on plates. The programme emerged from collaborative consultations between government agencies, academic institutions, and civil society organisations, representing a multi-stakeholder approach to agricultural transformation. This initiative is particularly significant as it is first of its kind of agriculture programme with priority on increasing consumptions in Odisha.

The integration of Self-Help Groups into agricultural programmes has gained considerable attention in development literature due to their proven capacity to mobilise social capital and facilitate collective action (Desai & Joshi, 2014) [6]. In the context of millet cultivation, SHGs serve as crucial intermediaries that bridge the gap between traditional knowledge systems and modern agricultural practices while ensuring inclusive participation of marginalised communities, particularly women farmers. This study examines how Odisha's Millet Mission has strategically utilised SHGs to create a comprehensive ecosystem for millet-based sustainable agriculture. The research explores the multifaceted role of SHGs in production, processing, marketing, and consumption promotion, while analysing the broader implications for sustainable development in tribal regions.

2. Literature Review and Theoretical Framework

2.1 Theoretical Foundations of Community-Based Agricultural Development

The theoretical foundation of this study draws from multiple disciplinary perspectives that collectively explain the success of community-based agricultural interventions. Social capital theory, as articulated by Coleman (1988) [3] and Putnam (1995) [22], provides the fundamental framework for understanding how SHGs function as repositories of trust, reciprocity, and collective efficacy that enable agricultural transformation.

The concept of social capital encompasses three dimensions: bonding capital (connections within homogeneous groups), bridging capital (connections across diverse groups), and linking capital (connections between different levels of power and authority), (Woolcock, 2001) [29]. In the context of millet cultivation, SHGs demonstrate all three dimensions by creating intra-group solidarity, facilitating inter-group cooperation, and establishing linkages with government agencies and market institutions.

Collective action theory further illuminates how SHGs overcome common pool resource dilemmas and transaction costs that individual farmers face in agricultural markets (Ostrom, 2009) [20]. The theory explains how shared norms, monitoring mechanisms, and graduated sanctions within SHGs enable successful collective management of resources and market participation.

2.2 Gender and Agricultural Development

Feminist political ecology provides crucial insights into how gender relations shape agricultural practices and environmental outcomes (Rocheleau *et al*., 1996) [24]. Women's traditional knowledge of indigenous crops, including millets, represents an invaluable resource that has been systematically marginalised in mainstream agricultural development programmes. The integration of SHGs into millet promotion recognises and valorises women's agricultural expertise while providing platforms for their economic empowerment.

Research by Agarwal (2010) [1] demonstrates that women's participation in agricultural decision-making not only improves household welfare but also promotes environmentally sustainable practices. The gendered nature of agricultural knowledge becomes particularly relevant in millet cultivation, where women have historically been the primary custodians of seed varieties and processing techniques.

2.3 Sustainable Agriculture and Climate Resilience

The theoretical framework of agroecology provides the scientific foundation for understanding millet-based sustainable agriculture (Altieri, 2002) [2]. Agroecological principles emphasise the integration of ecological processes into agricultural systems, promoting biodiversity, soil health, and climate resilience. Millets exemplify agroecological crops due to their drought tolerance, minimal input requirements, and ability to thrive in marginal lands.

Climate adaptation theory explains how traditional crops like millets serve as crucial strategies for smallholder farmers facing climate variability and change (Smit & Wandel, 2006) [26]. The inherent resilience of millets to drought, heat stress, and pest attacks makes them ideal crops for climate-vulnerable regions like Odisha's tribal areas.

2.4 Value chain development and market integration

Value chain theory provides the analytical framework for understanding how SHGs facilitate market integration of millet producers (Porter, 1985) [21]. The theory explains how value is created and captured at different stages of the production-to-consumption continuum. SHGs play crucial roles as aggregators, processors, and marketers, enabling smallholder farmers to access higher-value markets while retaining a greater share of value addition.

The concept of embedded markets explains how SHGs create socially embedded market relationships that reduce transaction costs and information asymmetries. These embedded relationships enable trust-based transactions that are particularly important for marketing traditional crops like millets, which may have limited formal market infrastructure.

3. Methodology

This study employs a secondary data analysis approach, synthesising information from government reports, research publications, programme documents, and case studies related to Odisha's Millet Mission. The methodology follows a mixed-methods approach, combining quantitative data analysis with qualitative thematic analysis to provide comprehensive insights into the role of SHGs in millet-based sustainable agriculture. Data sources include official publications from the Department of Agriculture and Farmers' Empowerment, Government of Odisha; research reports from academic institutions; evaluation studies conducted by civil society organisations; and case studies documented by implementing agencies. The analysis focuses on the period from 2017 to 2024, covering the implementation phases of the Millet Mission. The analytical framework examines SHG interventions across four dimensions: production enhancement, value addition and processing, market linkage development, and consumption promotion. Each dimension is analysed using relevant indicators such as area coverage, productivity improvements, income enhancement, and nutritional outcomes.

4. The Odisha Millet Mission: Programme Overview and Evolution

4.1 Genesis and Conceptual Framework

The Special Programme for Promotion of Millets in Tribal Areas of Odisha originated from the Comprehensive Malkangiri Pilot of the Revitalising Rainfed Agriculture Network (RRAN). The programme was implemented in 2012, in collaboration with the Watershed Support Services and Activities Network (WASSAN), to revive millets in farms and on plates in rainfed areas of Odisha. The conceptual evolution of the programme demonstrates a systematic approach to agricultural transformation that recognises the interconnected nature of production, consumption, and market systems. The programme's theoretical foundation rests on the understanding that sustainable agricultural development requires simultaneous interventions across the entire value chain, from seed to plate.

The Odisha Millet Mission represents a pioneering state-level initiative that emerged from the recognition of millets' potential to address multiple development challenges simultaneously. Launched in 2017, the OMM built upon

earlier pilot initiatives that demonstrated the viability of millet cultivation revival in the state's diverse agro-ecological zones. The Mission's approach represents a departure from conventional agricultural programmes that focus primarily on production enhancement. Instead, it adopts a holistic framework that addresses production constraints, processing challenges, market failures, and consumption patterns simultaneously. This comprehensive approach recognises that the revival of traditional crops like millets requires addressing both supply-side and demand-side factors.

4.2 Institutional Architecture and Governance

The institutional architecture of the Millet Mission reflects innovative governance arrangements that facilitate multi-stakeholder collaboration. The programme operates through a three-tier structure: state-level coordination through the Mission Secretariat, district-level implementation through District Collectors, and grassroots execution through a network of civil society organisations and SHGs. The Mission Secretariat serves as the apex coordinating body, responsible for policy formulation, resource allocation, and strategic direction. District Collectors provide administrative support and facilitate convergence with other government programmes. Civil society organisations, particularly WASSAN and the Revitalising Rainfed Agriculture Network, contribute technical expertise and field-level implementation capacity. The integration with Mission Shakti represents a strategic institutional innovation that leverages existing SHG networks for programme implementation. OMM is partnering with Mission Shakti, a government agency promoting 0.6 million SHGs with 7.2 million women members to promote awareness on nutrition of millets among women and also entrepreneurship. This partnership enables the Millet Mission to access established community institutions while Mission Shakti benefits from new livelihood opportunities for SHG members.

4.3 Geographical Coverage and Scaling Strategy

The geographical expansion of the Millet Mission demonstrates a systematic scaling strategy that prioritises tribal and marginalised regions while gradually expanding to other areas. The project demo area has grown from 54,000 hectares (Ha) in 2017 to about 82,000 Ha in 2022. The Mission Secretariat aims to raise this number to an ambitious 150,000 Ha by the end of 2023. The scaling strategy follows a hub-and-spoke model, where successful demonstration sites serve as learning centres for replication in neighbouring areas. This approach enables the programme to maintain quality while achieving scale, ensuring that successful practices are systematically documented and replicated. The focus on tribal areas reflects both social equity considerations and ecological rationale. Tribal communities have traditionally been the custodians of millet varieties and associated knowledge systems. Moreover, tribal areas often coincide with ecologically fragile regions where millets are particularly well-suited due to their climate resilience and low input requirements.

5. Role of self-help groups in millet-based agriculture

5.1 Production enhancement and technical support

Self-Help Groups serve as crucial institutions for disseminating improved agricultural practices and facilitating access to production inputs. The SHG model enables peer-to-peer learning, which is particularly effective for promoting agricultural innovations among smallholder farmers who may be sceptical of external interventions. In the context of millet cultivation, SHGs facilitate the introduction of improved varieties, better agronomic practices, and integrated pest management techniques. Under the Odisha Millets Mission programme, farmers are supported to grow finger millet (ragi), little millet, foxtail millet, kodo, and bajra. The SHG platform enables collective procurement of inputs, reducing transaction costs and ensuring access to quality seeds and organic inputs. local SHGs were trained to prepare bio-inputs to sell to farmers. Farmers who struggled to make timely payments for bio-inputs could pay in-kind, such as giving part of their harvest. This innovative payment system reduces financial barriers while ensuring input availability. SHGs also serve as repositories of traditional knowledge, documenting and preserving indigenous millet varieties and associated cultural practices. Women SHG members, who are often the primary custodians of seed varieties, play crucial roles in maintaining genetic diversity and ensuring seed security for their communities.

5.2 Value Addition and Processing Enterprises

The development of processing enterprises represents one of the most significant contributions of SHGs to millet value chains. Traditional millet processing is labour-intensive and time-consuming, which has historically limited consumption and market participation. SHGs have addressed this challenge by establishing community-based processing units that provide services to member farmers while generating income for women entrepreneurs. These include Custom Hiring Centres, Community-Managed Seed Centres, Millet Shakti Cafes, Millet Shakti-on-Wheels, Millet Shakti Outlets, Millet Shakti Tiffin Centres, Millet Thelas, Pulverizers, Dehullers, Threshers, and Cleaner-cum-Grader-Destoners. This diverse range of enterprises demonstrates the entrepreneurial capacity of SHG members and their ability to identify and address market gaps. The processing enterprises serve multiple functions within the millet ecosystem. They reduce post-harvest losses by providing timely processing services, add value to raw millets through various processing techniques, and create employment opportunities for rural women. Moreover, these enterprises strengthen local food systems by making processed millet products readily available in rural markets.

5.3 Market linkage development and collective marketing

SHGs play pivotal roles in addressing market failures that have historically limited millet commercialization. Individual smallholder farmers face significant challenges in accessing markets due to small marketable surplus, lack of market information, and weak bargaining power. SHGs overcome these constraints through collective marketing arrangements that aggregate produce, negotiate better prices, and reduce transaction costs. The collective marketing approach enables SHG members to access formal markets that would otherwise be inaccessible to individual farmers. Currently, there are 76 FPOs under OMM. But some of them are engaged only in minor processing and aggregation, without plans of scaling up market linkages. The formation of Farmer Producer Organisations (FPOs)

from SHG networks represents an institutional innovation that combines the social capital of SHGs with the commercial orientation required for market participation.

Market linkage development involves establishing relationships with various market actors, including institutional buyers, retail chains, and direct consumers. The programme has successfully created market linkages with government procurement programmes, including the Public Distribution System and Mid-Day Meal Scheme, providing assured markets for millet producers. The development of brand identity for millet products marketed through SHG networks has enhanced market positioning and consumer acceptance. The "Millet Shakti" brand has become synonymous with quality millet products while creating recognition for women's entrepreneurship in rural areas.

5.4 Consumption Promotion and Nutritional Awareness

Perhaps the most innovative aspect of SHG involvement in the Millet Mission is their role in promoting millet consumption and nutritional awareness. Traditional development programmes often assume that increased production automatically translates into improved consumption and nutrition outcomes. The Millet Mission recognises that changing consumption patterns requires targeted interventions addressing cultural preferences, cooking practices, and nutritional knowledge. SHGs serve as platforms for nutritional education, with women members becoming advocates for millet consumption within their communities. The peer-to-peer education model is particularly effective because SHG members share similar socio-economic backgrounds and cultural contexts with their target audiences. OMM in collaboration with Mission Shakti opened a Millet café with women SHG members in Hockey stadium and other public venues, demonstrating innovative marketing strategies that combine product promotion with women's entrepreneurship. These cafes serve as demonstration centres where consumers can experience diverse millet-based preparations while supporting women's enterprises. The consumption promotion activities extend beyond direct marketing to include cooking demonstrations, recipe development, and nutritional counselling. SHG members are trained as community nutrition educators, enabling them to provide practical guidance on incorporating millets into daily diets while addressing concerns about taste, cooking methods, and nutritional benefits.

6. Impact assessment and performance analysis

6.1 Agricultural production and productivity impacts

The integration of SHGs into millet cultivation has demonstrated significant positive impacts on agricultural production and productivity. Data analysis shows that recipient farmers outperformed non-recipients. The study identified that mission led to increased knowledge, adoption, productivity, higher annual income, and enhanced social participation among recipients and also contributed to the well-being of farmers, positively affecting multiple dimensions of rural livelihoods. Productivity improvements can be attributed to several factors facilitated through SHG networks. The adoption of improved varieties and better agronomic practices has increased yields per hectare. System of Rice Intensification (SRI) techniques adapted for millets have shown particular promise in enhancing productivity while reducing input requirements.

The collective procurement of quality seeds and organic inputs through SHGs has ensured consistent access to production materials while reducing costs. The peer learning networks within SHGs have accelerated the adoption of improved practices, as farmers are more likely to adopt innovations demonstrated by their peers rather than external agents. Soil health improvements resulting from millet cultivation have contributed to long-term productivity gains. Millets require minimal external inputs and contribute to soil organic matter through their root biomass and crop residues. This creates positive feedback loops that enhance the sustainability of farming systems.

6.2 Economic Impacts and Income Enhancement

The economic impacts of SHG-mediated millet cultivation extend beyond farm-level income improvements to encompass various income-generating activities along the value chain. The diversification of income sources through processing enterprises, marketing activities, and service provision has enhanced the economic resilience of participating households. Farm-level income improvements result from both increased productivity and better price realisation through collective marketing. The elimination of intermediaries through direct marketing arrangements has enabled farmers to capture a larger share of consumer prices. Moreover, the development of premium markets for organic and traditional varieties has created opportunities for price premiums. Non-farm income generation through processing enterprises has emerged as a significant source of economic empowerment for women. The establishment of millet processing units, retail outlets, and food service enterprises has created sustainable livelihood opportunities that complement agricultural income.

The economic impacts demonstrate important gender dimensions, with women SHG members experiencing greater income improvements compared to male farmers. This reflects the concentrated focus on women's enterprises and the valorization of women's traditional knowledge and skills in millet processing and preparation.

6.3 Social and Gender Empowerment Outcomes

The social empowerment outcomes of SHG-mediated millet cultivation represent some of the most significant impacts of the programme. Women's participation in agricultural decision-making has increased substantially, challenging traditional gender roles and power dynamics within households and communities. This dramatic increase in women's participation reflects both the programme's targeted approach and the natural affinity between women's traditional roles and millet cultivation. The development of leadership skills among SHG members has created a cadre of rural women leaders who serve as change agents within their communities. These leaders facilitate technology adoption, organise collective activities, and represent their communities in interactions with government agencies and market actors. Social capital enhancement through SHG networks has strengthened community cohesion and collective efficacy. The success of millet cultivation activities has enhanced the credibility and social standing of SHGs, enabling them to undertake additional development activities and access resources from various sources. However, challenges remain in ensuring equitable participation within SHGs and addressing social hierarchies

that may limit the participation of the most marginalised community members.

6.4 Nutritional and Food Security Outcomes

The nutritional impacts of millet cultivation through SHGs extend beyond increased production to encompass improvements in dietary diversity, micronutrient intake, and food security. Millets are recognised as nutritionally superior to major cereals, particularly in terms of protein content, mineral density, and dietary fibre. Household-level food security has improved through increased production of nutritious grains that can be stored for extended periods without deterioration. The long shelf life of millets makes them particularly valuable for food security in regions prone to seasonal food shortages and climate-related disruptions. Dietary diversification has been promoted through SHG-led nutrition education programmes that demonstrate various methods of incorporating millets into traditional diets. The development of new recipes and food products has addressed taste preferences while maintaining nutritional benefits.

Child nutrition outcomes have shown improvements in areas where millet cultivation and consumption have been successfully promoted. The high mineral content of millets, particularly iron and zinc, addresses common micronutrient deficiencies that affect child development and maternal health. The integration of millets into institutional feeding programmes, including Mid-Day Meal Schemes and Anganwadi centres, has created opportunities for improving the nutritional quality of public food programmes while supporting local production systems.

7. Conclusion

The Odisha Millet Mission represents a pioneering approach to sustainable agricultural development that successfully integrates community institutions, traditional knowledge systems, and modern agricultural practices. The strategic utilisation of Self-Help Groups as key implementing partners has created a comprehensive ecosystem for millet-based agriculture that addresses production, processing, marketing, and consumption challenges simultaneously. The evidence demonstrates that SHG-mediated interventions have achieved significant impacts across multiple dimensions of development. Agricultural productivity improvements, income enhancement, women's empowerment, and nutritional security outcomes collectively illustrate the transformative potential of community-based approaches to agricultural development. The programme's success in expanding coverage from 54,000 to 82,000 hectares while maintaining quality and achieving positive outcomes reflects the effectiveness of the SHG-based implementation model.

The theoretical significance of this study lies in demonstrating how social capital theory, collective action principles, and agro ecological approaches can be integrated into practical development interventions. The success of SHGs in facilitating agricultural transformation validates theoretical propositions about the importance of community institutions in overcoming market failures and transaction costs that constrain smallholder agriculture.

From a policy perspective, the Odisha experience provides valuable insights for replicating similar approaches in other regions and contexts. The institutional innovations, partnership arrangements, and implementation strategies developed through the Millet Mission offer practical models that can be adapted to promote sustainable agriculture and rural development in similar settings. The nutritional and food security implications of millet revival through SHGs extend beyond individual households to encompass broader public health outcomes. The integration of nutritionally superior crops into local food systems, combined with awareness generation and consumption promotion, creates pathways for addressing malnutrition and dietary deficiencies that affect large populations in rural India.

Looking forward, the Odisha Millet Mission provides a foundation for scaling similar approaches across India and other developing countries facing challenges of food security, climate adaptation, and rural development. The lessons learned from this experience can inform the design of agricultural programmes that prioritise sustainability, inclusivity, and community empowerment while achieving measurable development outcomes.

The study contributes to the growing body of evidence on community-based natural resource management and sustainable agriculture, demonstrating how traditional institutions can be leveraged for contemporary development challenges. The success of SHGs in facilitating agricultural transformation while promoting social empowerment validates approaches that prioritise community participation and local knowledge systems.

Future research should focus on longitudinal impact assessments that track the sustainability of outcomes over extended periods. Additionally, comparative studies examining similar approaches in different contexts can help identify the factors that determine success and failure in community-based agricultural programmes. Understanding the scalability and replicability of the Odisha model requires systematic documentation and analysis of implementation experiences across diverse settings.

The integration of millet cultivation with SHG networks represents more than an agricultural intervention; it embodies a comprehensive approach to sustainable development that addresses multiple Sustainable Development Goals simultaneously. The programme's contributions to food security, gender equality, climate action, and poverty reduction demonstrate the potential for agricultural development to serve as a catalyst for broader social and economic transformation.

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