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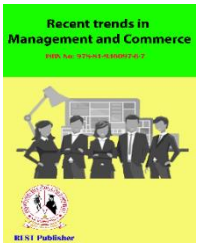

Value Chain Analysis of Millets Clusters in India through a Sustainable Development Perspective - a Narrative Literature Review

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Abstract: *This narrative literature review explores the millet value chain in India through a sustainability perspective, identifying key research gaps to guide future studies. Millet cultivation is critical for food security, climate resilience, and rural livelihoods, yet policy shifts favouring high-yield crops have historically marginalized its production. Recent government initiatives, such as promoting Farmer Producer Organizations (FPOs), seek to revitalize millet farming and strengthen local value chains. Using a qualitative narrative review, this study synthesizes multidisciplinary research on value chains, cooperatives, and millet markets, integrating academic and grey literature from sources like ScienceDirect, Google Scholar, EconBiz, and AgEcon Search. The findings highlight the adaptation of Value Chain Analysis (VCA) from its industrial roots to sustainable agriculture, emphasizing FPOs' role in improving smallholder farmers' market access. However, persistent challenges include limited access to markets, inadequate infrastructure, and consumer misconceptions about millet. Several research gaps emerge. Despite the growing significance of the millet sector in India, academic research remains limited. This study identifies key gaps, including the need for localized value chain analysis, governance structures, and institutional mapping. Additionally, the role of women and marginalized communities in FPOs is underexplored, particularly in tribal millet clusters. The rapid rise of FPOs necessitates deeper academic engagement, especially in millet-centric value chains. Furthermore, consumer awareness of millets' health benefits is documented, but research on their willingness to pay for sustainable production remains scarce. Addressing these gaps can strengthen the millet sector and support sustainable food systems.*

Keywords: *Value Chain Analysis, Sustainable Development, Farmers Producer Organization (FPO), Millet, Narrative Literature Review*

1. INTRODUCTION

Sustainable development means maintaining progress over time but has various definitions and applications. The WCED's 1987 report defined it as meeting present needs without harming future generations' ability to do the same. It is discussed across three dimensions: economic, environmental, and social. Economic sustainability ensures steady production, manageable debt, and balanced growth. Environmental sustainability prioritizes resource conservation, biodiversity, and ecosystem stability. Social sustainability promotes equity, access to services, gender equality, and political participation. Together, these pillars create a comprehensive framework for long-term sustainability (Harris, 2001). Recent discussions suggest adding cultural diversity as a pillar of sustainable development, highlighting its role in ethical, spiritual, and sustainable living. Indigenous communities and initiatives like the Earth Charter support integrating it with ecological integrity, human rights, and peace to reinforce sustainability values (Elliott, 2013). Tackling global hunger requires focus on ecological preservation, economic stability, and social fairness. Sustainable farming depends on protecting land, soil, water, and biodiversity. Rising costs and limited credit burden small farmers, demanding policies for fair markets and sustainability. Addressing undernutrition and preventing environmental harm are vital for long-term food security (Swaminathan, 2010). Agriculture is key to India's economy and sustainability, with over half of its farmland being unirrigated. India has the largest rainfed farming region, yet widely grown crops like rice and wheat are ill-suited for it. Millets, highly nutritious and drought-resistant, once made up 40% of grain production but fell to 20% post-Green Revolution, which favoured high-yield irrigated crops. Policies prioritizing rice and wheat, in the

Public Distribution System (PDS), marginalized millets. Labelled "coarse grains" and "orphan crops," they were stigmatized as "poor man's food," reducing their cultural and nutritional importance (Dayakar Rao et al., 2021). Given the increasing prevalence of malnutrition, reintegrating millets into mainstream agriculture has become essential for ensuring nutritional security (Padulosi et al., 2021). To boost millet cultivation, India rebranded them as Nutri-Cereals, declared 2018 the National Year of Millets, and pushed for UNGA's recognition of 2023 as the International Year of Millets, highlighting their sustainability amid climate change (Dayakar Rao et al., 2021). India has officially rebranded millets as "Shree Anna," signifying their status as a supreme food grain. India rebranded millets as "Shree Anna," highlighting their importance as supreme food. The 2023–2024 Budget outlined ambitious plans to make India a global millet hub (Ministry of Finance, 2024). States like Odisha, Andhra Pradesh, Chhattisgarh and some others launched Millet Missions, forming Farmer Producer Organizations (FPOs) to unite farmers and collaborate with NGOs and private stakeholders. Aligned with national policies, FPOs strengthen millet markets and supply chains, making millet production increasingly FPO-centric (Rajib Kumar et al., 2023). India's FPO policy prioritizes "Cluster Identification," selecting a geographic area and enrolling farmers to enable effective collectivization (Dept. of Agriculture and Cooperation, 2013). In June 2024, the UN declared 2025 the International Year of Cooperatives, highlighting cooperatives as sustainable, people-focused models that prioritize social and environmental well-being over profit ("New Delhi Action Agenda on a Cooperative Future: Creating Prosperity for All," 2024). The primary objective of this literature review is to evaluate the dynamics of the value chain of millets cluster through a sustainability lens, with the goal of identifying research gaps and guiding future studies. This literature review integrates key concepts of value chains, cooperatives (FPOs), and millet clusters, within the broader framework of sustainable development.

2. METHODOLOGY

A narrative literature review was used to analyse diverse sources, effectively covering multidisciplinary and emerging fields (Snyder, 2019). This approach effectively examines value chains, cooperatives' role in FPOs, India's millet market, and agri-food sustainability. While extensive academic literature exists on value chain analysis and cooperatives, which are well- established topics, there is a noticeable scarcity of research on Farmer Producer Organizations, sustainable value chains in the Indian context, and millet value chains from a marketing or strategic management perspective. This gap is expected, as FPOs' evolution as business entities and the millet revival are recent, making research still emerging. To gain a full understanding, academic literature, non-academic sources, and grey literature, including policy papers, government documents, and sector reports, were reviewed. The topic's complexity makes a systematic review impractical, as screening all relevant articles is unfeasible. A narrative review was chosen to qualitatively support the argument rather than provide an exhaustive sample. A quantitative approach was unsuitable, so an exploratory, open- ended method was used to confirm, revise, and adapt findings, emphasizing human interpretation (Torraco, 2005). Narrative reviews are not inferior to systematic reviews, as critical evaluation frameworks exist for both (Baethge et al., 2019). The primary research databases used for this study were Elsevier's ScienceDirect and Google Scholar, supplemented by EconBiz and AgEcon Search. Additionally, ResearchRabbit, a literature mapping tool that helps discover related studies. Keywords used for search are – value chain analysis, agri* value chains, sustainab* value chain analysis, farmer cooperatives, farmer producer organi*, value chain of millets.

3. FINDINGS

Conceptual evolution of Value Chain Analysis: Michael Porter introduced the concept of the "Value Chain" in 1985. The value chain represents the full range of business processes and activities involved in producing goods or delivering services. Porter's model illustrates how companies acquire raw materials, add value through various stages of production, and ultimately distribute the final product to consumers (Porter, 1985). A value chain is broadly defined as a series of interconnected activities that transform goods or services from their initial conception, through multiple production stages involving inputs and modifications, to their final consumption and eventual disposal (Kaplinsky & Morris, 2000). The original concept of the value chain can be traced back to the notion of "Filière," which emerged in the 1960s in France. Originally developed to analyze agricultural commodity chains in developing countries, this framework focused on evaluating inputs, outputs, costs, prices, and value addition (Clay & Feeney, 2019). The Filière approach integrates a wide array of theories and methodologies, drawing on management science, Marxist economics, institutional economics, systems analysis, industrial organization, and various accounting techniques (Raikes et al., 2000). Value Chain Analysis (VCA) serves as a strategic framework characterized by both the dissection and integration of activities, offering detailed insights and a comprehensive perspective. This approach emphasizes identifying sources of sustainable competitive advantage, mapping interconnections between value-creating activities, and formulating robust competitive

strategies (Ensign, 2001). VCA examines inter-firm interactions to evaluate firms' current conditions and possible developments. The external environment of organizations is further explored, highlighting that value chain analysis is designed to assess the distribution of power within the chain and identify the entities, such as firms or institutions that exercise it. Within this framework, VCA has been utilized to evaluate whole sectors and industry clusters (Frederick, 2014). With the globalization of business and economic activities, VCA has expanded to incorporate approaches that extend outside the limits of individual firms (Zamora, 2016). Value chain analysis, initially developed for industrial products, has been successfully adapted for agricultural product chains. Furthermore, these methods can form the foundation for a cooperative approach to enhance chains, particularly in environments where cultural barriers impede collaboration and the alignment of common goals (Taylor, 2005). According to the Food and Agriculture Organization (FAO) of the United Nations, a food value chain (FVC) comprises all stakeholders engaged in the coordinated production and value addition of food products. FAO further defines a sustainable FVC as one that ensures profitability at every stage (economic sustainability), delivers widespread benefits to society (social sustainability), and maintains or enhances environmental health (environmental sustainability) (FAO, 2024).

Development of Farmers Producer Organizations (FPOs) in India: The International Cooperative Alliance (ICA) adopted a pragmatic approach in defining cooperatives through its Statement on the Cooperative Identity, referring to them as self-governing groups of individuals who voluntarily come together to fulfil their shared economic, social, and cultural needs and goals through a collectively owned and democratically managed enterprise (ICA, 1995). Government of India's National Policy for the Promotion of FPOs highlights that the collectivization of producers, particularly small and marginal farmers, into Farmer Producer Organizations (FPOs) is among the most effective strategies for addressing key challenges in Indian agriculture, such as improving access to finance, inputs, technology, and markets. The policy further emphasizes that the special provision under the Companies Act, 1956 for registering FPOs provides an optimal institutional framework for organizing producers (Dept. of Agriculture and Cooperation, 2013). India has seen various farmer collectives, but traditional models failed to boost bargaining power or economic well-being. The limitations of cooperatives and the success of hybrid models led to FPOs' rise (Ramappa & Yashashwini, 2018). FPOs can learn from traditional cooperatives' failures and new models' successes. Though designed for autonomy, they face structural weaknesses, often prioritizing equity over efficiency. To improve, FPOs should focus on member centrality (relevance to livelihoods), patronage centrality (role in agriculture), and domain centrality (economic impact). Sustainability depends on strategic design over legal frameworks (Shah, 2016). Producer companies limit membership to primary producers, unlike cooperatives, which allow external entities like government agencies, risking undue influence. This makes producer companies a stronger option for farmers, artisans, and weavers. A nationwide in-depth on FPCs found weak governance because of the absence of ownership. While member investment should foster ownership, intermediaries often hinder this impact (Govil et al., 2020). Additionally, FPOs face challenges like poor management, limited market access, financial constraints, and farmer mobilization issues (Shree & Vaishnavi, 2022). Comparative studies between FPO member farmers and non-member show that FPO members have a medium perception of effectiveness, while non-members have a low one. Members appreciate timely inputs, support, and market access, whereas non-members are more sceptical, especially about inputs, marketing, and finances. Direct involvement leads to a more favourable view of FPOs (Joshi & Bose, 2023). As on February 2025, 10,000 FPOs were formed under the Central Sector Scheme itself (PIB Delhi, 2025). It is estimated that there would over 45,000 FPOs registered in India (Tata-Cornell Institute, 2024). Despite FPOs' rapid growth in India, academic engagement remains limited, underscoring the need for greater research and public involvement (Phansalkar, 2024; Raina et al., 2022). Academic research in the area of agri-cooperatives, largely focused on specific sectors like dairy and cooperatives in irrigated areas, primarily in Western India (Prasad & Prateek, 2019). Marginalized groups, such as women and tribal farmers from mountainous and rain-fed regions, are frequently excluded from FPO development dialogue (Prasad et al., 2023).

The Dynamics of Millets Sector in India: Millets, nutrient-rich small-seeded grains, have been integral to human diets for millennia. Cited in Ayurveda for therapeutic benefits, they have traditionally served as both food and therapy in indigenous communities. Commonly grown in India are sorghum, pearl millet, finger millet, foxtail millet, barnyard millet, little millet, and proso millet (Ahirwar et al., 2023). Despite the many advantages of millets, dietary patterns in India have shifted considerably over the past six decades, with a growing preference for rice and wheat. In the 1960s, millets constituted 20% of the Indian food basket, but by 2022, this share had declined to just 6%, accompanied by a 33.9% reduction in cultivation area between 1951 and 2022. This decline

is largely due to the Green Revolution, which prioritized the large-scale cultivation of rice and wheat, pushing millets to the margins. Rajasthan is currently the largest millet producer, contributing 26.7%, followed by Maharashtra (14.4%), Uttar Pradesh (13.9%), and Karnataka (12.8%). In terms of yield, Andhra Pradesh leads in overall millet and jowar production, with yields of 2,363 kg per hectare for millets and 3,166 kg per hectare for jowar (NABARD Annual Report 2022–23, 2023, pp. 15–28). To combat malnutrition and improve farmers' livelihoods, particularly in rainfed regions, there was a growing need to revive millet cultivation. The Union Government's agricultural policy has shifted from a Green Revolution-driven model to one centered on sustainable agriculture, prompted by the ecological and social challenges the Green Revolution created in rainfed areas. This policy transition moved from a centralized approach to a more decentralized, region-specific framework. Civil society organizations and state governments have been instrumental in promoting for rainfed agriculture and millet cultivation(Dept. of Agriculture and Cooperation, 2013) (Raina et al., 2022). Additionally, Padmashri Dr. Khader Vali's extensive campaign promoting millets as a superfood, played a significant role in influencing policy changes. He is also credited with introducing the term "Siridhanyalu" to describe millets (Saniya et al., 2023). Ancient grains, minimally altered by human selection, offer resilience, rich nutrition, and health benefits, aiding in hunger and malnutrition. They support food diversification, specialized diets, and small-scale farmers. However, their impact is limited by consumer perceptions, low availability, insufficient germplasm research, and gaps in food processing knowledge (Majzoobi et al., 2023). The growth of the millet value chain in India has been primarily driven by the efforts of the Government of India. India's growth plans for the millet sector are echoed by NABARD, which aims to triple India's millet production by 2030 (Mishra, 2023) and APEDA's projection that millet exports will reach USD 2 billion by 2030 (APEDA & Yes Bank, 2022). To realize these goals, as an initial step, millet clusters were identified, and FPOs were established to leverage collective farming benefits, making the millet value chain FPO-centric (Dept. of Agriculture and Cooperation, 2013). Successful FPOs contribute significantly to the development of millet farming communities by fostering social cohesion, empowering farmers, and facilitating collective action and knowledge sharing (Sangappa et al., 2023). Accordingly, Andhra Pradesh launched the "Comprehensive Revival of Millets Cultivation by Tribals in North Coastal Andhra and Parts of Rayalaseema" initiative to establish Millet Hubs in tribal and rainfed regions. To achieve this, Farmer Producer Organizations (FPOs) were formed to support collective farming, while partnerships with NGOs, private stakeholders, and support agencies were strengthened to enhance the millet value chain (Seeds Development Corporation Limited, Government of Andhra Pradesh, 2025). Millet-focused FPOs address small farmers' marketing challenges by fostering collaboration and trust. They enhance competitiveness through economies of scale and support quality assurance, certification, and collective bargaining. Key activities include input procurement, financing, processing, quality control, and market facilitation. Challenges remain, including low consumer awareness, limited reach, and inadequate infrastructure (Khushwaha et al., 2023). Millet farmers moderately perceive FPOs' general and service activities but favor extension services. They benefit from market access, collateral-free loans, and training. However, weak market links, delayed inputs, intermediaries, financial constraints, poor management, and high deposit requirements hinder effectiveness (Sangappa, Rafi, B., et al., 2023). NITI Aayog's report highlights millet promotion strategies, focusing on state-led missions, ICDS integration, and research advancements. Key programs include Odisha's Millet Mission, Andhra Pradesh's Revival Initiative, Chhattisgarh and Tamil Nadu's Millet Missions, Madhya Pradesh's kodo and little millet efforts, Haryana's Bhavantar Bharpayee Yojana, and Nagaland's NFSM- Nutri Cereals Mission (Rajib Kumar et al., 2023). Consumers are becoming more aware of the nutritional, economic, and ecological advantages of including millets in their diet (Shah et al., 2023). As the demand for healthy and sustainable food grows, understanding consumer preferences and conducting market research have become increasingly vital (Khushwaha et al., 2023). One of the largest surveys on millets covering over fifteen thousand urban consumers across seven major Indian cities to investigate the knowledge, perceptions, and consumption patterns of millets revealed that health concerns (28%), weight loss (15%), and taste preferences (14%) are the primary motivators for consumption; while the lack of millet consumption at home (40%) and taste preferences (22%) act as major barriers. Social media became the primary source of information on millets (Kane-Potaka et al., 2021). Studies on consumer behaviour across different regions have produced similar results, with notable differences influenced by local contexts (Alekhya & Shravanthi, 2019; Reddy & Patel, 2023).

4. DISCUSSION

Research Methodology:

Upon analysing the literature, the following critical research gaps are identified:

- The millet sector did not receive much traction from academic researchers as compared to some other sectors. This gap is understandable, given that the growth in millet sector is fairly
- recent. This offers a valuable opportunity for academic researchers to explore the evolving millet industry.
- To support India's ambitious growth plans for the millet sector, developing strong, localized value chains is crucial. A value chain analysis, including institutional mapping and product value addition at each stage, is essential for understanding governance structures and maximizing opportunities.
- Additionally, there is a noticeable gap in literature regarding women and marginalised communities like tribals in the FPO development dialogue. Analysis of gender-specific roles within FPOs and studies on the functioning of women-only FPOs is scant. Millet clusters, such as those in North Coastal Andhra Pradesh, stand out as a classic case for such studies. Composed entirely of tribal women in hilly regions, they present a valuable opportunity for further research.
- Although the number of FPOs in India has grown at a rapid pace in recent years, academic engagement in the sector has remained relatively low. Research studies on the millet value chain can help bridge this gap, as millet value chains are significantly FPO-centric.
- Consumers serve a key role in sustainable food value chains. Studies show awareness of millets' health benefits and chemical-free production but less on social impacts and low ecological footprint. Further research is needed on whether this awareness influences willingness to pay a premium for sustainable foods.

5. CONCLUSION

The literature review underscores the critical role of sustainable value chains in the promotion and development of millets in India. It highlights the interplay between economic, social, and environmental sustainability, demonstrating that the revitalization of millet cultivation aligns with broader sustainable development goals. The historical decline of millets due to policy-driven favoritism towards rice and wheat has had lasting implications on nutrition security and agricultural sustainability. However, recent initiatives, including government rebranding efforts and the International Year of Millets, signify a renewed commitment to reintegrating millets into mainstream agriculture. Farmer Producer Organizations (FPOs) emerge as key enablers in strengthening the millet value chain, addressing challenges in market access, financial constraints, and collective bargaining power. The rapid rise of FPOs, particularly in millet clusters, indicates a shift towards cooperative models that enhance smallholder resilience and sustainability. Despite this progress, research gaps remain, particularly in understanding the gender dynamics within FPOs, the role of marginalized communities, and the effectiveness of value addition strategies at different stages of the millet supply chain. Additionally, consumer awareness and preferences play a decisive role in determining the success of millet-based interventions. While there is increasing interest in the health benefits of millets, limited awareness regarding their ecological advantages and social impact persists. Further studies on consumer behavior and willingness to pay for sustainable foods could provide actionable insights for policymakers and stakeholders. In conclusion, developing robust, localized millet value chains, strengthening FPOs, and fostering consumer engagement are crucial steps toward ensuring long-term sustainability in the millet sector. Future research should address existing gaps to enhance the strategic implementation of sustainable agricultural practices.

Limitations: The review may have missed significant studies due to the broad scope of research areas. Integrating studies from different disciplines and methodologies carries the risk of inconsistencies, which could challenge the formulation of clear and cohesive conclusions. However, efforts have been made to mitigate this limitation by analysing comparable studies.

Social Implications: The socio-economic significance of this narrative literature review lies in its ability to address the challenges of agricultural sustainability, nutritional security, and rural livelihoods, particularly in rainfed regions that are often overlooked in academic discussions. By exploring the vital role of Farmer Producer Organizations (FPOs), this research provides key insights into revitalizing millet cultivation and strengthening its

value chain. It underscores the transformative impact of millet- focused FPOs in improving the socio-economic well-being of marginalized communities. Furthermore, the study highlights the strategic importance of millet-based initiatives in bolstering food security and fostering economic resilience in disadvantaged areas.

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