

Review Article

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Role of extension personnel in strengthening market-led extension: a comprehensive review

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ABSTRACT

Market-Led Extension (MLE) has emerged as a transformative paradigm in agricultural advisory systems that shifting the traditional focus from production enhancement to profitability, value-chain integration and market responsiveness. This review synthesises existing literature to examine the evolving role of extension personnel in strengthening MLE and supporting farmers in navigating modern, market-driven agricultural environments. The study highlights that globalisation, changing consumer preferences, price volatility and the rise of integrated value chains necessitate extension approaches that go beyond technology dissemination and incorporate market intelligence, quality standards, value addition and entrepreneurial capacity. Extension personnel now function as knowledge brokers, innovation intermediaries, market facilitators and capacity builders, enabling farmers to access real-time information, adopt quality-compliant practices, reduce post-harvest losses, and engage effectively with processors, retailers and digital platforms. Evidence from empirical studies demonstrates that interventions related to collective action, digital advisory tools, direct marketing models and post-harvest value addition significantly enhance farmers' income, bargaining power and competitiveness. Successful case examples further validate the practical potential of MLE-supported initiatives in improving livelihood outcomes and strengthening grassroots agribusiness systems. However, challenges such as limited human resources, infrastructural gaps, inadequate market literacy and fragmented institutional coordination and the fragmented nature of empirical evidence across regions, commodities and institutional contexts which limits cross-comparison and generalization.

Keywords: Market-led extension, Agricultural value chains, Extension personnel, Farmer empowerment, Market intelligence, Agripreneurship development, Post-harvest, Value addition.

Introduction

Agricultural extension in India has historically functioned as a pivotal interface between research institutions and farming communities which facilitating the diffusion of scientific knowledge, improved technologies and context-specific agronomic practices that have contributed substantively to national food, nutritional and livelihood security [30]. Extension-led dissemination of improved crop varieties, resource-efficient production methods and modern management practices played a central role in transforming Indian agriculture from subsistence-oriented systems to a productive sector capable of meeting national food demands. Recent assessments highlight that extension continues to underpin contemporary farming systems by enabling farmers to adopt climate-resilient strategies and navigate emerging challenges associated with climate variability and resource stress [31].

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Over time, however, the extension system has undergone substantial conceptual and operational shifts. The post-independence, top-down production-led model, though catalytic during the Green Revolution through mass media, demonstrations and structured trainings, often failed to accommodate socio-economic heterogeneity, marginal farmer needs and agro-ecological diversity which resulting in uneven impacts and sustainability concerns. These limitations fostered a transition toward participatory, pluralistic and demand-driven approaches that integrate local knowledge and address farmer-specific requirements. Subsequently, digital technologies, ICT tools and inclusive advisory platforms have become integral to modern extension, enhancing both outreach and advisory precision [31,14]. As agriculture evolved to generate marketable surpluses, farmers increasingly faced challenges related to price volatility, market integration, post-harvest losses, value-chain coordination and income instability issues inadequately addressed by traditional production-centric models. This context led to the emergence of Market-Led Extension (MLE), which incorporates market intelligence, consumer preferences, value-chain dynamics and value addition into extension frameworks, thereby enabling farmers to align production with market demand, improve post-harvest management and engage more effectively with buyers and

value-chain actors.

Although MLE demonstrates considerable promise, its implementation remains inconsistent due to chronic underinvestment, limited human resources, suboptimal extension worker-farmer ratios, infrastructural constraints and fragmented institutional coordination, all of which impede the performance of traditional and market-led models alike. Consequently, a comprehensive review of this evolution from production-led to market-led extension becomes essential to assess current effectiveness, identify persistent gaps and outline pathways for strengthening extension systems to enhance farmer empowerment, market responsiveness, sustainable and profitable agricultural development [28].

Concept of PLE and MLE

Production-Led Extension (PLE) dominated during the Green Revolution which emphasizing increased agricultural output through high-yielding varieties, improved technologies and intensive practices to achieve food security. While effective in raising productivity, PLE's focus on output over market demand exposed farmers to price fluctuations, surplus production and weak bargaining power amid globalisation and market volatility. These challenges prompted a shift toward Market-Led Extension (MLE) which integrates market orientation, value-chain participation and economic decision-making to enhance farmers' competitiveness [19,32]. MLE aligns production with market needs through marketing intelligence, post-harvest management and value-chain engagement which drawing on market orientation theory that links efficiency to consumer preferences [1] and value-chain development theory, emphasising farmer involvement in grading, processing, packaging and marketing for higher returns [37]. Extension personnel transition from technology disseminators to facilitators connecting farmers with markets, fostering economically informed, information-rich advisory systems [32]. MLE centres on marketing principles, emphasizing customer orientation, competitive advantage and value creation that encourages farmers to become proactive price-makers [18]. Economic analysis complements this by incorporating profit maximization, cost-benefit assessments, risk evaluation and market forecasting [1]. Extension education strengthens capacities in value addition, post-harvest handling, collective action via FPOs and SHGs, entrepreneurship and ICT-based market intelligence which links farmers with financial institutions and modern markets. Overall, MLE aims to enhance profitability, reduce intermediary dependence, improve product quality, promote value addition and enable informed decisions, transforming farmers into market-driven agripreneurs [19,32].

Need for Paradigm Shift towards Market-Led Extension

The shift toward Market-Led Extension (MLE) is driven by structural changes in agriculture, rising market integration and the limitations of the traditional Production-Led Extension (PLE) model. While PLE was crucial during the Green Revolution by maximising yields, it overlooked market access, post-harvest management, price realization and consumer-driven production. Globalisation, evolving quality standards and volatile markets have made it essential for extension services to equip farmers for value-chain participation, price intelligence and demand-led production [12]. Modern food systems are increasingly preference and quality-driven with supermarket expansion, urbanization and trade liberalization

restructuring value chains [29,35]. Under the production-centric system, farmers face low incomes due to weak market linkages, post-harvest losses, limited bargaining power and reliance on intermediaries [13]. Price fluctuations, unpredictable consumer demand and supply-demand imbalances heighten risk [2,9]. These challenges highlight the importance of market intelligence, real-time price information and value-chain understanding that enables farmers to engage in value addition, contract farming, direct marketing and niche products [38;3].

MLE integrates these elements, enhancing incomes, product differentiation, collective marketing and reducing transaction costs, while promoting sustainability, rural entrepreneurship and high-value market engagement [34;23]. Evidence shows that MLE increases resilience, adaptability and economic empowerment in the face of socio-economic and environmental fluctuations [21, 27]. Consequently, extension systems must transition from production-focused models to market-oriented, information-driven and profitability-centred approaches to ensure farmers remain competitive in modern, value-chain-integrated agriculture.

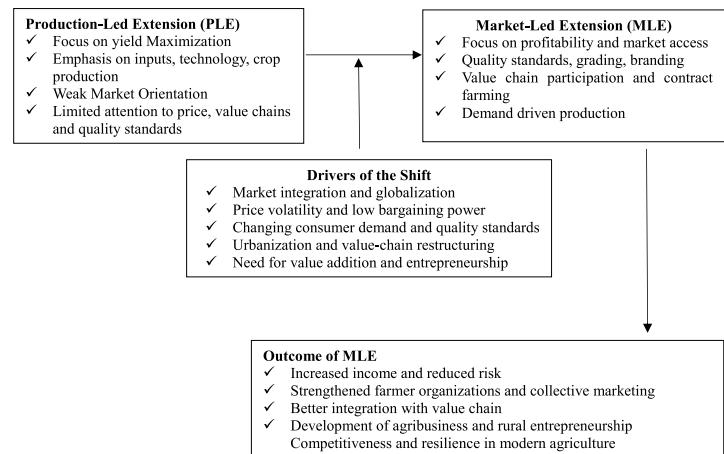
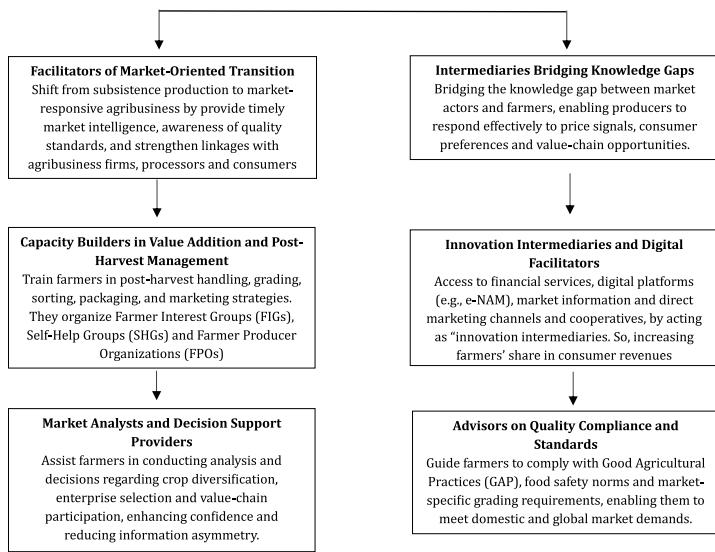


Figure 1: Shift from Production led extension (PLE) to Market led extension (MLE)

Role of Extension Personnel in Market-Led Extension

Extension personnel play a pivotal role in strengthening Market-Led Extension by guiding farmers toward market-oriented decisions and improved linkages. Their role is crucial in promoting efficiency, better income opportunities and enhanced participation in agricultural markets [40, 5, 17, 36, 33, 16]. The key role of extension personnel in Market-Led Extension is described below.





Market-Led Extension Approaches for Farmer Empowerment and Value Chain Competitiveness

Market-Led Extension (MLE) empowers farmers by shifting from traditional technology-focused outreach to approaches that build market literacy, entrepreneurial capacity and value-chain integration. Tools like SWOT analysis help farmers identify demand-driven opportunities, competitive strengths and risks such as perishability and price volatility, enabling strategic, market-responsive planning [38]. Collective action through FIGs, SHGs, FPOs and cooperatives strengthens bargaining power, facilitates aggregation, reduces transaction costs and enhances access to higher-value markets benefits, well supported in studies by [10, 11, 22]. Capacity building through training, demonstrations, Farmer Field Schools and exposure visits equips farmers with skills in enterprise selection, quality management, post-harvest handling and value addition that helping them to adopt innovations that improve product quality and marketability [6]. ICT tools including mobile advisories, digital platforms and e-NAM reduce information asymmetry by providing real-time prices, demand forecasts and weather updates, thereby strengthening decision-making and negotiation capacity [4].

Post-harvest management and value addition form crucial pillars of MLE, as 10-40% losses in cereals, horticultural crops and perishables limit farmer income. Training in scientific harvesting, drying, grading, storage and packaging minimises losses and ensures compliance with buyer standards [15]. Value addition such as processing fruits, dairy, spices and dehydrated products enhances shelf life, stabilises earnings and allows farmers to capture a greater share of consumer value [26, 20]. Direct marketing channels like farmers' markets, Apni Mandis, Rythu Bazaars and digital platforms reduce intermediary margins and improve transparency, increasing profitability by 20-40% [25, 24, 35]. Structured linkages with processors, contract farming firms, institutional buyers and exporters further ensure stable demand, reduce market risk and incentivise quality-based production [41].

Empirical Insights on Collective Action and Market-Led Interventions

Research on Market-Led Extension (MLE) consistently shows that integrating market intelligence, value addition, farmer collectives and post-harvest management significantly enhances farmer income, empowerment and market participation.

Empirical evidence demonstrates that MLE interventions strengthen farmers' ability to negotiate prices, diversify enterprises and adopt demand-driven production strategies. For example, [42] reported that women trained in minor millet value addition nearly doubled their household income while gaining skills, leadership capacity and confidence. Similarly, [39] found that training in mango-based processing boosted rural women's entrepreneurship and earnings, confirming the direct livelihood benefits of MLE-led value addition. Farmer collectives and structured market linkages further reinforce empowerment within MLE frameworks. Studies by [11, 22] highlight that FPOs, SHGs and cooperatives improve farmers' bargaining power, market access and participation in high-value supply chains. These groups enable bulk marketing, standardisation and contract farming arrangements that reduce risks associated with price fluctuations and market uncertainties. Supporting this, [41] showed that farmers linked with agro-processing industries in Tamil Nadu earned nearly 49% higher income than those in non-linked areas, illustrating the profitability of backward and forward linkages facilitated by extension services.

Real-world case studies further validate the transformative impact of MLE at the grassroots level. The SHG "Nidhi" in Kozhikode district successfully adopted vermicomposting after extension training, generating steady income, supporting organic farming and improving savings. In the Jammu region, KVK-led interventions in fish farming enabled farmers such as Sh. Kuldeep Verma to adopt scientific aquaculture, enhance production and secure reliable market channels, while poultry farmers in Samba district of Jammu and Kashmir transitioned from low-profit backyard units to viable agribusinesses through extension support in marketing and enterprise planning. These cases echo [8] findings that market-oriented extension and value-chain integration foster improved livelihoods, stronger market participation, and sustained enterprise growth. Overall, evidence across studies and field experiences affirms that MLE is both theoretically robust and practically transformative, delivering substantial socio-economic benefits by enhancing profitability, empowerment and resilience among farming communities.

Future Strategies & Policy Implications

- **Strengthening Farmer Producer Organisations (FPOs):** Strengthening FPOs is crucial for enhancing farmers' collective bargaining power, reducing input costs and improving marketing efficiency. Future strategies should focus on professionalising FPO management, building leadership capacity and supporting them with financial, technical and marketing services so they can operate as competitive agribusiness units.
- **Enhancing Digital and Market Intelligence Systems:** Developing robust digital tools for real-time price tracking, demand forecasting and advisory delivery will greatly support market-led decision-making. By integrating mobile apps, AI-based analytics and digital marketing platforms into extension work, farmers can access accurate and timely information that helps them plan production and marketing more efficiently.
- **Improving Post-Harvest Infrastructure and Value Addition:** Investing in rural-level infrastructure such as cold storage, grading centers and small processing units is essential to reduce post-harvest losses and improve product

quality. Extension services should guide farmers in value addition activities, branding and packaging to help them earn higher returns and better compete in modern markets.

- **Expanding Direct and Alternative Marketing Channels:** Promoting direct marketing avenues like farmer markets, digital marketplaces and institutional linkages can significantly increase farmers' share in the consumer price. Future strategies should focus on connecting farmers and FPOs with retailers, processors and exporters which enabling them to bypass intermediaries and secure more stable and profitable market arrangements.
- **Building Capacity of Farmers and Extension Personnel:** Continuous capacity building is essential to prepare both farmers and extension staff for a market-driven agricultural environment. Training programs should emphasise entrepreneurship, value-chain understanding, financial management and modern production techniques so that farmers are empowered to make informed, strategic decisions aligned with market requirements.

Conclusion

Market-Led Extension represents a transformative shift from traditional production-oriented extension to a system that prioritises market responsiveness, value creation and farmer empowerment. The literature and case studies consistently demonstrate that MLE enhances farmers' negotiating power, reduces market risks and improves livelihoods through collective action, value addition, digital access and effective post-harvest management. As agricultural markets become increasingly dynamic due to globalisation, urbanisation and changing consumer preferences, farmers must be equipped with market intelligence, entrepreneurial skills and institutional support to remain competitive. MLE thus emerges not only as an extension approach but as a comprehensive development strategy connecting farmers with profitable opportunities across the value chain. The future of Indian agriculture depends on strengthening these market-oriented pathways which ensures that small and marginal farmers gain equitable access to markets, technologies and financial services. When supported by strong institutions, modern infrastructure and digitally empowered extension personnel, MLE has the potential to drive rural transformation, enhance income stability and promote sustainable, inclusive growth in the agricultural sector.

Future Scope of the Study

Future research should focus on generating robust empirical evidence through longitudinal and mixed-method studies to evaluate the long-term impact of Market-Led Extension on farmer income stability, resilience and value-chain participation. Greater emphasis is also needed on assessing the role of digital technologies, Farmer Producer Organizations (FPOs) and public-private partnerships in scaling up MLE across diverse agro-ecological and socio-economic settings. Such studies will help refine extension strategies and inform policy frameworks for inclusive market-oriented agricultural development.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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