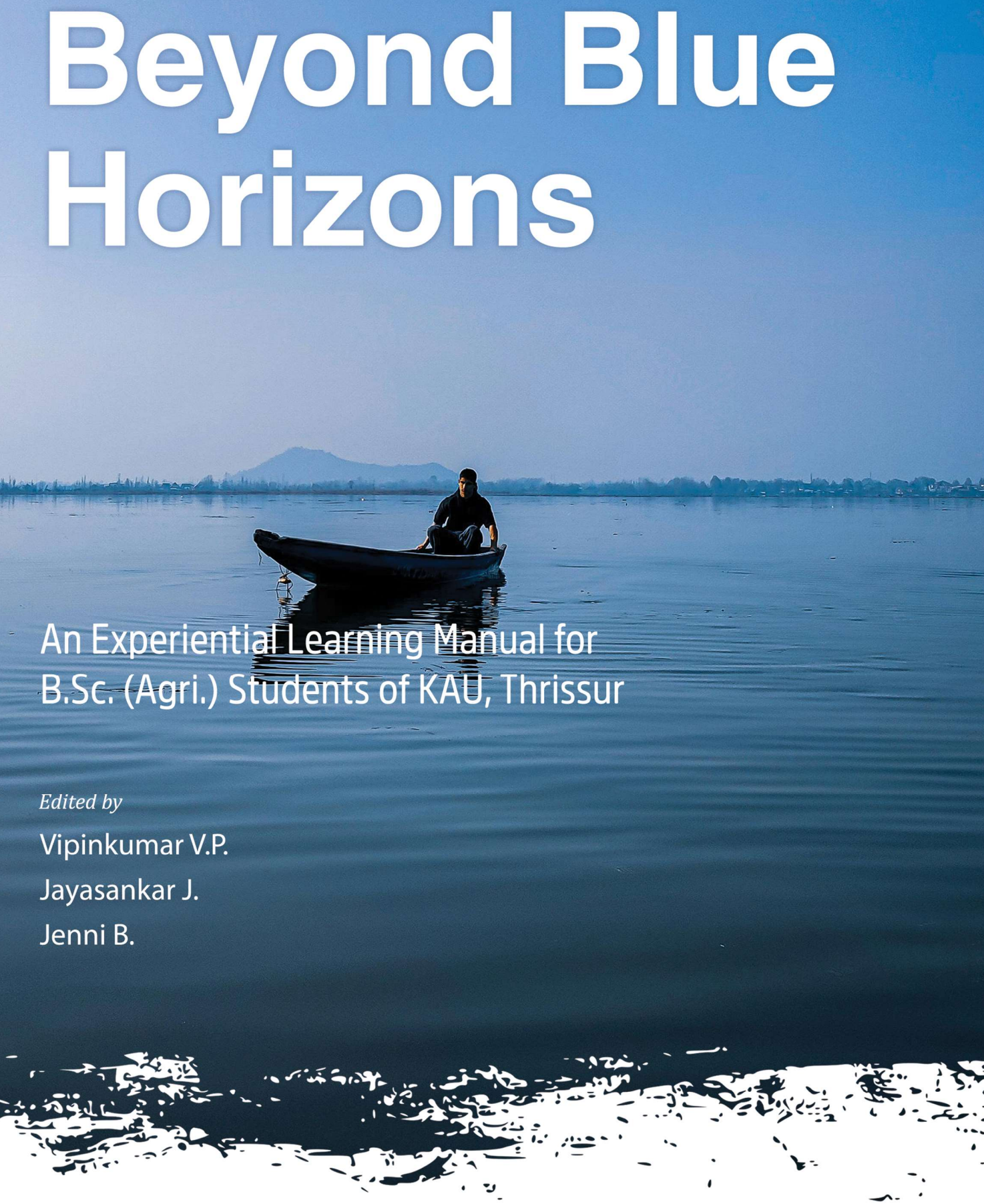
Beyond Blue Horizons



An Experiential Learning Manual for
B.Sc. (Agri.) Students of KAU, Thrissur

Edited by

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ICAR-Central Marine Fisheries Research Institute
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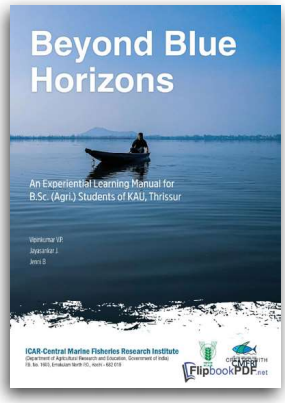

Beyond Blue Horizons
Training Manual for BSc (Agri) students of Kerala Agricultural University

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FOREWORD

It is with great pleasure and deep satisfaction that I present this foreword to the Training Manual of the Science Camp titled "Beyond Blue Horizons: An Experiential Training Manual for B.Sc. Agriculture Students." Conducted from July 14 to 18, 2025, at the STI Hub Digital Training Hall, ATIC, ICAR-CMFRI, Kochi, this programme exemplifies our continued commitment to innovative, experiential, and interdisciplinary learning in agriculture and allied sectors.

Organized by ICAR-Central Marine Fisheries Research Institute through its Agricultural Technology Information Centre (ATIC), the training served as a dynamic platform for B.Sc. Agriculture students from the College of Agriculture, Vellanikkara, Thrissur. The thematic focus on integrating field-based experiences with advanced laboratory analyses reflects a progressive approach to education—one that fosters a seamless continuum between knowledge generation, validation, and application. Such initiatives are vital in equipping students with the skills and perspectives required to address emerging challenges in agriculture and fisheries.

I place on record my sincere appreciation to Dr. Vipinkumar V.P., Principal Scientist and ATIC Manager, ICAR-CMFRI, for his exemplary leadership, meticulous planning, and unwavering dedication in organizing this programme. His efforts, along with those of the entire team, have ensured the successful conduct of this Science Camp, setting a high standard for future capacity-building initiatives.

The programme was thoughtfully designed to bridge the gap between theoretical understanding and practical application. It offered participants a rich blend of innovative lectures on emerging topics, hands-on training sessions, field exposure visits, and institutional interactions. The opportunity to access advanced laboratories, aquarium facilities, and the museum at CMFRI significantly enriched the learning experience. Equally important were the interactive sessions with farmers, which fostered meaningful exchanges between academia and practitioners, grounding scientific knowledge in real-world contexts.

Such experiential learning opportunities are invaluable in enabling students to appreciate the dynamic flow of information from field observations to laboratory insights, ultimately supporting informed decision-making and innovation in production systems. I am confident that the knowledge and exposure gained through this Science Camp will contribute significantly to the academic growth and professional development of the participants.

I extend my warm congratulations to all the students and faculty members who actively engaged in this programme. Your enthusiasm, curiosity, and commitment to learning are truly commendable. May this experience inspire you to strive for excellence and contribute meaningfully to the advancement of agriculture and fisheries.

I am confident that this training manual will serve as a lasting resource, capturing the essence of the programme and reflecting the collective efforts that made this initiative both impactful and memorable.

Dr. Grinson George
Director, ICAR-CMFRI
Kochi

PREFACE

It is with immense pleasure and a deep sense of fulfilment that I present this compendium, "Beyond Blue Horizons: A Training Manual for B.Sc. Agriculture Students of Kerala Agricultural University." This volume encapsulates a unique and inspiring journey of experiential learning, meticulously designed and conducted at the STI Hub Digital Training Hall, ATIC, ICAR-CMFRI, Kochi, from July 14 to 18, 2025.

Envisioned as a transformative academic engagement, this Science Camp brought together bright and inquisitive B.Sc. Agriculture students from Kerala Agricultural University, Thrissur, and guided them through a rich continuum of learning—from field-level realities to the precision of laboratory analytics. At a time when agriculture is rapidly transitioning into a data-driven and innovation-led enterprise, the programme provided a vibrant platform for students to explore the convergence of traditional knowledge systems with modern scientific advancements, with a special emphasis on the fisheries sector.

The training was thoughtfully structured to deliver an immersive and practice-oriented learning experience. Through a dynamic blend of expert lectures, hands-on sessions, field exposure visits, institutional interactions, and meaningful dialogues with farmers, participants were encouraged not only to learn but to question, analyse, and innovate. The focus was on nurturing scientific curiosity, strengthening practical competencies, and inspiring a forward-looking approach to sustainable agriculture and fisheries development.

This manual, comprising ten thoughtfully curated chapters, reflects the thematic depth and diversity of the programme. It covers a wide spectrum of subjects including integrative analytics, digital interventions, field diagnostics, and emerging marine agri-technologies. What makes this volume particularly engaging is its strong practical orientation—each chapter offers insights, methodologies, and experiences that readers can readily connect with and apply. The concluding chapter, featuring the comprehensive report prepared by the students, stands as a testament to their active engagement and the effectiveness of the experiential learning model adopted during the camp.

I place on record my sincere gratitude to Dr. J. Jayasankar, Head of the FRAEE Division, and Dr. B. Jenni, ACTO, ATIC, for their scholarly contributions, editorial excellence, and steadfast support as co-editors of this compendium. Their efforts have been instrumental in shaping this manual into a valuable and enduring academic resource.

As the Course Director and Chief Editor, I consider this compendium not merely as a documentation of an event, but as a celebration of collaborative learning and an invitation to explore the vast and promising interface between agriculture and fisheries sciences. While this endeavour represents only a beginning—a glimpse into a much larger horizon—it is my earnest hope that this volume will inspire readers to delve deeper, think innovatively, and contribute meaningfully to this evolving domain.

I warmly invite students, researchers, academicians, and practitioners to engage with the chapters that follow—rich in practical insights, field-based observations, and scientific perspectives—and to draw inspiration for future learning and innovation.

Dr. Vipinkumar V. P.
Principal Scientist & ATIC Manager
ICAR-CMFRI, Kochi

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Marketing and Value Chain Development in Agriculture: An Indian Perspective

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Anuja A R and Vipinkumar V.P
ICAR-Central Marine Fisheries Research Institute, Kochi-682018, Kerala

Introduction:

Agricultural marketing in India is evolving from traditional systems of localized trading to more integrated value chains that connect farmers with processors, retailers, and consumers. A value chain refers to the full range of activities and actors adding value to a product as it moves from farm to fork. Unlike a basic supply chain (focused mainly on logistics and transport), a value chain emphasizes value addition and coordination at each step – from input supply and production to processing, distribution, and marketing. In today's context, developing efficient value chains is crucial for improving farm incomes, ensuring quality and safety, and meeting consumer demands. This chapter explores the concept of value chain development in agriculture and allied sectors with a focus on recent trends, technologies, and case studies from India.

Agricultural Value Chains vs. Traditional Supply Chains

A traditional marketing supply chain for farm produce often involves multiple intermediaries and informal exchanges where producers simply sell to the next link with limited information flow. In contrast, a value chain is characterized by stronger linkages and information sharing among participants to collectively improve product value and respond to market needs. For example, in a value chain, farmers might receive feedback on quality standards and consumer preferences, while buyers may support farmers with inputs, credit, or training to improve output. This cooperation results in higher-quality products and better returns for all actors, rather than the adversarial, price-only transactions of traditional chains. Table 1 provides an overview of how a value chain approach differs from a traditional supply chain in agriculture:

Table 1: Traditional Supply Chain vs. Modern Value Chain in Agriculture

Aspect	Traditional Supply Chain	Modern Value Chain
Focus	Movement of goods (logistics)	Value addition and coordination at each step
Information Flow	Minimal, one-directional (price info only)	Extensive, two-way (quality standards, demand trends, etc.)
Relationships	Adversarial or arms-length (spot transactions)	Collaborative partnerships (contracts, cooperatives, etc.)
Intermediaries	Many layers, some redundant	Streamlined; non-value-adding layers removed or upgraded
Quality Control	Inconsistent, little feedback to producers	Emphasis on standards, traceability, and continuous improvement
Farmer's Share of Price	Often low (commodity sold unprocessed)	Higher via direct links, processing, or premium markets

Key Components of a Value Chain: At each stage – input supply, production, post-harvest handling, processing, distribution, and retail – there are opportunities to add value. An agricultural value chain might include activities like development of improved seed varieties, efficient farm practices, grading and packaging, cold storage, food processing, branding, and logistics management. It also encompasses the flow of knowledge, finance, and services (like extension or credit) that enable these activities (Fig 1).

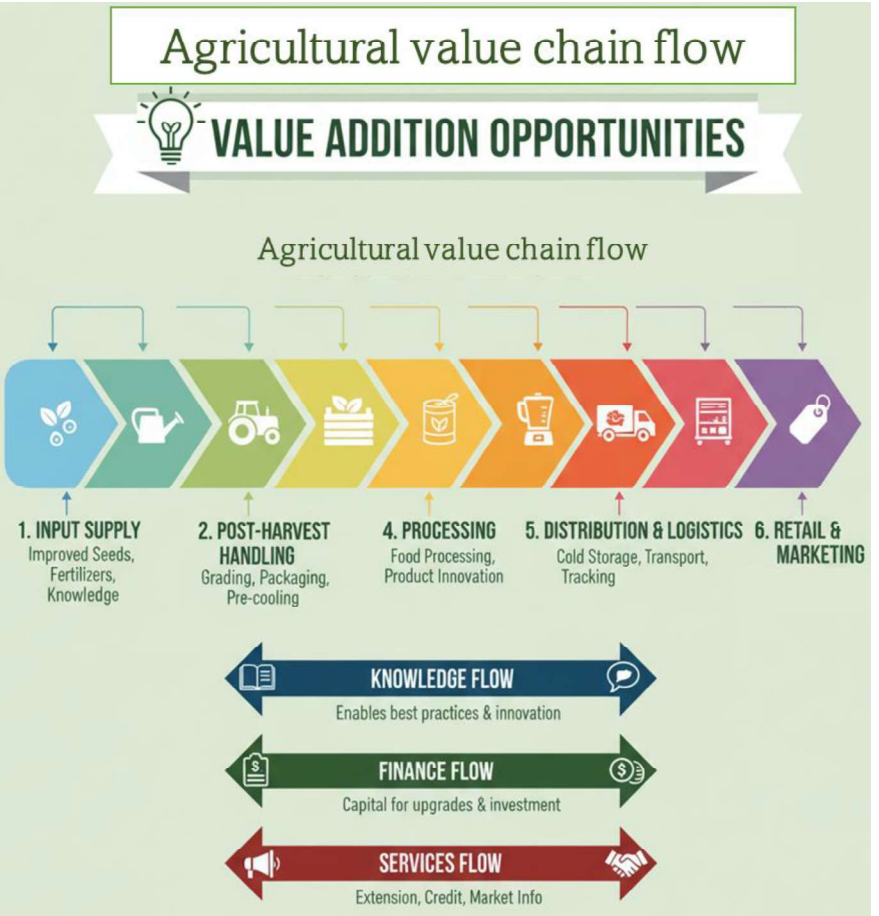

Figure 1: Key Stages and Supporting Flows in the Agricultural Value Chain

In essence, value chain development in marketing aims to integrate small producers into formal, efficient networks that can deliver better quality and earn premium prices, rather than leaving them in informal channels with low returns. This is especially important in India, where a "dual value chain" often exists – an informal chain for local markets and a formal chain for high-end or export markets. Integrating farmers into modern value chains (domestic supermarkets, food processors, or export buyers) can significantly boost their income and livelihoods.

Importance of Value Chain Development in the Current Context

Several trends underline the importance of value chain development in India's agricultural marketing today:

- *Changing Consumer Demand*: Rising incomes and urbanization have led to higher demand for quality, safety, and processed foods – from fresh fruits and vegetables to dairy, meat, and ready-to-eat products. Consumers increasingly seek year-round availability, uniform quality,

and convenient packaging, which require efficient value chains (e.g., cold storage for perishables, processing facilities for value-added products).

- *Need for Farmer Income Enhancement*: Traditionally, farmers received only a small fraction of the final retail price of many commodities. For instance, coffee growers often obtain barely 10% of the retail value of a cup of coffee, and other middlemen capture much of the rest. Value chain interventions (like direct farmer-consumer links, fair trade, or on-farm processing) aim to increase the producer's share by reducing intermediaries and adding value at the farm or community level.
- *Post-Harvest Losses and Efficiency*: India faces significant post-harvest losses due to gaps in the supply chain. For fruits and vegetables, losses of 30-40% have been reported due to lack of storage. Strengthening the chain with better storage, transport, and processing can drastically reduce waste and improve overall supply.
- *Global Market Opportunities*: Integration into global value chains can open up lucrative markets. India is already a major exporter of commodities like rice, spices, seafood, and more. But without value addition, exports are mostly raw or minimally processed goods. By investing in processing and quality control (for example, producing spice oils/extracts instead of raw spices, or branded processed foods), India can capture more value internationally.
- *Technological Advances*: New technologies are revolutionizing agri-value chains. The adoption of digital platforms, blockchain, artificial intelligence, GIS, drones, and mobile apps is underway to streamline marketing and logistics. For example, the Electronic National Agricultural Market (e-NAM) platform has digitally connected over 1,500 wholesale mandis (markets) across 23+ states, enabling farmers to discover better prices beyond their local market.
- Policy Support and Investments: The Indian government and states are prioritizing value chain development through various schemes – from Mega Food Parks and cold chain grants (to spur food processing and logistics) to promoting Farmer Producer Organizations (FPOs) that aggregate produce for better marketing. In Kerala, for instance, the *Kudumbashree* mission (a women's self-help group network) has formed hundreds of producer groups to facilitate primary processing, collective marketing, and value addition in agriculture and animal husbandry. These groups help farmers aggregate produce, obtain better prices, and even collectively procure inputs like feed or seeds at lower cost, thereby improving viability. Such institutional support is creating an ecosystem conducive to robust value chains.

With this backdrop, let us delve into how value chain development is playing out in specific segments: crops, dairy, livestock (meat/poultry), and fisheries – highlighting recent trends, success stories, and emerging interventions.

Value Chain Development in Agriculture

*Horticulture and Staple Crops***:** India's diverse crop production – from grains and pulses to fruits and vegetables – has seen numerous value chain initiatives. A key challenge in crop marketing has been the dominance of traditional APMC mandis and middlemen which often led to low farmgate prices. The emergence of alternative marketing channels is a notable trend. For example, the introduction of e-NAM allows farmers to sell produce electronically across markets, increasing competition for their produce. Similarly, many states now have farmers' markets (direct sale yards) and promote contract farming to link farmers with food processors or retailers. During the COVID-19 pandemic, digital marketplaces and e-commerce proved their worth, with startups enabling farm-to-door delivery of produce when physical markets were disrupted. This accelerated the adoption of online agri-marketing platforms.

Farmer Producer Organizations (FPOs) and Cooperatives: Collective action via FPOs/cooperatives is helping small farmers attain scale and bargaining power. By 2025, thousands of FPOs are active in India, some specializing in particular commodities (e.g., turmeric in Tamil Nadu, organic vegetables in Karnataka, etc.). FPOs aggregate members' produce, maintain quality, and often directly tie up with bulk buyers or processors, bypassing several intermediaries. For instance, in Maharashtra, grape-grower cooperatives have set up packhouses and export infrastructure that allowed them to ship quality grapes to European supermarkets, a feat impossible for individual small farmers. In Kerala, the government-backed *Kudumbashree* network has engaged women in collective farming and marketing of vegetables and other crops. Such examples show that forming value chain organizations at the community level can greatly enhance market access and incomes.

Technology Interventions in Crop Value Chains: Modern technology is addressing age-old bottlenecks. There are pilot initiatives employing blockchain and IoT to manage the supply chain of vegetables. Likewise, mobile apps for crop marketing are on the rise. Platforms now allow farmers to check daily prices, find buyers, or even schedule pickups of their produce. Drones and remote sensing are being trialed to assess crop quality and yields before harvest, helping traders and agro-industries plan procurement more efficiently.

Dairy value chains: The dairy value chain has been revolutionized by the cooperative model, particularly in states like Gujarat (Amul), Karnataka (Nandini), Rajasthan (Saras), and Kerala (Milma). The Amul cooperative in Gujarat, managed by the Gujarat Cooperative Milk Marketing Federation (GCMMF), epitomizes a well-structured value chain benefitting millions of small producers. This integration eliminated middlemen and ensured farmers receive a majority share of the consumer's rupee. Key features of Amul's value chain include: direct procurement of milk twice daily from farmers (ensuring prompt payment), a network of chilling centers and dairy plants for processing (into

pasteurized milk, butter, cheese, etc.), and a robust distribution network that delivers products across India. Strict quality control is maintained from farm to retail, and the cooperative has continually diversified into value-added products (infant milk powder, ice cream, chocolates) to meet market demand. An impressive aspect is Amul's use of technology: it was among the first Indian food brands to adopt internet-based B2C commerce and village information kiosks for farmers. Amul implemented an ERP system with IBM, linking its procurement and marketing systems to optimize supply-demand and reduce waste.

Kerala's milk cooperative MILMA (Kerala Cooperative Milk Marketing Federation) runs on Amul's pattern, organizing dairy farmers across the state. While Kerala's milk production is smaller relative to its consumption, value chain efforts focus on improving procurement (through village level "Anand" model societies) and quality. Moreover, value addition is emphasized: Kerala's dairy cooperatives produce a range of products (curd, ghee, flavored milk, traditional sweets), tapping into local preferences and festivals. This diversification helps farmers earn more than they would by selling raw milk alone.

With the rise of e-commerce grocery platforms in India, dairy value chains are adapting to new channels. Many urban consumers now get milk and dairy products delivered to their doorstep via apps, which requires last-mile cold chain solutions. Private dairy companies are also expanding, often sourcing milk via their own chilling centers or contract arrangements in areas outside the cooperative network. Importantly, the dairy chain has also embraced sustainability – for instance, some cooperatives provide cattle feed, veterinary care, and even biogas units (turning dung to energy) as part of an integrated approach. This ensures environmental and economic sustainability in the long run.

Livestock (Meat and Poultry): While traditionally these products were sold in unorganized wet markets, today we see increasing integration, processing, and branding in this space. The Indian poultry sector has rapidly adopted contract farming since the mid-1990s, with Suguna Foods pioneering vertical integration by providing inputs and buy-back arrangements, which now cover nearly 80% of broiler production. This model streamlines the value chain—integrators own feed mills, hatcheries, processing plants, and distribution networks—reducing intermediaries, ensuring steady farmer incomes, consistent supply, and better-quality products. Suguna's contract farming model shows how inclusive value chains can provide small farmers with stable incomes, spur rural entrepreneurship, and integrate producers into modern agribusiness—demonstrating both commercial success and socio-economic impact. Alongside, initiatives like the National Egg Coordination Committee (NECC) standardized egg pricing and marketing, making India a leading producer of poultry and eggs while expanding into value-added and export markets. For smallholders,

integration into formal value chains—through cooperatives and startups linking livestock producers to markets with assured procurement and support—has become essential to secure fair prices and reduce dependence on middlemen. A large share of India's meat is still sold fresh through informal markets, but gradual integration into cold-chain based formal systems is underway. Cultural preference for fresh meat slows this shift, yet modernization through processing, refrigeration, and logistics is expanding, supported by government schemes like meat-focused Food Parks and subsidies for refrigerated vans.

Fisheries and Aquaculture: Fisheries – including capture fisheries (marine and inland) and aquaculture – form another critical component of India's agricultural economy. However, the fish value chain historically suffered from high spoilage, long chains of intermediaries, and quality issues. Recent years have seen strong efforts to modernize and streamline fisheries value chains, from catch to consumer.

Cold chain gaps remain a major challenge in Indian fisheries, as fresh fish spoils quickly in tropical climates and traditionally passes through many intermediaries without refrigeration. To address this, investments under schemes like PMMSY have supported ice plants, cold storage, and refrigerated transport, though only about 5–10% of fish currently uses cold chain facilities. Expanding modern infrastructure such as refrigerated trucks and vending vehicles is extending market reach, reducing waste, and improving quality for consumers. Startups like Captain Fresh, Jalongi, and FreshToHome are reshaping India's fish supply chain by sourcing directly from producers, using cold-chain logistics, and delivering via e-commerce. With processing and packaging done at the source, they improve quality, extend shelf life, and meet rising demand in a market growing 10–18% annually. Fisheries have long suffered from opaque auctions and exploitative middlemen, but reforms like direct marketing, fisher producer companies, and cooperatives such as '*Matsyafed*' are improving transparency and farmer share. Emerging tools like blockchain promise further price fairness, while reducing non-value-adding intermediaries helps both fishers and consumers.

Value addition in fisheries is expanding beyond exports like shrimp to include ready-to-cook products, hygienically packaged dried fish, and processed snacks for domestic markets. Initiatives such as solar dryers, women's SHG-led processing, and online marketing are boosting incomes, while traceability systems ensure quality and compliance for global trade.

Government initiatives like vessel upgrades, training in post-harvest handling, and formation of fisher cooperatives aim to strengthen value chains and support India's ₹1 trillion fisheries export target. Overall, India's fisheries value chain is steadily modernizing through cold-chain expansion, disintermediation, value addition, and digital innovation to reduce waste and raise fisher incomes.

Challenges and the Way Forward

Despite progress, many challenges remain in developing robust agri-value chains:

Infrastructure Gaps: Rural roads, reliable electricity for cold storage, and processing facilities are still inadequate in many regions. Without these, value chain improvements cannot reach the last mile. Continued investment in rural infrastructure and logistics is needed.

Small Farm Sizes: The average Indian farm is small, making it hard for individual farmers to invest in value addition or negotiate with large buyers. Scaling up through aggregation (FPOs, cooperatives) is essential but not always easy – capacity building and professional management support for these groups are needed.

Market Information & Transparency: While digital tools help, many farmers still lack timely information on prices and demand trends. Expanding rural internet connectivity and smartphone penetration, along with user-friendly advisory services, will help farmers make informed marketing decisions.

Regulatory and Policy Hurdles: Agricultural marketing in India is governed by a mix of state and central regulations (e.g., APMC Act, Essential Commodities Act). Reforms to allow easier inter-state trade, direct farm sales, and contract farming have been attempted (like the farm laws of 2020) but face political hurdles. A consensus on pro-farmer, pro-market regulations is needed to unlock the full potential of value chains. Encouragingly, many states have amended laws to facilitate direct buying from farmers and to promote private markets – this trend should continue in a balanced manner protecting farmer interests.

Ensuring Inclusiveness: There is a risk that modern value chains prefer larger or more resourceful farmers, marginalizing smallholders and women. Targeted efforts (like involving marginal farmers in FPOs, or initiatives like Kerala's *Kudumbashree* which engages women in value addition are needed so that value chain development is inclusive.

Quality and Food Safety: As value chains develop, maintaining high quality and safety is non-negotiable, especially for exports and modern retail. This means more testing labs, certification systems, and training at the farmer level about issues like pesticide residues or antibiotics. It's both a challenge and an opportunity – meeting standards can open premium markets.

Climate Change and Sustainability: Climate fluctuations can disrupt value chains (e.g., unseasonal rains spoiling stored onions). Building climate-resilient value chains – through better storage, insurance, and flexible logistics – will be

important. Moreover, sustainability is a growing concern; global buyers favor value chains that are environmentally friendly and socially responsible. Indian agriculture will need to adopt more climate-smart practices and show sustainability credentials in its value chains (like carbon footprint labeling, etc.) to stay competitive.

Way Forward: The future of agricultural marketing in India is undeniably tied to value chain development. By investing in infrastructure, embracing technology, fostering cooperatives/FPOs, and enabling supportive policies, India can ensure that its farmers are not just producers of commodities but active participants in lucrative value-added chains. This will lead to higher farm incomes, reduction in wastage, and a more secure food system

Conclusion

Value chain development represents a holistic approach to agricultural marketing – one that views the journey of a product from the farm to the consumer as a connected, value-creating process rather than a series of isolated transactions. In the current scenario, with rapid technological advances and changing market dynamics, focusing on value chains is not just beneficial but necessary. India's experiences – be it the white revolution in dairy, the contract farming success in poultry, the digital foray in crop marketing, or the modernization of fish supply chains – all illustrate that strengthening each link of the chain can transform the entire system. The ultimate aim is clear: to ensure that farmers receive a fair, increased share of the consumer share by building efficient, equitable value chains, and that consumers receive quality products at reasonable prices. Achieving this win-win is the hallmark of a well-developed agricultural value chain, and with continued effort, it can become the norm across India's diverse agricultural landscape.

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