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RESEARCH ARTICLE

Revolutionizing smallholder farming through integrated supply chain management: the Sahyadri farms case study

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ABSTRACT

This research paper examines the transformative model Sahyadri Farms implemented in the Nashik District of Maharashtra, India. Founded by visionary farmer Vilas Shinde, Sahyadri Farms serves as a compelling case study of the power of integrated supply chain management to revolutionize smallholder agriculture. The study analyzes the organization's founding, growth, and operational strategies, demonstrating their impact on supply chain efficiency, farmer sustainability, and consumer satisfaction. Findings highlight the scalability and sustainability of the Sahyadri Farms model, emphasizing its potential to strengthen the agricultural value chain, empower farmers, support food security, and promote environmental responsibility.

Keywords: Smallholder Farming Transformation, Agricultural Value Chain, Supply Chain Management in Agriculture, Farmer Producer Company

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INTRODUCTION

The agricultural sector, a cornerstone of global food security and economic stability, faces unprecedented challenges magnified by the intricacies of modernity and environmental concerns. Central to these challenges are smallholder farmers, who, despite being vital to the agricultural landscape, grapple with myriad obstacles that threaten their livelihoods and the sustainability of their practices. These challenges include the adverse effects of climate change, the fragmentation of supply chains, and significant post-harvest losses, each compounding the others in a cycle that often leaves these essential contributors to our food systems at a disadvantage (Govil et al, 2020).

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With its erratic weather patterns, increasingly unpredictable water availability, and the spread of pests and diseases, climate change places immense stress on the fragile ecosystems within which smallholder farmers operate. Such environmental shifts not only threaten crop yields but also increase the vulnerability of these farmers to economic instability and poverty. The situation is further exacerbated by fragmented supply chains, where the lack of integration and coordination among various stakeholders leads to inefficiencies and increased costs. This disconnection within the supply chain impedes access to markets, quality inputs, and timely information, leaving farmers unable to maximize their productivity or profits (Patankar et al., 2020).

Moreover, post-harvest losses represent a critical and yet often overlooked challenge. Due to inadequate storage, processing facilities, and logistics, approximately 40% of agricultural produce never reaches the market, leading to a direct loss of income for farmers and a broader issue of food insecurity. These losses are not just numerical figures but represent a colossal waste of human labour, financial investments, and scarce resources like water and land, further intensifying the urgency to address these systemic flaws (Shree & Vaishnavi, 2022).

Indian agriculture is predominantly composed of small and marginal farmers, necessitating the aggregation of these farmers to achieve economies of scale and provide food at reasonable prices. Various forms of farmer aggregation, such as cooperatives and farmer associations, have been attempted but have yet to be successful. Farmers Producer Companies (FPCs) have emerged as a practical solution (Mukherjee et al.2022). FPCs, registered under the Companies Act of 1956, aim to enhance production, productivity, and profitability for small farmers by managing the entire supply chain. They are democratically owned and run by farmer members, with professional management overseeing day-to-day operations. Since 2002, approximately 9500 FPCs have been registered in India, with several success stories documented in the literature. These success stories provide valuable insights for other FPOs and policymakers to emulate and implement appropriate interventions for their success (Kumari et al., 2021).

Amid these daunting challenges, Sahyadri Farms emerges as a beacon of innovation and resilience. Established by a visionary group of smallholder farmers led by Mr Vilas Shinde, Sahyadri Farms has embarked on a mission to transform the agricultural paradigm for smallholders. By integrating supply chain management practices and sustainable farming techniques, Sahyadri Farms has navigated these challenges and set a new standard for agricultural excellence.

This paper aims to delve into Sahyadri Farms' transformative journey and explore how it has effectively addressed smallholder farmers' multifaceted challenges (Vemireddy et al., 2024). Through a comprehensive examination of its innovative approach to supply chain integration and sustainable farming practices, this study aims to highlight the impactful strategies employed by Sahyadri Farms. By doing so, it seeks to offer valuable insights into how similar models can be replicated and adapted across different contexts, potentially paving the way for a more sustainable, efficient, and equitable agricultural future (Deshmukh and Kumar, 2023). The aim of this study was to analyze the socioeconomic and environmental benefits of Sahyadri Farms' integrated supply chain management system, ultimately showcasing its potential to revolutionize smallholder farming globally.

SAHYADRI FARMS: AN OVERVIEW

Sahyadri Farms stands as a testament to the power of unity and vision in transforming the landscape of agriculture for smallholder farmers in India. At the heart of Sahyadri Farms' inception was a simple yet profound belief held by smallholder farmers led by the visionary Mr Vilas Shinde. They believed in the potential of collective effort to bring about significant change in their farming practices, aiming to compete globally by producing high-quality agricultural produce. This belief laid the

foundation for a pioneering model in the agricultural sector, setting new standards for quality, sustainability, and farmer empowerment (Vemireddy et al., 2022; Lalitha et al., 2024).

The journey of Sahyadri Farms began with an informal alliance of four smallholder farmers who shared a common vision of overcoming the myriad challenges that individual farmers faced when working in isolation. These challenges ranged from accessing finance and adopting new technologies to adding value to their products. The founding farmers recognized that by working together, they could pool resources, share knowledge, and collectively negotiate better terms in the market, thus overcoming the barriers that limited their success.

Table 1 : Corporate Overview of Sahyadri Farms.

Particulars	Details
Name of the Company	Sahyadri farmers Producer. Ltd (Sahyadri Farms)
Founded by	Mr. Vilas Shinde
Year of establishment	27th December 2010
Category of the Company	Company Limited fry Shares Indian Non- Government Company
CIN	U01403MH20l0P'l'C2l 1392
Factory	Gat No. 314/2/1, A/P Mohadi, Tal. Dindori
	Nashik - 422207, Maharashtra, India
Land	30000 Acres +
Villages covered	252+
Registered farmers	18000+
Countries served	42+
Corporate Customer worldwide	110+
Total turnover	1000 Cr
	India's largest Grape producer
	India's First FPC with blockchain technology, traceability and transparent fair trade
Achievements so far	first to start incubation centre for IPCs

Over the years, this small coalition evolved into Sahyadri Farms, a name that has become synonymous with innovation, quality, and the empowerment of farmers. Today, Sahyadri Farms is not just a company, as shown in Table 1, but a movement that has

grown to service over 18,000 registered farmers across 31,000 acres, cultivating nine different crops (Sahyadri Farms). This remarkable expansion from an informal group to a significant fruit and vegetable export company highlights the scalability of Sahyadri Farms' model. The growth of Sahyadri Farms is a story of how visionary leadership, coupled with a commitment to the collective good, can drive significant change in the agricultural sector.

Central to Sahyadri Farms' success is its unwavering commitment to its founding vision: to enable and empower smallholder Indian farmers to compete globally by cultivating the highest quality fresh produce. This vision has guided every decision and strategy Sahyadri Farms implements, from developing its infrastructure to adopting innovative technologies and practices. By building people, processes, and practices that support this vision, Sahyadri Farms has created a sustainable ecosystem that benefits the farmers, consumers, and the broader community (Shroff, 2021).

The farm's infrastructure is state-of-the-art, comprising an advanced pack-house, expansive cold storage capabilities, and a robust technological framework. These components have been scaled to optimize efficiency, forming an all-encompassing support system that guides farmers from planting to point-of-sale. This ensures that the produce not only meets but exceeds global standards. Adopting sophisticated technology has been pivotal in streamlining Sahyadri Farms' operations, amplifying productivity, and minimizing waste. These advances are crucial to the farm's vision of crafting an agile, swift, and inventive agricultural value chain.

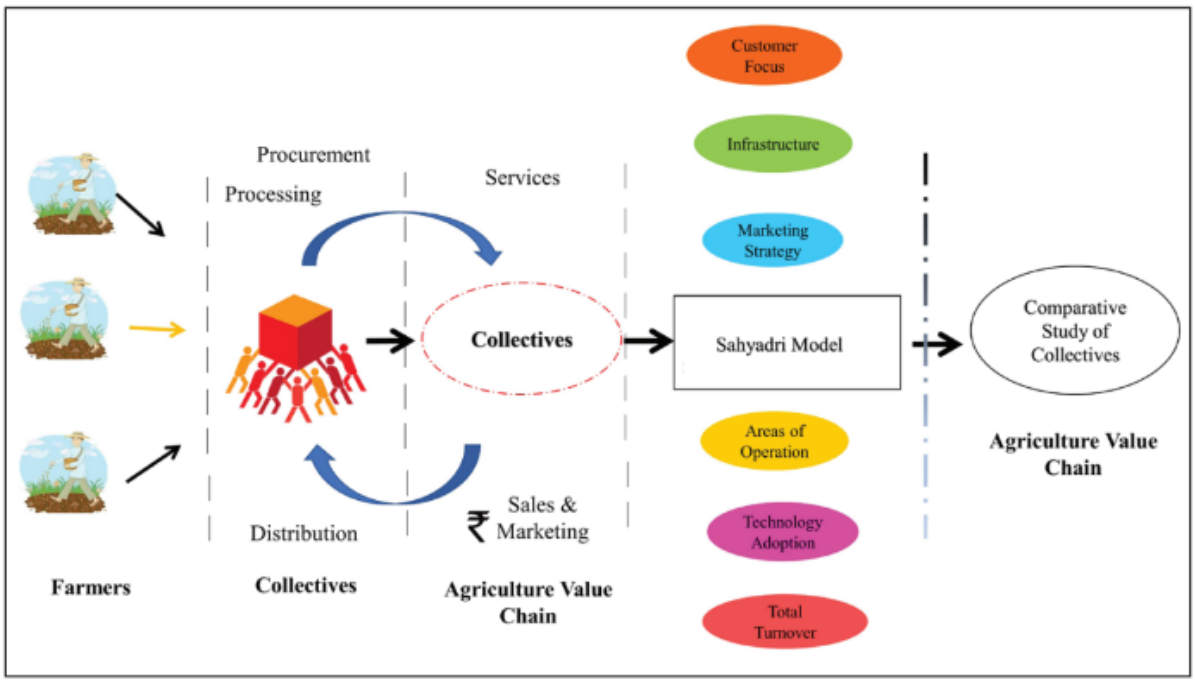

Figure 1:. Research Framework (Kumari et al.2021).

Looking at the research framework depicted in Figure 1, we can see the role of collectives in centralizing the agricultural value chain from the farmers to the marketplace. This includes all facets from procurement and processing to distribution and sales,

with a particular emphasis on services that directly enhance farmer's capabilities and market reach. The Sahyadri Model, as illustrated, emphasizes customer focus, infrastructure, marketing strategy, and other operational areas, all of which are driven by technology adoption and aim at achieving a significant total turnover. The comparative study of collectives in the diagram suggests an analytical approach to understanding different collective models and their impacts on the agricultural value chain. Sahyadri Farms' growth trajectory reflects more than just the economic advancement of individual farmers. It represents a paradigm for sustainable agriculture, showcasing the synergies between cohesive supply chain management and environmentally conscious farming techniques. This model demonstrates the potential for a robust and economically viable agricultural ecosystem when innovative approaches are integrated effectively (Kumari et al. 2021).

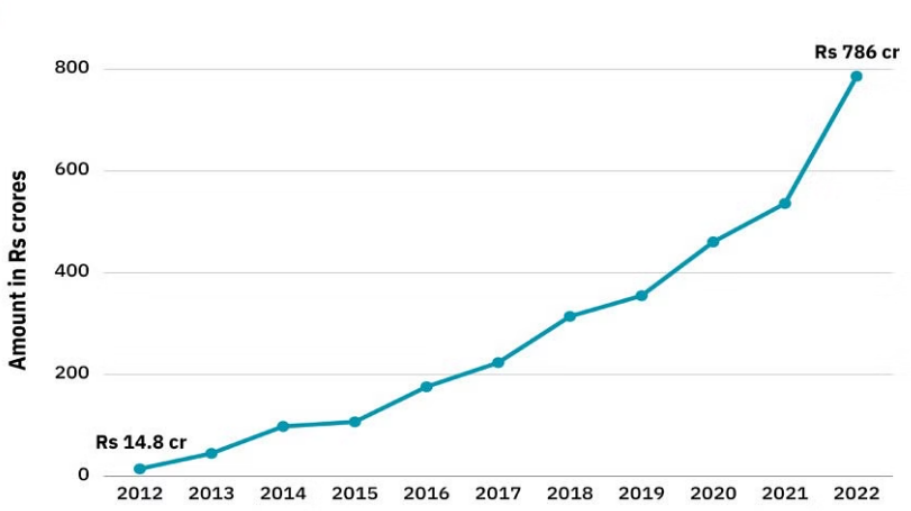

Figure 2: Sahyadri Farms turnover

Sahyadri Farms' journey from a modest beginning to a leading exporter in the agricultural sector encapsulates the transformative power of collective action and innovative thinking in overcoming the challenges faced by smallholder farmers. Sahyadri Farms marked notable financial accomplishments in the fiscal year 2022-23. With a reported turnover of Rs 1,007 crores, the company showcased impressive growth of 28 % compared to the preceding year.

Operational excellence through Crop-specific integrated value chains involves strategically coordinating various elements within the agricultural value chain to optimize efficiency, productivity, and sustainability. Sahyadri Farms exemplifies this concept through its meticulous focus on infrastructure development and technology adoption, which collectively enhance every stage of the agricultural process (Jha et al., 2022).

INFRASTRUCTURE DEVELOPMENT

Agro-Advisory Teams

Sahyadri Farms recognizes the importance of providing farmers with expert guidance and support. Therefore, it has established agro-advisory teams comprising agricultural experts who offer personalized advice on crop selection, cultivation techniques,

pest management, and soil health. These teams serve as a valuable resource for farmers, empowering them with the knowledge and skills needed to optimize their yields and ensure the quality of their produce.

Pack-house

Sahyadri Farms' advanced pack-house facility is central to its infrastructure. Equipped with modern sorting, grading, and packaging equipment, the packhouse ensures the efficient processing and packaging of fruits and vegetables. By standardizing the packaging process and adhering to stringent quality control measures, Sahyadri Farms maintains consistency in product quality, which is essential for meeting domestic and international market demands (Kale & Raj, 2020).

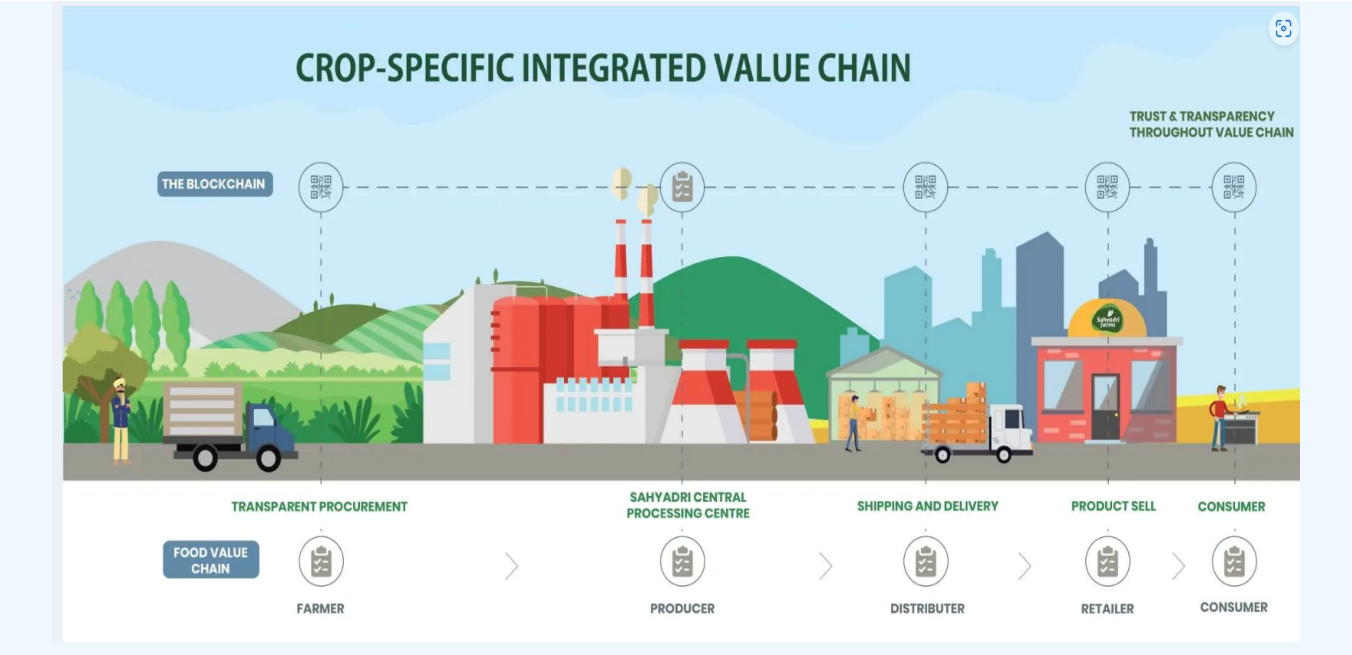

Figure 3: Building crop-specific integrated value chains (Sahyadri Farms)

Cold Storage Facilities

Post-harvest losses represent a significant challenge in agriculture, particularly in regions with inadequate storage infrastructure. Sahyadri Farms addresses this issue by investing in extensive cold storage facilities that preserve the freshness and quality of produce. By maintaining optimal temperature and humidity levels, these facilities extend the shelf life of agricultural products, minimizing wastage and maximizing marketability (Ranga Rao, 2019).

TECHNOLOGY ADOPTION

Modern Farming Techniques

Sahyadri Farms embraces modern farming techniques that leverage technology to optimize resource use and increase productivity. For example, precision agriculture technologies such as GPS-guided equipment and drone imagery enable precise planting, irrigation, and fertilization, minimizing input wastage and maximizing crop yields. Additionally, drip irrigation systems ensure efficient water distribution, conserving water resources while promoting crop health and growth.

Processing Infrastructure

Besides enhancing on-farm productivity, Sahyadri Farms invests in advanced processing infrastructure to add value to its agricultural products. Modern processing techniques such as dehydration, pulping, and canning enable Sahyadri Farms to diversify its product offerings and cater to diverse market preferences. Moreover, by automating specific processing tasks, Sahyadri Farms improves operational efficiency and reduces labour costs, ultimately enhancing its competitive advantage in the market.

BUSINESS STRATEGY: IMPACT ON FARMER SUSTAINABILITY AND CONSUMER BENEFITS

The impact of Sahyadri Farms on farmer sustainability and consumer benefit underscores its pivotal role in transforming India's agricultural landscape. The Business strategy of Sahyadri Farms, as depicted in Fig. 4, through its innovative practices and commitment to excellence, Sahyadri Farms has empowered smallholder and marginal farmers and enhanced consumer satisfaction by ensuring quality and reliability in the supply chain (Vemireddy et al., 2022).

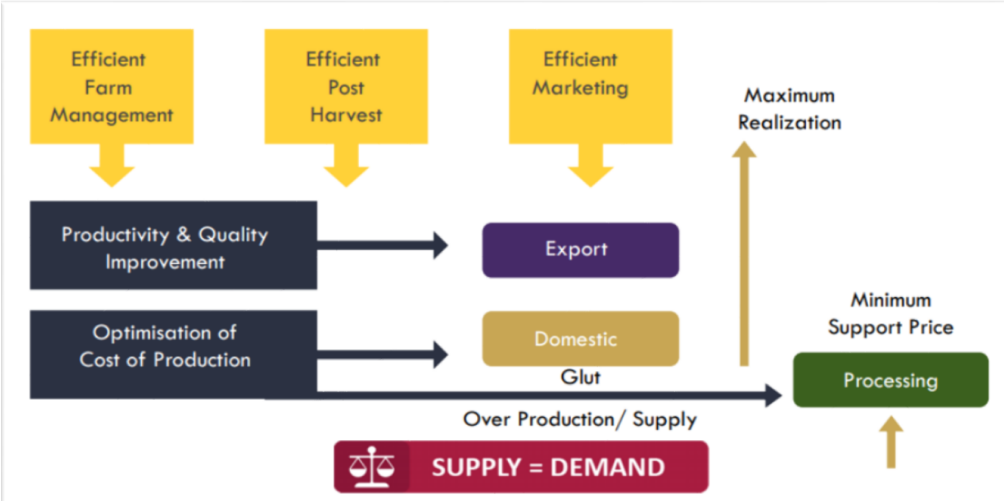

Figure 4: Business strategy of Sahyadri Farms

ENHANCING FARMER LIVELIHOODS

Sahyadri Farms' model is centred around empowering and uplifting smallholder and marginal farmers. Sahyadri Farms has enabled these farmers to achieve sustainable incomes and lead dignified lives by providing them access to critical resources, knowledge, and markets.

Access to Markets

One of the most significant challenges smallholder farmers faces is more access to stable markets. Sahyadri Farms addresses this issue by providing farmers with direct access to domestic and international markets through its extensive network of buyers

and distributors. By eliminating the need for intermediaries, Sahyadri Farms ensures that farmers receive fair prices for their produce, improving their economic prospects and reducing their dependence on exploitative intermediaries.

Capacity Building

Sahyadri Farms invests heavily in capacity-building initiatives to enhance farmers' skills and knowledge. Farmers are educated on modern agricultural practices, sustainability principles, and market trends through training programs, workshops, and demonstrations. This equips them with the necessary tools to improve their productivity, reduce post-harvest losses, and adapt to changing market dynamics, thereby increasing their resilience and long-term viability (Kudtarkar & Ramesh,2023).

Financial Inclusion

Sahyadri Farms recognizes the importance of financial inclusion in empowering farmers and fostering economic sustainability. To this end, it provides farmers access to credit, insurance, and other financial services through strategic partnerships with financial institutions. This enables farmers to invest in inputs, equipment, and infrastructure, improving their productivity and income (Srinivasan, 2021).

Consumer Satisfaction

In addition to benefiting farmers, Sahyadri Farms' integrated approach to supply chain management also ensures consumer satisfaction by delivering high-quality, fresh produce with minimal post-harvest losses and unnecessary intermediaries.

Quality Assurance

Sahyadri Farms prioritizes quality at every stage of the supply chain, from cultivation to distribution. By implementing strict quality control measures and adhering to international standards, Sahyadri Farms ensures that only the finest produce reaches consumers. This commitment to quality enhances consumer satisfaction and strengthens the brand's reputation for reliability and excellence.

Reduced Post-Harvest Losses

Post-harvest losses represent a significant challenge in the agricultural sector, leading to food waste and reduced profitability. Sahyadri Farms addresses this issue by investing in advanced storage, transportation, and processing infrastructure that minimizes post-harvest losses and preserves produce's freshness and nutritional value. By reducing wastage and maximizing shelf life, Sahyadri Farms enhances the availability and affordability of fresh produce for consumers (Phadke et al.2022).

Direct Market Access

Sahyadri Farms ensures transparency and accountability in the supply chain by eliminating unnecessary middlemen and establishing direct relationships with consumers. This direct market access enables consumers to trace the origin of their food, verify its quality and safety, and support sustainable agricultural practices. As a result, consumers have confidence in the products they purchase from Sahyadri Farms, leading to greater satisfaction and loyalty.

Table 2: Agricultural Value Chain (AVC) Strategic Overview

Major produce and Role in AVC	Dealing with vegetables and fruits, which are perishable products. The focus was given more to processed products to increase the utility.
Marketing strategy	Direct marketing, Retail chain, e-Commerce, Wholesale,
Technology adoption	Own website as well as own app
Market catered	Domestic as well as export
Role of actors	A form of the collective owned and managed by farmers
Information flow	The organization provides information to the FPO members.
Transparency	All process is controlled by ERP and blockchain technology so their Agricultural Value Chain (AVC) Strategic Overview Are complete trust and transparency.
Vertical and hierarchical coordination	Chairman, board of members, and FPO members coordinate for AVC.
Role of governance	Captive and modular governance.
Benefits to chain partners	Assured market linkage and better price for the produce.
Margin	The higher margin on the product because of direct marketing.
Logistic drivers	Focused on building cold storage and infrastructure for building the value chain
Cross-functional drivers	Pricing was focused to generate a value chain surplus.
Network building	Build up a strong network through quality products in and across the country
Competitive advantage	Sahyadri came to be known as a brand across the world.

CHALLENGES AND LESSONS LEARNED

Navigating the challenges posed by climate change and ensuring the scalability and sustainability of agricultural practices are critical priorities for Sahyadri Farms. Through innovative strategies and valuable lessons learned, Sahyadri Farms has emerged as a leader in addressing these challenges while fostering growth and profitability for all stakeholders (Govil et al., 2020).

Addressing Climate Change and Resource Use:

Sahyadri Farms recognizes the urgent need to adapt to the changing climate and its impact on agricultural productivity. To mitigate the risks associated with climate change, Sahyadri Farms implements a range of adaptation strategies, including adopting drought-resistant crop varieties, implementing precision irrigation techniques, and promoting climate-smart agricultural practices. These strategies help farmers cope with erratic weather patterns, water scarcity, and other climate-related challenges, ensuring the resilience and sustainability of agricultural production (Patwardhan et al., 2020).

Sustainable Resource Management: Overuse of fertilizers and other agricultural inputs can harm soil health, water quality, and ecosystem integrity. Sahyadri Farms prioritizes sustainable resource management practices to minimize environmental impact while maximizing productivity. This includes using organic fertilizers, crop rotation, and integrated pest management techniques to maintain soil fertility, reduce chemical runoff, and promote biodiversity. By adopting a holistic approach to resource management, Sahyadri Farms enhances the long-term sustainability of agricultural production while safeguarding natural resources for future generations.

Scalability and Sustainability

Building a scalable and profitable agri-enterprise requires significant infrastructure and technology investments. Sahyadri Farms prioritizes the development of robust infrastructure, including pack-houses, cold storage facilities, and transportation networks, to support its growing operations. By investing in state-of-the-art technology and equipment, Sahyadri Farms enhances efficiency, reduces post-harvest losses, and ensures the quality and safety of agricultural produce. This investment in infrastructure lays the foundation for scalability and sustainability, enabling Sahyadri Farms to meet growing demand while maintaining profitability (RAO, 2022).

Partnerships and Collaboration

Scaling agricultural operations requires collaboration and partnership with various stakeholders, including farmers, government agencies, research institutions, and private sector partners. Sahyadri Farms actively engages with stakeholders to foster collaboration, share knowledge and resources, and leverage collective expertise. By working together, Sahyadri Farms and its partners can overcome challenges, identify opportunities, and drive innovation in the agricultural sector. This collaborative approach enhances scalability and profitability and promotes social inclusiveness and community development (Ashish and Agarwal, 2023).

Continuous Improvement

Building a scalable and sustainable agri-enterprise is an ongoing process that requires continuous learning and adaptation. Sahyadri Farms embraces a culture of continuous improvement, where feedback, evaluation, and innovation are encouraged at every level of the organization. By learning from past experiences, identifying areas for improvement, and implementing innovative solutions, Sahyadri Farms remains agile and resilient in the face of evolving challenges and opportunities. This commitment to continuous improvement ensures Sahyadri Farms's long-term success and sustainability as a leading agri-enterprise in India and beyond (Wadkar, 2022) (Neti & Govil 2022).

CONCLUSION AND FUTURE DIRECTIONS

In conclusion, Sahyadri Farms is a beacon of innovation and success in transforming the agricultural landscape, particularly for smallholder farmers in India. Through its visionary leadership, commitment to excellence, and innovative practices, Sahyadri Farms has significantly contributed to agriculture, enhancing farmer livelihoods, promoting sustainability, and ensuring consumer satisfaction. Sahyadri Farms' impact on agriculture is multifaceted and far-reaching. By empowering smallholder farmers and providing them access to markets, knowledge, and resources, Sahyadri Farms has transformed the lives of thousands of farmers, enabling them to achieve sustainable incomes and lead dignified lives. Through its integrated supply chain management practices, Sahyadri Farms has reduced post-harvest losses, enhanced productivity, and improved the quality and safety of agricultural produce. This has benefited farmers and strengthened food security, promoted economic growth, and fostered environmental sustainability.

Furthermore, Sahyadri Farms' commitment to innovation and continuous improvement has set a new standard for agricultural excellence. By investing in infrastructure, technology, and capacity-building initiatives, Sahyadri Farms has demonstrated how strategic resource integration and collaboration with stakeholders can drive operational efficiency, scalability, and profitability in agriculture. As a result, Sahyadri Farms has emerged as a model of best practice in the agricultural sector, inspiring others to emulate its success and adopt similar approaches to address the challenges facing agriculture today.

Looking ahead, Sahyadri Farms' future prospects are bright, with numerous opportunities for further growth, expansion, and impact. One potential area for future research and development is replicating Sahyadri Farms' model in other regions and countries facing similar agricultural challenges. By sharing its knowledge, experience, and best practices, Sahyadri Farms can help catalyze agricultural transformation on a global scale, empowering farmers, enhancing food security, and promoting sustainable development. Additionally, there is scope for further innovation and experimentation within Sahyadri Farms. Sahyadri Farms can further enhance its operational efficiency, productivity, and sustainability by leveraging emerging technologies such as artificial intelligence, blockchain, and precision agriculture. These technologies can revolutionize agriculture, enabling more precise and sustainable resource management, real-time monitoring and decision-making, and improved traceability and transparency throughout the supply chain.

Furthermore, Sahyadri Farms can explore opportunities for value addition and diversification, such as organic farming, agro-processing, and niche product development. By expanding its product portfolio and exploring new markets and distribution channels, Sahyadri Farms can capture untapped opportunities for growth and profitability while meeting evolving consumer preferences and market demands. In conclusion, Sahyadri Farms' journey is a testament to the transformative power of vision, innovation, and collaboration in agriculture. As it continues to lead by example, Sahyadri Farms has the potential to drive positive change within the agricultural sector and in society at large. By remaining committed to its core values of sustainability, inclusivity, and excellence, Sahyadri Farms will undoubtedly play a pivotal role in shaping the future of agriculture for generations to come.

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