



Unveiling Constraints in Banana Value Chains: A Holistic Analysis in Palakkad District, Kerala

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ABSTRACT

Investigations into value chains, aiming to identify priority constraints experienced by value chain actors, play a vital role in comprehending socio-economic dynamics and formulating sustainable development strategies. The banana value chain in the Palakkad district of Kerala exhibits widespread distribution and significant fragmentation. Many stakeholders voiced their concerns, drawing attention to the challenges they faced in their daily operations. In this context a value chain-based study was conducted during October, 2022. Employing diverse research techniques such as interviews, focus group discussions, and the analytical hierarchy process (AHP), the study categorized constraints into economic, technical, social, and environmental groups. Results indicated that economic factors had the most substantial impact, followed by technical, social, and environmental constraints. The study highlights the profound influence of these constraints on the financial aspects of all involved stakeholders. It further emphasizes the necessity for targeted policy interventions and strategic planning to effectively address these issues and enhance the agricultural sector's efficiency and economic viability in the area.

INTRODUCTION

Indian agriculture is currently in the process of diversification, with over 47 per cent of the total agricultural output being made up of high-value products like horticulture, livestock, and fisheries (Gulati & Ganguly, 2010). Robust value chain networks are crucial to enhance producers' share in consumer rupee, reduce spoilage, and maintain product quality. Despite being a top agricultural producer, India's small and marginal farmers, constituting to 86.1 per cent of agricultural farms, and are facing income disparities (Gulati et al., 2022). Fragmented agricultural networks with excess intermediaries hinder value chain development and, overshadowed the increasing cereal output. Fruits and vegetables offer a compelling alternative in the changing conditions as it, promises increased

income, job creation, and innovative solutions to existing food challenges. However, barriers along the agri-value chain impede actors' activities and overall functionality. A value chain is a collection of interconnected activities that enhance the worth of a product. Strengthening the connections in value chains is essential for diversifying agricultural activities, stimulating economic growth, and addressing food security challenges. In this connection, a study is conducted in the banana value chains of Palakkad district, Kerala. The ultimate aim is to offer a well-informed perspective on elevating these value chains' performance, aligning with sustainable development principles (Govindan et al., 2014; Nyaoga & Magutu, 2016). The identification of constraints within the agricultural value chain plays a pivotal role in boosting efficiency and productivity. By pinpointing bottlenecks and challenges,

stakeholders can implement targeted solutions to enhance the overall sustainability and resilience of the agricultural value chain. This proactive approach not only ensures the long-term economic viability of agricultural enterprises but also promotes environmental stewardship, fostering a balance between profitability and ecological preservation. Moreover, the findings may challenge some prevailing assumptions regarding local food systems, leading to question conventional wisdom and explore counter-intuitive conclusions. Despite the existence of a highly distributed value chain for horticultural products, which holds significant potential for high value, certain barriers prevent the stakeholders from operating beyond the current established framework. The study sheds light on the constraints in the banana value chain, providing insights for decision-makers facing complex problems in the business sector. The primary objective of the research was to recognize the various challenges encountered by actors within the banana value chain in Palakkad district, Kerala. Additionally, the study sought to prioritize these constraints systematically to foster the sustainable advancement of the relevant sector.

METHODOLOGY

This research study is driven by the imperative recognition of the significance of comprehending the constraints within value chains (Trienekens, 2011), and has adopted an ex post facto approach in October, 2022 in Palakkad district, leading banana producing district in Kerala. The three largest banana-producing blocks - Attappadi, Mannarkkad, and Sreekrishnapuram of Palakkad were purposively chosen, along with high-production panchayats viz; Agali, Kumaramputhur and Karimpuzha respectively. The study involved 170 value chain actors like input dealers (19 nos), banana farmers (105 nos), commission agents (19 nos), wholesalers (19 nos), value-addition dealers (17 nos), retailers (19 nos), and consumers (105 nos). Semi-structured interviews and focus group discussions were held to collect data. Value chain sketching and participatory linkage mapping techniques were used for drawing the conclusions. The constraints were ranked using the Analytic Hierarchy Process (AHP) (Wind & Saaty, 1980). The initial phase of AHP involves structuring the multi-criteria decision-making problem as a hierarchical model, where the goal is at the top, followed by criteria and alternatives. Subsequently, the relative significance of one criterion compared to another is determined

through pairwise comparisons, generating a matrix based on these assessments. In the final step, several computations are performed to ascertain the priority vector (weights) and the consistency of the judgments. The consistency index (CI) indicates the consistency of pair wise comparison. If the CI meets the required standards, the decision can be accepted; otherwise, the evaluations should be reiterated until the desired level of consistency is achieved (Kumar & Pant, 2023). It aids in analysing decisions with multiple criteria, where participants compare paired objectives and evaluate their relative importance. (Morgan, 2017). Another benefit is found in employing pairwise comparisons, which lessens the cognitive load associated with prioritizing decision-making (Himes, 2007).

$$\text{Consistency index (CI)} = \frac{(\lambda)_{\max} - n}{n - 1}$$

$$\text{Consistency ratio (CR)} = \frac{\text{CI}}{\text{Random index}}$$

In the formula, 'n' represents the number of compared elements. The consistency of AHP is determined by the CI value from the pairwise comparison table. If the CI value exceeds 0.1, the comparison needs to be redone. $(\lambda)_{\max}$ can be calculated by multiplying the judgment matrix's right by the priority vector, resulting in a new vector. The corresponding priority vector is used to divide the elements of the weighted sum matrices or the new vector. The average of these values is $(\lambda)_{\max}$ and the consistency ratio is the comparison between consistency index and random index.

RESULTS

Ranking of value chain constraints

It was discerned that economic constraints (C1) emerged as the primary risk within the banana value chain, as delineated in Table 2. Technical constraints (C4) were identified as the second most significant, while social constraints (C2) and environmental constraints (C3) occupied the third and fourth positions. The whole $\lambda_{\max}$ was 4.11 and the consistency index (CI) was 0.036.

Table 1. Criteria for ranking of value chain constraints

Goal	Criteria for ranking of value chain constraints			
Criteria	Economic (C1)	Social (C2)	Environmental (C3)	Technical (C4)
Sub criteria	Unexpected price hike of fertilizers (C11)	Exploitation of producers by middlemen in rural area (C21)	Unscientific use of plant protection (PP) Chemicals (C31)	Unawareness about recent technologies (C41)
	Banana price fluctuations (C12)	Inadequate government procurement system (C22)	Occurrence of natural disaster (C32)	Inadequate value addition centers (C42)
	Influx of cheapest banana from neighbor states (C13)	Poor bargaining power of producers (C23)	Product loss due to wild animal attack (C33)	Unavailability of cold storage facilities (C43)
	Delay in getting crop insurance (C14)	Poor market orientation and information (C24)	Changes in soil productivity due to unscientific package of practices (C34)	High investment cost of recent technologies for value addition (C44)

Table 2. Ranking of major constraints in value chain

Criteria rank	Major Constraints	Priority vector/Criteria weight	Test values
1	Economic (C1)	0.49	λ max = 4.11
2	Technical (C4)	0.23	Consistency Index (CI) = 0.036
3	Social (C2)	0.15	Consistency ratio (CR)= 0.04
4	Environmental (C3)	0.07	

Table 3. Ranking of major constraints and sub constraints in the value chain

Criteria rank	Major Constraints	Priority vector/Criteria weight	Test values
Ranking of sub constraints			
1	Invasion of cheapest banana from neighbor states (C13)	0.49	λ max = 4.11
2	Banana price fluctuations (C12)	0.23	Consistency index (CI) = 0.036
3	Unexpected price hike of fertilizers (C11)	0.15	Consistency ratio (CR)= 0.04
4	Delay in getting crop insurance (C14)	0.07	
Ranking of technical constraints			
1	Inadequate value addition centers (C42)	0.40	λ max = 4.04
2	Unavailability of cold storage facilities (C43)	0.26	Consistency index (CI) = 0.01
3	High investment cost of recent technologies for value addition (C44)	0.18	Consistency ratio (CR)= 0.01
4	Unawareness about recent technologies (C41)	0.10	
Ranking of social constraints			
1	Exploitation of producers by middlemen in rural area (C21)	0.42	λ max = 4.01
2	Inadequate government procurement system (C22)	0.31	Consistency index (CI) = 0.003
3	Poor market orientation and information (C24)	0.19	Consistency ratio (CR)= 0.003
4	Poor bargaining power of producers (C23)	0.11	
Ranking of environmental constraints			
1	Product loss due to wild animal attack (C33)	0.43	λ max = 4.10
2	Occurrence of natural disaster (C32)	0.28	Consistency index (CI) = 0.03
3	Changes in soil productivity due to unscientific package of practices (C34)	0.15	Consistency ratio (CR)= 0.03
4	Unscientific use of PP Chemicals (C31)	0.11	

The consistency ratio (CR) derived through these parameters was 0.04, which was less than 0.1 and it implied the consistency of ranking results. The primary economic constraint (Table 3), was the influx of competitively priced bananas from neighboring states, mainly Tamil Nadu and Karnataka. Following closely, price fluctuations (Reema et al., 2020; Warshini et al., 2022) in the banana market accounted for a significant economic constraint. The overall consistency of ranking results, indicated by the consistency ratio (CR) of 0.1 (less than or equal to 0.1), demonstrated coherence in the findings, with a calculated λ max of 4.28 and a consistency index (CI) of 0.09.

The primary technical constraints, as summarized in Table 3, revealed that the most significant bottleneck in the chain was the insufficient local value addition centers. Following closely, the unavailability of cold storage facilities emerged as the second critical constraint (Warshini et al., 2022). The third major constraint was the high investment costs associated with recent technologies for value addition, reported by actors. Finally, the lack of awareness about recent technologies, particularly among producers, constituted the fourth constraint. In the comprehensive analysis, the overall λ max value was 4.04, and the consistency index (CI) was low at 0.01. Calculating the consistency ratio (CR) based on these parameters resulted in a value of 0.01, falling below the threshold of 0.1. This underscores a high level of consistency in our ranking results.

Table 3 outlines a predominant constraint surfaced - the exploitation of producers by middlemen in rural areas. The second most critical constraint, as indicated by actors, was the inadequacy of government procurement agencies (Ramesh et al., 2014). Poor market orientation and information (Dassou et al., 2021) were the third ranked social constraint. The fourth constraint, contributing to the above, was the poor bargaining power of producers. The comprehensive analysis yielded an overall λ max value of 4.01, accompanied by an exceedingly low consistency index (CI) of 0.003. Calculating the consistency ratio (CR) based on these parameters resulted in a value of 0.003, falling below the threshold of 0.1. This underscores the high level of consistency in our ranking results. In the environmental dimension, the foremost constraint was product loss due to wild animal like wild boar and elephant attacks (Table 3). The wild animal attacks caused huge crop damage and economic loss to the farmers (Sumitha & Shaharban, 2022). The floods that occurred in 2018 and 2019 severely impacted banana plantations, leading to significant economic losses. A high rainfall (20-56% above average) were reported during the monsoon season 2018 in the Palakkad district (Lal et al., 2020). The overall λ max was 4.01, with a low consistency index (CI) of 0.03. The consistency ratio (CR) derived from these parameters was 0.03, below the acceptable threshold of 0.1. This signifies a reliable and consistent set of rankings for the environmental constraints in the banana value chain, providing a robust foundation for further analysis and decision-making.

DISCUSSION

The study underscores critical challenges in the banana value chain, notably the economic impact of price fluctuations (Roy & Paul, 2015; Mehazabeen et al., 2021) on farmers' livelihoods and the need for urgent policy interventions. The more frequent and severe extreme weather occurrences linked to climate change directly impact the food supply and agricultural produces, serving as a significant contributor to fluctuations and unpredictability in the prices of banana contributing to economic constrain (Tadesse et al., 2014). Thus, in total the decrease in prices has adverse effects on farmers, affecting their farm income, constraining their ability to invest in capital (Subervie, 2008), and dissuading them from adopting advanced technologies that could enhance banana yields.

Technical constraints, like the lack of local value addition centers (Chandrakar et al., 2015) and cold storage facilities (Gebre et al., 2020), contribute to lower banana prices. Value addition in banana demands substantial capital investment, necessitating customized financing to suit the distinctive attributes of the agricultural and agro-industrial sectors (Ngore et al., 2011). Boosting value addition in banana sector is crucial to encourage market-oriented smallholder farming (Omiti et al., 2007), allowing rural inhabitants to increase profits from their agricultural yield through agribusiness (Ngore et al., 2011). In addition to this, financing value addition to banana is necessary for helping the farmers from high investment cost of recent value addition technologies, with agribusiness recognized as the optimal method to direct credit into agriculture, thereby fostering value addition (Stanton, 2000).

The farmers were experiencing reduced profits due to their limited understanding of market trends, consumer preferences, inadequate post-harvest practices, storage, and transportation, alongside an inefficient management system for the entire value chain (Sarkar et al., 2022). Middlemen played a crucial role within any value chain, since they coordinated the flow of raw banana and its value added products between producer and consumer (Fung et al., 2007) and helped the producers find innovative banana products (Popp, 2000) that could meet the changing demand of consumers in the global market. Middlemen can address the prevalent market inefficiencies commonly found in developing nations (Maertens & Barrett, 2013). However, they might also claim a significant portion of the profit margin within the value chain and limit the chances for small-scale farmers to improve their position (Lee et al., 2012). The exploitation of banana farmers by middlemen primarily stems from the farmers' lack of knowledge about marketing and its functions (Sarkar et al., 2022). Since many farmers' education level is low and uninformed about post-harvest practices such as cleaning, sorting, grading, storage and proper packaging of raw banana, they often fall prey to exploitation (Badar & Mustafa, 2008). As a response, policymakers and development practitioners are increasingly emphasizing the role of collective action and farmer organizations in advancing a pro-poor market-oriented approach (Hellin et al., 2009).

Product loss due to wild animal attack was the major environmental constrain in the banana field caused them serious economic losses (Laznik & Trdan, 2014). Wild boars, with their substantial size and reliance on plants in their varied diet, frequently

destroy and consume banana (Schley & Roper, 2003). Due to their ability to overcome bio fencing, employing varying combinations of methods are required (Thapa, 2010). Hence, advancing to more sophisticated fencing and strategies is essential to discourage wild boars in the field. Ultimately, as the wild boar population expands, controlled hunting should be taken into account (Schley et al., 2008). The flood in 2018, the second most environmental constraint, significantly impacted farmland and communities, posing a substantial threat to both human lives and their assets in Kerala (Lal et al., 2020) which also had a significant impact on banana farmers in the locale and the other actors in its value chain. The potential cause behind these environmental constraints could be the lack of knowledge among farmers regarding proper pesticide and fertilizer use (Zamsuddin, 2022). Consequently, the soil has gradually lost its fertility and health due to inappropriate farming methods and excessive application of chemical fertilizers over time, as reported by Ruhela et al., (2021).

CONCLUSION

The economic constraint involves a cheaper banana influx from neighbouring states, with the proposed solution being improved quality control at state borders, as endorsed by Khadka & Solberg (2020), and support for local banana production. Crucial for competitiveness is supporting local banana production through subsidies and addressing rising fertilizer costs. Digitalizing the crop insurance procedure may speed up the process and help to obtain the money quickly. In the technical dimension, insufficient value addition centers are a priority, addressed by establishing farmer-owned centers, and providing subsidized cold storage facilities are key strategies for efficiency and shelf-life extension (Ruhela et al., 2021). Socially, producer exploitation by middlemen is a concern, remedied through enhanced social involvement and institutional ties. The primary environmental constraint is product loss from wildlife attacks. Addressing these challenges and implementing proposed solutions at the policy level will foster sustainable development in the sector.

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