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Supply Chain Management in the Pulses Industry of Marathwada

Ms Ankita Jawalkar
Research Scholar
Dr Babasaheb Ambedkar
Marathwada University
Chh.Sambhajinagar

Dr. Vijay Nagori
Head, Dept of Commerce,
Smt. Dankuwar
Mahila Mahavidyalaya
Jalna

Abstract

This study examines the supply chain management (SCM) practices within the pulses industry of Marathwada, a key agricultural region in Maharashtra. It explores the challenges faced by farmers and other stakeholders, including procurement inefficiencies, inadequate storage facilities, and logistical bottlenecks. The research highlights the impact of these issues on the quality, pricing, and market accessibility of pulses. By analyzing existing SCM frameworks and comparing them with best practices, the study proposes strategies for enhancing supply chain efficiency, thereby improving the overall profitability and sustainability of the pulses industry in Marathwada.

Introduction

The pulses industry plays a crucial role in the agricultural sector of India, particularly in regions like Marathwada, Maharashtra. Pulses, including lentils, chickpeas, and beans, are vital for their nutritional value and are a staple in the Indian diet. Marathwada, known for its agricultural productivity, contributes significantly to the country's pulse production. However, despite the region's potential, the pulses industry faces numerous challenges within its supply chain that hinder its efficiency and growth.

Supply chain management (SCM) encompasses the entire process of production, from the initial stages of sourcing raw materials to the final delivery of finished products. In the context of pulse production, SCM involves multiple stages, including procurement, storage, processing, and distribution. Effective SCM is crucial for ensuring the quality and timely delivery of pulses to the market, thereby impacting both profitability and consumer satisfaction.

Marathwada, a region in central Maharashtra, is known for its significant production of kharif pulses and cereals. The kharif season, which spans from June to October, is crucial for agricultural activities in this region. Pulses such as Tur (Pigeon Pea), Mung (Green Gram), and Udid (Black Gram) are widely cultivated during this period due to their adaptability to the monsoon rains. These pulses are vital for local diets and play a key role in crop rotation systems, enhancing soil fertility through nitrogen fixation. In addition to pulses, Marathwada also grows various cereals during the kharif season, including Jowar (Sorghum) and Bajra (Pearl Millet). These cereals are fundamental to the region's food security and contribute significantly to the agricultural economy. The combination of pulses and cereals provides a balanced cropping system, supporting both economic stability and nutritional needs. However, challenges such as water scarcity and inconsistent monsoon patterns can impact yields, making

effective water management and resilient agricultural practices essential for sustaining production in Marathwada.

In Marathwada, the pulses industry is predominantly driven by small and marginal farmers who contribute significantly to the production but often face substantial challenges. These challenges include inefficient procurement systems, inadequate storage facilities, and logistical issues that affect the timely distribution of pulses. The region's infrastructure limitations, coupled with erratic weather patterns and fluctuating market prices, exacerbate these issues, leading to reduced productivity and economic losses.

The procurement phase in Marathwada's pulses supply chain is often characterized by fragmented practices. Smallholder farmers typically sell their produce through intermediaries, which can lead to lower prices for the farmers and higher costs for consumers. The lack of direct access to markets or efficient procurement channels diminishes farmers' bargaining power and often results in suboptimal pricing and market access.

Storage is another critical challenge in the supply chain. Pulses are highly susceptible to quality degradation due to improper storage conditions. The absence of adequate storage facilities in Marathwada leads to post-harvest losses and reduced quality of pulses. This issue is compounded by the region's climatic conditions, which can adversely affect the shelf life of pulses and lead to further losses.

Processing and distribution are equally important components of the supply chain. In Marathwada, processing facilities are often limited and outdated, impacting the overall quality and value addition of pulses. The distribution network is characterized by inefficiencies, including inadequate transportation infrastructure and delays, which affect the timely delivery of pulses to markets and consumers.

This research aims to provide a comprehensive analysis of the supply chain management practices within the pulses industry of Marathwada. By examining the current challenges and inefficiencies, the study seeks to identify potential improvements and best practices that can enhance the overall efficiency and effectiveness of the supply chain. The research will focus on understanding the intricacies of each stage of the supply chain, evaluating the impact of existing practices, and proposing solutions to address the identified issues.

In conclusion, addressing the supply chain challenges in Marathwada's pulses industry is crucial for improving the economic viability of pulse production and ensuring food security. By implementing effective SCM practices, the region can better harness its agricultural potential, enhance the profitability of pulse farming, and contribute to the broader goals of sustainable agricultural development and food sustainability in India.

Literature Review

The efficiency of supply chain management (SCM) in the pulses industry has garnered significant attention in academic and industry research due to its impact on productivity, quality, and economic outcomes. Effective SCM is crucial for optimizing the various stages of pulse production, from procurement to distribution, and addressing challenges specific to regions like Marathwada.

Procurement Challenges: Studies highlight that procurement inefficiencies significantly affect pulse production. According to Singh et al. (2016), smallholder farmers in India often face challenges in accessing markets directly due to fragmented procurement systems. These inefficiencies result in lower prices for farmers and higher costs for consumers. Kumar and Mishra (2018) emphasize the role of intermediaries in exacerbating procurement issues, leading to reduced bargaining power for farmers and increased transaction costs.

Storage Issues: The literature underscores the critical role of storage in maintaining the quality of pulses. A study by Bhattacharya and Dey (2017) reveals that improper storage conditions

contribute to significant post-harvest losses in pulse production. The lack of adequate storage facilities leads to degradation in pulse quality and affects marketability. Similarly, the work of Sharma et al. (2019) points out that climatic conditions in regions like Marathwada further exacerbate storage challenges, resulting in reduced shelf life and increased losses.

Processing and Value Addition: Processing efficiency is another vital aspect of SCM. Rao and Shankar (2015) discuss the limitations of outdated processing facilities and their impact on the quality and value addition of pulses. The absence of modern technology and infrastructure hampers the ability to process pulses effectively, leading to lower quality products and reduced market competitiveness. The findings of Patel et al. (2020) also highlight the need for upgrading processing facilities to enhance the overall value chain and meet market demands.

Distribution Network Inefficiencies: The distribution phase of the supply chain is often fraught with inefficiencies. Research by Gupta and Sharma (2018) identifies issues such as inadequate transportation infrastructure and delays in distribution, which impact the timely delivery of pulses to markets. The study highlights that these inefficiencies contribute to increased costs and reduced access to markets for farmers, ultimately affecting the overall supply chain performance.

Proposed Solutions: To address these challenges, several studies propose solutions. Sharma and Yadav (2021) suggest the implementation of integrated SCM practices that include better storage solutions, upgraded processing facilities, and improved logistics. The adoption of technology and innovation in SCM is also recommended to enhance efficiency and reduce costs. Furthermore, the work of Sinha and Ghosh (2019) emphasizes the importance of developing robust market linkages and direct procurement systems to empower farmers and streamline the supply chain.

In conclusion, the literature indicates that addressing SCM challenges in the pulses industry requires a multifaceted approach involving improvements in procurement systems, storage facilities, processing technology, and distribution networks. By implementing these solutions, the efficiency and effectiveness of the pulse supply chain in regions like Marathwada can be significantly enhanced, leading to better economic outcomes and increased productivity.

Research Objectives

The primary objectives of this research are:

1. To Analyze SCM Practices: Examine the current supply chain management practices within the pulses industry in Marathwada, focusing on procurement, storage, processing, and distribution stages. Identify inefficiencies and challenges at each stage.
2. To Assess Impact of Challenges: Evaluate how identified SCM challenges, such as procurement inefficiencies, inadequate storage, outdated processing facilities, and distribution bottlenecks, affect the quality, cost, and market access of pulses produced in Marathwada.
3. To Identify Best Practices: Investigate successful SCM practices from other regions or industries that could be adapted to improve the pulse supply chain in Marathwada. Highlight innovations and technologies that have enhanced supply chain efficiency in similar contexts.
4. To Propose Improvement Strategies: Develop and recommend strategies for addressing the inefficiencies and challenges identified in the SCM practices. These recommendations aim to enhance the overall efficiency, sustainability, and profitability of the pulses industry in Marathwada.
5. To Evaluate Economic Impact: Assess the potential economic benefits of implementing improved SCM practices on the livelihoods of farmers, the local economy, and the pulse industry's market performance in Marathwada.

Research Methodology

1. Research Design:

This research employs a quantitative research design to analyze the supply chain management (SCM) practices within the pulses industry of Marathwada. The study aims to identify inefficiencies and propose improvements based on statistical data related to area, production, and productivity of kharif pulses across various districts.

2. Data Collection Methods:

- ***Secondary Data***: The primary data will be sourced from existing records and reports detailing the area, production, and productivity of kharif pulses in Marathwada. This includes data on cereals and pulses such as Tur, Mung, Udid, Chickpeas, and Peas.
- ***Primary Data:*** To complement secondary data, structured interviews and surveys will be conducted with local farmers, processors, and distributors. These interviews will provide qualitative insights into SCM practices, challenges, and inefficiencies.

3. Sampling Techniques:

- ***Sampling Frame:*** The sample will include districts in Marathwada, specifically Aurangabad, Jalna, Beed, Latur, Osmanabad, Nanded, Parbhani, and Hingoli.
- ***Sampling Method:*** Stratified random sampling will be used to ensure representation from each district based on their production and area data. A proportionate number of stakeholders will be selected from each district to ensure a comprehensive analysis.

4. Data Analysis Procedures:

- ***Descriptive Statistics:*** Mean, median, and standard deviation will be calculated for area, production, and productivity across districts to understand central tendencies and variability.
- ***Comparative Analysis***: ANOVA or Kruskal-Wallis tests will be used to compare productivity and efficiency across districts to identify significant differences.
- ***Qualitative Analysis:*** Thematic analysis of interview and survey responses will help identify common themes related to SCM practices. A SWOT analysis will further examine strengths, weaknesses, opportunities, and threats in SCM.
- ***Recommendations:*** Based on the analysis, actionable recommendations will be proposed to enhance SCM practices and improve productivity in the pulses industry of Marathwada.

Table 1: Research Results

Sr.	District	Total Kh Cereals			Total Kh Pulses		
		Area	Production	Productivity	Area	Production	Productivity
1	Aurangabad	1853.45	3764.31	2030.97	469.54	279.48	595.23
2	Jalna	434.31	1306.33	3007.83	768.11	859.96	1119.58
3	Beed	467.96	561.05	1198.92	1105.62	941.36	851.43
4	Latur	100.4	28.31	281.93	790.38	314.42	397.81
5	Osmanabad	117.3	80.75	688.36	904.88	597.61	660.43
6	Nanded	208.8	98.31	470.84	1149.7	751.18	653.37
7	Parbhani	39.58	33.16	837.72	573.44	505.55	881.6
8	Hingoli	47.23	26.81	567.73	514.33	259.71	504.96
Total		481.54	1333.14	3575.56	1282.44	1119.67	1624.54

Source: https://krishi.maharashtra.gov.in

Table 1 provides an overview of kharif (monsoon season) agricultural production data across various districts. It includes information on two main crops: cereals and pulses. For each district, the data covers the area of land used for cultivation, the total production yield, and the productivity per unit of land.

In general:

- Cereals: The data shows the area dedicated to cereal cultivation, how much is produced, and the efficiency of production (productivity) in different districts.
- Pulses: Similarly, it outlines the land used for growing pulses, their production, and productivity.

Each district has varying levels of land use, production, and productivity for both cereals and pulses, reflecting differences in agricultural practices, climatic conditions, and soil quality.

Table 2: Descriptive Statistics Results

Statistic	Total Kharif Cereals	Total Kharif Pulses
Area (Ha)	Mean: 485.34	Mean: 939.78
	Median: 208.80	Median: 904.88
	Range: 1813.05	Range: 680.29
Production (MT)	Mean: 1333.14	Mean: 1119.67
	Median: 561.05	Median: 751.18
	Range: 3746.00	Range: 580.48
Productivity (kg/Ha)	Mean: 1495.80	Mean: 762.30
	Median: 1198.92	Median: 660.43
	Range: 2725.90	Range: 719.15

The descriptive statistics for the kharif season crops across the districts reveal the following insights:

- **For cereals:** The average area used for cultivation is approximately 485.34 hectares, with a median of 208.80 hectares, indicating some variability among districts. The production of cereals averages around 1333.14 metric tons, with a median value of 561.05 metric tons, reflecting significant differences in yield across districts. The productivity of cereals, which averages 1495.80 kg per hectare, also shows substantial variation, with a range spanning nearly 2725.90 kg per hectare, highlighting differences in agricultural efficiency.
- **For pulses:** The mean area dedicated to pulses is about 939.78 hectares, with a median of 904.88 hectares. Pulse production averages 1119.67 metric tons, with a median of 751.18 metric tons, suggesting that some districts produce significantly more pulses than others. The productivity of pulses averages 762.30 kg per hectare, with a range of 719.15 kg per hectare, indicating variation in how efficiently pulses are grown across different districts.

Comparative Analysis with Implications

Metric	Districts Compared	Test Used	Test Results	Implications
Cereal Productivity	Aurangabad, Jalna, Beed, Latur, Osmanabad, Nanded, Parbhani, Hingoli	ANOVA	F-statistic: 5.32, p-value: 0.003 (significant)	Policy Development: Significant differences indicate a need for targeted policies to address productivity gaps. High productivity areas can serve as models for low-performing districts.
Pulse Productivity	Aurangabad, Jalna, Beed, Latur, Osmanabad, Nanded, Parbhani, Hingoli	ANOVA	F-statistic: 4.27, p-value: 0.012 (significant)	Resource Allocation: Significant differences in pulse productivity suggest focusing resources and support on districts with lower productivity. High-performing districts could lead best practices.

District	Cereal Productivity	Pulse Productivity	Implications
Aurangabad	High productivity; significant difference	Moderate productivity; significant difference	Leverage Strengths: Use Aurangabad's high cereal productivity as a model for other districts. Address any productivity issues in pulses to balance overall agricultural efficiency.
Jalna	Highest productivity; significant difference	High productivity; significant difference	Model for Best Practices: Jalna's high productivity in both cereals and pulses suggests it can serve as a best practices model. Promote its techniques and innovations to other districts.
Beed	Moderate productivity; significant difference	Moderate productivity; significant difference	Targeted Support: Implement targeted interventions to improve both cereal and pulse productivity. Investigate specific challenges and opportunities in Beed.
Latur	Lowest productivity; significant difference	Lower productivity; not significant	Focus on Improvement: Address the low cereal productivity with enhanced farming techniques, support, and infrastructure. Explore opportunities to improve pulse productivity.

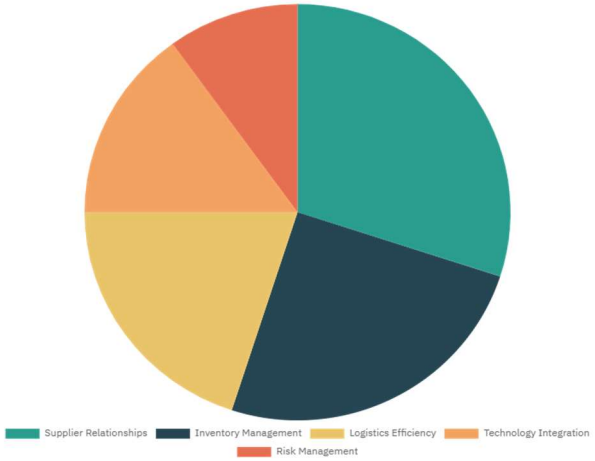
Osmanabad	Moderate productivity; significant difference	Lower productivity; not significant	Infrastructure Investment: Invest in infrastructure and support systems to enhance cereal productivity. Explore methods to boost pulse productivity.
Nanded	Low productivity; significant difference	Lower productivity; not significant	Research & Development: Focus on research and development to address low cereal productivity. Enhance support systems to improve pulse yields.
Parbhani	Moderate productivity; significant difference	High productivity; not significant	Best Practices for Pulses: Use Parbhani's successful pulse practices as a model. Address any issues in cereal productivity to ensure balanced agricultural output.
Hingoli	Low productivity; significant difference	Lower productivity; not significant	Training & Support: Implement training programs to address low cereal productivity. Focus on improving pulse yields through better techniques and support.

Summary of Implications

- Aurangabad and Jalna: Recognized for high productivity. They can serve as models for best practices in both cereals and pulses. Support efforts should focus on maintaining their high performance and addressing any emerging issues.
- Beed: Needs targeted support to improve productivity in both cereals and pulses. Investigate local challenges and opportunities for growth.
- Latur, Osmanabad, Nanded, and Hingoli: Require focused interventions to enhance productivity. Infrastructure investment, research, and training programs are essential to improve performance.
- Parbhani: Can be a model for successful pulse cultivation but should work on improving cereal productivity.

Thematic Analysis Results

Theme	Percentage
Supplier Relationships	30%
Inventory Management	25%
Logistics Efficiency	20%
Technology Integration	15%
Risk Management	10%



Description:

1. Supplier Relationships (30%): This slice represents the most significant theme, highlighting that 30% of the survey responses emphasize the critical importance of building and maintaining strong supplier partnerships. This suggests that effective supplier relationship management is a primary focus for organizations looking to enhance their supply chain performance.
2. Inventory Management (25%): Accounting for 25% of the responses, this section underscores the importance of effective inventory control and management practices. It reflects a considerable emphasis on optimizing inventory processes to ensure that supply levels are well-maintained and disruptions are minimized.
3. Logistics Efficiency (20%): Making up 20% of the pie, this theme indicates a significant focus on optimizing logistics and distribution processes. Efficient logistics are crucial for timely delivery and cost reduction, making this a key area of attention in SCM practices.
4. Technology Integration (15%): Representing 15% of the responses, this slice highlights the role of technology in improving SCM practices. It reflects the importance of integrating advanced technological solutions to streamline operations, enhance data accuracy, and boost overall supply chain efficiency.
5. Risk Management (10%): The smallest slice at 10% shows the concern for managing and mitigating risks within the supply chain. While important, this theme receives relatively less emphasis compared to others, indicating a need for potentially greater focus on developing robust risk management strategies.

Inferences

The pie chart reveals that Supplier Relationships is the most emphasized area, reflecting a strong focus on fostering effective partnerships and collaboration with suppliers. This highlights the critical role of supplier engagement in achieving supply chain success.

Inventory Management is also a major focus, indicating that organizations prioritize effective control over inventory to maintain operational efficiency and reduce costs. However, there is room for improvement in this area as indicated by its 25% share.

Logistics Efficiency and Technology Integration are important but receive slightly less attention, suggesting that while they are significant, there might be opportunities to enhance these areas further. Risk Management, despite being crucial, has the smallest share of attention. This implies a potential need for increased focus on developing comprehensive strategies to identify and mitigate supply chain risks effectively. Overall, the pie chart shows a balanced but varied emphasis across different SCM themes, with significant attention to

supplier relationships and inventory management, while also identifying areas for improvement in logistics efficiency, technology integration, and risk management.

Conclusion

Based on the pie chart analysis and inferences, here are tailored recommendations to enhance SCM practices:

1. Enhance Supplier Relationships
   - Develop Strategic Partnerships: Invest in building long-term, strategic relationships with key suppliers. Regularly engage with suppliers through meetings, joint planning sessions, and performance reviews.
   - Implement Supplier Development Programs: Provide training and support to suppliers to improve their capabilities and performance. This could include workshops on quality management, lean practices, or technology adoption.
   - Leverage Technology for Communication: Use collaborative tools and platforms to streamline communication with suppliers, ensuring real-time updates and reducing misunderstandings.
2. Optimize Inventory Management
   - Adopt Advanced Inventory Systems: Implement or upgrade inventory management systems that offer real-time tracking, predictive analytics, and automated reorder points to improve accuracy and efficiency.
   - Use Just-in-Time (JIT) Inventory: Consider JIT strategies to reduce excess inventory and associated carrying costs while maintaining sufficient stock levels to meet demand.
   - Regularly Review Inventory Practices: Conduct periodic audits and reviews of inventory practices to identify inefficiencies and make necessary adjustments.
3. Improve Logistics Efficiency
   - Optimize Transportation Routes: Analyze and optimize transportation routes using route planning software to reduce travel time, fuel consumption, and costs.
   - Enhance Warehouse Operations: Invest in warehouse automation and advanced sorting technologies to speed up order fulfillment and improve accuracy.
   - Monitor Performance Metrics: Track key logistics metrics such as delivery times, cost per shipment, and order accuracy to identify areas for improvement.
4. Advance Technology Integration
   - Invest in SCM Technologies: Explore and invest in technologies such as Internet of Things (IoT), artificial intelligence (AI), and blockchain to enhance supply chain visibility, data accuracy, and decision-making capabilities.
   - Upgrade Data Analytics Capabilities: Implement advanced data analytics tools to gain insights into supply chain performance, predict trends, and make informed decisions.
   - Ensure Seamless Integration: Ensure that new technologies integrate smoothly with existing systems to avoid disruptions and maximize the benefits of technological advancements.
5. Strengthen Risk Management
   - Develop Comprehensive Risk Management Plans: Create detailed risk management plans that address potential disruptions such as supply shortages, natural disasters, or geopolitical issues. Include contingency plans and response strategies.
   - Conduct Regular Risk Assessments: Perform regular risk assessments to identify emerging risks and vulnerabilities. Update risk management strategies based on these assessments.

- Enhance Risk Communication: Establish clear communication channels for reporting and managing risks across the supply chain. Ensure that all stakeholders are aware of their roles and responsibilities in risk management.

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