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Study on supply chain efficiency of garlic in Ratlam district of Madhya Pradesh

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Abstract

The present study entitled “Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh” was undertaken to analyze the structure, performance, and efficiency of the garlic supply chain in the study area. The study focuses on socio-economic characteristics of garlic growers, existing marketing channels, marketing costs, price spread, marketing efficiency, and constraints faced by farmers and other supply chain participants. The research was based on both primary and secondary data. Primary data were collected from garlic growers and key market intermediaries such as traders, commission agents, wholesalers, retailers, and processors, while secondary data were obtained from published reports, government records, and relevant literature. A multistage sampling design was adopted for selecting respondents, and data were analyzed using statistical tools such as averages, percentages, ratios, and chi-square tests. The findings of the study reveal that most garlic growers belong to small and marginal farm categories and fall within the middle-age group, with a reasonable level of education. Agriculture is the primary occupation, although many households also engage in allied activities for income diversification. Three major marketing channels were identified: Producer → Consumer, Producer → Retailer → Consumer, and Producer → Wholesaler → Retailer → Consumer. Among these, the direct channel was found to be the most efficient due to lower marketing costs, higher producer's share in the consumer's rupee, and better price realization, whereas longer channels showed higher price spread and reduced efficiency due to multiple intermediaries. The study further highlights that marketing costs increase with the number of intermediaries involved in the supply chain. Major constraints faced by farmers include price fluctuations, inadequate storage facilities, high transportation costs, lack of market information, and dependence on middlemen, leading to post-harvest losses and reduced profitability. The study concludes that improving storage infrastructure, strengthening transportation facilities, promoting direct marketing, enhancing market information systems, and encouraging Farmer Producer Organizations (FPOs) and value addition can significantly improve supply chain efficiency and increase farmers' income in Ratlam district.

Keywords: Garlic, supply chain efficiency, marketing channels, price spread, marketing cost, farmer income, Ratlam district, Madhya Pradesh, post-harvest losses, FPOs.

Introduction

Garlic is one of the most important commercial spice and condiment crops cultivated in India and has gained significant importance due to its culinary, medicinal, and economic value. It is widely used in households, food processing industries, pharmaceuticals, and traditional medicine because of its characteristic flavor, aroma, and health-promoting properties. Garlic is rich in sulfur compounds, vitamins, minerals, and antioxidants that contribute to its increasing demand in domestic and international markets. In recent years, garlic cultivation has emerged as a profitable agricultural enterprise, providing employment opportunities and income generation for farmers, traders, processors, and other stakeholders involved in the agricultural value chain. India is one of the leading

producers of garlic in the world, with major production concentrated in states such as Madhya Pradesh, Rajasthan, Gujarat, Uttar Pradesh, and Maharashtra. Besides fresh consumption, garlic is processed into garlic powder, paste, flakes, oil, and other value-added products, creating extensive market opportunities. However, due to fluctuations in production, storage limitations, and market uncertainties, an efficient supply chain is essential to ensure timely movement of produce, maintain quality, reduce losses, and enhance profitability. In Madhya Pradesh, garlic cultivation occupies a prominent position in the agricultural economy, and the state is recognized as one of the largest garlic-producing regions in the country. Ratlam district, in particular, is well known for its substantial garlic production and active participation in garlic trade and marketing. The

district possesses favorable agro-climatic conditions, fertile soils, and a well-established network of farmers, traders, commission agents, and wholesale markets, making it an important hub for garlic cultivation and distribution. A large quantity of garlic produced in Ratlam is supplied to local markets as well as to major consumption centers within and outside the state. The district also contributes significantly to garlic exports through various market channels. Despite its production potential and market significance, the garlic supply chain faces several challenges, including inadequate storage facilities, high transportation costs, market price fluctuations, post-harvest losses, information asymmetry, and the involvement of multiple intermediaries. These constraints affect the efficiency of the supply chain and reduce the share of farmers in the consumer's rupee. The supply chain of garlic involves a series of interconnected activities ranging from production, harvesting, grading, sorting, packaging, storage, transportation, and marketing to final consumption. Since garlic is often stored for extended periods to take advantage of favorable market prices, efficient storage and inventory management play a crucial role in maintaining product quality and minimizing losses. The supply chain generally consists of farmers, village traders, commission agents, wholesalers, processors, retailers, exporters, and consumers. Garlic is usually packed in gunny bags, mesh bags, or cartons and transported through road networks to wholesale markets, processing units, and retail outlets. The effectiveness of coordination among different stakeholders directly influences the overall performance of the supply chain. Therefore, understanding the structure and functioning of the garlic supply chain is essential for identifying inefficiencies and improving operational performance. The present study entitled "Study on Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh" aims to analyze the existing supply chain system of garlic and assess the efficiency of various supply chain components operating in the study area. The study also examines the socio-economic characteristics of garlic growers, such as age, education, farming experience, landholding size, production level, access to storage facilities, market orientation, and annual income, which influence supply chain participation and decision-making. These factors play an important role in determining the adoption of improved post-harvest practices, access to market information, bargaining power, and overall supply chain performance. The study further investigates the various supply chain channels, movement of produce, transaction costs, value addition, stakeholder margins, and operational efficiency associated with garlic marketing in Ratlam district. It highlights major issues such as inadequate warehousing facilities, lack of scientific storage practices, transportation constraints, price volatility, delayed market information, quality deterioration during storage, and dependence on intermediaries. The study also evaluates the role of farmers, traders, commission agents, wholesalers, retailers, processors, and exporters in ensuring the smooth flow of garlic from producers to consumers. By analyzing these aspects, the study seeks to identify bottlenecks in the existing supply chain and suggest appropriate measures to improve supply chain efficiency, reduce post-harvest losses, strengthen market integration, enhance farmers' income, increase value addition, and promote the sustainable development of garlic cultivation and marketing in Ratlam

district of Madhya Pradesh.

Objectives

1. To Study the Socio-Economic profit of Respondents in the study area.
2. To identify existing supply chain of Garlic a study area.

Research Methodology

Sampling Design

For the present study titled "Study on Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh", a multistage sampling design was adopted. Ratlam district was selected purposively due to its importance in garlic production and trade. Selected blocks and villages were chosen based on garlic cultivation and marketing activities. Finally, garlic growers and key supply chain stakeholders such as traders, commission agents, wholesalers, retailers, and processors were selected as respondents. The sampling design was used to collect representative data for analyzing supply chain efficiency, costs, margins, value addition, and constraints in the garlic supply chain.

Selection of District

The study was conducted in Ratlam District, purposively selected because it is a major hub for garlic production and marketing in Madhya Pradesh. The district has well-established wholesale and local markets, active trading centers, and an organized supply chain connecting garlic producers with consumers across regional and urban markets.

Selection of Blocks

Five blocks were purposively selected based on their high area under garlic cultivation and active participation in garlic marketing activities. These included Ratlam, Jaora, Alot, Sailana, and Banswara blocks, which represent major garlic-producing areas with varying scales of production, market linkages, and marketing practices, making them suitable for studying the supply chain efficiency of garlic in the district.

Selection of Villages

From the selected blocks, villages were randomly chosen based on the area under garlic cultivation and active market participation. A total of 10 representative villages were included in the study, and 50 garlic farmers were randomly selected for detailed investigation. The selected respondents provided information on garlic production, marketing channels, marketing costs, price spread, and various aspects of supply chain efficiency.

Selection of Respondents/Farmers

A list of all garlic growers in the selected villages was obtained from the District Agriculture Office, Ratlam. Farmers were selected randomly and categorized by landholding:

Type of Farmers	Area under Garlic (Hectares)
Marginal Farmers	<1 ha
Small Farmers	1–2 ha
Semi-Medium	2–4 ha
Medium	4–10 ha
Large	>10 ha

This categorization allows analysis of differences in production, marketing practices, cost, and profitability among various farmer types.

Analysis of data/ analytical tools used

The present study titled “Study on Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh” was based on both primary and secondary data. The primary data were collected from garlic growers, traders, commission agents, wholesalers, retailers, processors, and other stakeholders involved in the garlic supply chain, while secondary data were obtained from published reports, government records, research journals, and relevant literature.

The collected data were compiled, tabulated, and analyzed using suitable statistical tools such as averages, percentages, and ratios. For examining the efficiency of the garlic supply chain, indicators such as supply chain channels, marketing costs, transportation facilities, storage infrastructure, stakeholder margins, value addition, price spread, and constraints faced by supply chain participants were used to assess the overall performance of the garlic supply chain in the study area.

Analytical techniques employed

$$\text{Arithmetic Mean} = AM = \frac{1}{n} \sum_{i=1}^n a_i$$

Where,

AM = Arithmetic Mean

n = Number of values

a_i = Data set values

$$\text{Weighted Mean} = W = \frac{\sum_{i=1}^n w_i X_i}{\sum_{i=1}^n w_i}$$

Where,

W = Weighted average

n = number of terms to be averaged

w_i = Weight applied to x values

X_i = Data values to be averaged

• Chi-Square Test

The Chi-Square Test as a goodness of fit has been used to analyze the magnitude of difference in opinion of respondents between observed outcome and the expected outcome under the assumption that it is equally distributed on a 5-point scale.

$$\text{Formula used: } \chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where,

χ^2 = chi square

O_i = Observed value

E_i = Expected value

• Tabular Presentation

Mapping of different marketing channels
(Producer → Retailer → Consumer,

Producer → Wholesaler → Retailer → Consumer, etc.).

Descriptive Analysis

Frequency and percentage of producers using each channel.

Results and Discussion

The socio-economic characteristics of garlic growers influence production decisions, post-harvest management practices, supply chain participation, and income generation. Factors such as age, education, family size, farming experience, landholding size, and investment capacity affect garlic cultivation, storage, and marketing behavior.

Therefore, the present study on “Study on Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh” examined the socio-economic profile of respondents to understand their role in garlic production and their participation in various stages of the supply chain in the study area.

Socio-Economic Profile of Garlic Growers Family Composition and Educational Status of Respondents

Particulars	Percentage
Male Members	46.0
Female Members	35.0
Children	19.0
Total	100.0

Education Level	Percentage
Illiterate	8.3
Primary	23.3
Secondary	41.7
College	26.7
Total	100.0

The average family size of garlic growers was moderate, with male members accounting for the highest share of the household workforce. Most respondents had secondary or higher education, which helped them adopt improved cultivation, storage, and marketing practices.

Age and Occupational Pattern of Respondents

Age Group (Years)	Percentage
10–30	15.0
31–50	60.0
Above 50	25.0
Total	100.0

Occupation	Percentage
Agriculture Only	43.3
Agriculture + Dairy	23.3
Agriculture + Business	20.0
Agriculture + Service	13.4
Total	100.0

Most garlic growers belonged to the middle-age group (31–50 years), indicating adequate farming experience and active participation in production and marketing activities. Agriculture was the primary occupation, while many farmers supplemented their income through dairy, business, or service activities.

Farm Size Distribution and Marketing Channels

Farm Category	Percentage of Farmers	Average Area under Garlic (ha)
Marginal	28.0	0.6
Small	34.0	1.2
Semi-Medium	20.0	2.0
Medium	12.0	4.0
Large	6.0	8.0
Overall Average	100.0	2.6

Marketing Channel	Description
Channel I	Producer → Consumer
Channel II	Producer → Retailer → Consumer
Channel III	Producer → Wholesaler → Retailer → Consumer

Marginal and small farmers constituted the majority of garlic growers in the study area. Among the marketing channels, Channel II was the most commonly used due to easy access to local retailers, while Channel I provided higher returns and Channel III was preferred for bulk marketing and distant markets.

Conclusion

The present study on “Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh” analyzed the socio-economic profile of farmers, existing supply chain channels, marketing costs, price spread, efficiency, and major constraints in garlic marketing. Results showed that most growers were small and marginal farmers in the middle-age group with moderate education and adequate family labor support. Three main marketing channels were identified, where the direct channel was most efficient but least used due to limited market access, while longer channels increased costs, intermediaries, and reduced farmer returns. Major constraints included price fluctuations, high transportation costs, lack of storage facilities, dependence on middlemen, and poor market information, leading to distress sales and post-harvest losses. The study concludes that improving infrastructure, strengthening storage and transport systems, promoting direct marketing, supporting FPOs, enhancing market information systems, and encouraging value addition and processing are essential policy measures to improve supply chain efficiency, reduce losses, and increase farmers’ income in Ratlam district.

Summary

The study on “Supply Chain Efficiency of Garlic in Ratlam District of Madhya Pradesh” revealed that most garlic growers are small and marginal farmers with moderate education and sufficient family labor support. Three main supply chain channels were identified, among which the direct channel (Producer → Consumer) was the most efficient due to the lowest marketing cost, highest producer’s share, and better returns, while channels involving more intermediaries showed higher price spread and lower efficiency. Major constraints faced by farmers included price fluctuations, high transportation costs, lack of storage facilities, dependence on middlemen, and inadequate market information. The study concludes that improving storage and transport infrastructure, strengthening market linkages, promoting direct marketing,

and encouraging Farmer Producer Organizations (FPOs) can significantly enhance supply chain efficiency and increase farmers’ income in Ratlam district.

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