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Supply Chain Efficiency and Marketing Channel Analysis of Wheat in Prayagraj District of Uttar Pradesh: An Empirical Investigation

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ABSTRACT

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Wheat is a pivotal staple crop in Prayagraj district, Uttar Pradesh, yet structural inefficiencies in its marketing system persistently erode producer profitability and constrain supply chain performance. This study examines the prevailing wheat marketing channels in the Pratappur block of Prayagraj district, quantifies the associated marketing costs, margins, price spreads, and efficiency indices, and identifies the primary constraints faced by producers. A multi-stage purposive-cum-random sampling technique was adopted to select 120 wheat cultivators and 10 market intermediaries. Primary data were collected via structured personal interview schedules. Analytical tools employed include descriptive statistics, marketing cost-margin analysis, Acharya's Modified Measure of Marketing Efficiency, and Garrett's Ranking Technique. Two marketing channels were identified. Channel I (Producer → Retailer → Consumer) demonstrated significantly superior efficiency (index: 11.19) and secured 91.80% of the consumer's rupee for the producer, compared to Channel II (Producer → Wholesaler → Retailer → Consumer), which yielded an efficiency index of only 5.02 and a producer's share of 83.39%. Despite this, 62.50% of farmers relied on Channel II. Frequent price fluctuations, high transportation costs, and a lack of farm-level market information were the leading constraints, as determined by Garrett's Ranking. The study recommends establishing village-level procurement centres, subsidizing transportation, promoting Farmer Producer Organizations (FPOs), and integrating digital market platforms (e-NAM) to enhance efficiency and producer welfare.

Introduction

Establishing the Territory

Wheat (*Triticum aestivum* L.) constitutes one of the most strategically important cereal crops in the global food security architecture, serving as the primary dietary

staple for an estimated 2.5 billion people worldwide (FAO, 2024). At the macroeconomic level, global wheat production reached approximately 789.7 million metric tons (MMT) during the 2023/24 marketing year, with China, India, and Russia collectively commanding nearly 43 percent of total world output (USDA, 2024). Within the Indian subcontinent, wheat occupies a position of

paramount importance as the second most cultivated cereal crop after rice. In the agricultural year 2023-24, India produced approximately 113.29 million tonnes of wheat across an area of 318.3 lakh hectares, reflecting a compound annual growth rate (CAGR) of 1.64% over the preceding decade (Ministry of Agriculture and Farmers Welfare, 2024). Uttar Pradesh (U.P.) emerges as the undisputed apex of India's wheat economy, contributing approximately 35.65 million tonnes in 2024-25 alone — the largest output of any single state — driven by the fertile alluvial plains of the Indo-Gangetic basin (Directorate of Economics and Statistics, 2025).

In the past two decades, considerable scholarly attention has been devoted to the structural inefficiencies characterizing agricultural marketing systems across Indian agrarian economies (Gandhi, 2006; Acharya & Agarwal, 2001). A well-established body of literature documents that the producer's realized share of the consumer's rupee is systematically eroded by the presence of multiple tiers of intermediaries — including village traders, commission agents (Arhatiyas), wholesalers, and retailers — each extracting disproportionate margins at successive nodes of the supply chain (Bhargava, 2024; Kumar *et al.*, 2023). Pioneering methodological contributions by Acharya and Agarwal (2001) and Gandhi (2006) established the foundational framework for quantifying marketing efficiency, margin analysis, and price spread within the context of Indian commodity markets.

Establishing the Niche

Despite the substantial volume of research on wheat marketing at the state and national levels, significant lacunae persist at the granular, district-level scale within the agro-economically distinctive eastern belt of Uttar Pradesh. It remains empirically unclear how the specific socio-economic profile of predominantly smallholder and marginal farming households in districts such as Prayagraj mediates their channel-choice behaviour and, consequently, their realized marketing efficiency. While several studies have analysed price spreads in western U.P. districts like Hardoi (Bhargava, 2024) and Kanpur Dehat (Singh *et al.*, 2017), the Pratappur block of Prayagraj district — representing a critical agricultural micro-zone with a heterogeneous farming demography has not been subject to rigorous contemporary empirical investigation. Furthermore, the quantification of marketing constraints through robust ranking methodologies such as Garrett's Technique remains

limited for this specific geographic context.

Occupying the Niche

The purpose of this study was to conduct a comprehensive empirical investigation into the wheat supply chain and marketing system operating within the Pratappur block of Prayagraj district, Uttar Pradesh. Specifically, the study aimed to: (i) assess the socio-economic profile of the respondent farming community; (ii) identify and map the prevailing marketing channels; (iii) rigorously quantify the associated marketing costs, marketing margins, price spreads, and efficiency indices for each channel; and (iv) systematically identify and rank the key constraints confronting wheat producers in accessing efficient markets. The findings are intended to provide an evidence-based foundation for policy interventions targeting supply chain optimization and producer welfare enhancement in the region.

The academic literature on agricultural marketing channels and supply chain efficiency in India converges on several well-established theoretical propositions. Acharya and Agarwal (2001), in their seminal treatise on Agricultural Marketing in India, formulated the Modified Measure of Marketing Efficiency — a ratio of the net price received by the farmer to the total of marketing costs and intermediary margins — which has since become the universally adopted benchmark for channel performance evaluation. Their foundational work established that the direct producer-to-consumer channel is invariably the most efficient, as it eliminates structural frictions introduced by redundant intermediaries.

Gandhi (2006) provided a comprehensive national-level analysis of wheat marketing systems, demonstrating that established intermediaries rarely provide value-commensurate services in proportion to the margins they extract, characterizing the traditional marketing framework as functionally exploitative rather than facilitative. This critique established the intellectual impetus for a generation of micro-level studies across Indian agricultural districts.

At the district level, Kumar, Bhargava, and Singh *et al.*, (2023) conducted an exhaustive economic analysis of wheat marketing in Hardoi district, revealing that the producer's share in the consumer's rupee was 98.63% in the direct channel, precipitously declining to 73.78% in the extended wholesale channel. This stark divergence underscored the exploitative premium extracted by

intermediary layers. Corroborating evidence was furnished by [Bhargava \(2024\)](#), who documented that marketing costs in the wholesale channel (Rs. 73.78/quintal) were nearly four times those of the direct channel (Rs. 20.00/quintal) in the same geographical context.

Studies focusing on Eastern Uttar Pradesh present a particularly salient contextual backdrop. [Yadav, Kushwaha, Maurya, and Yadav \(2020\)](#) documented in Azamgarh district that 57.62% of total marketed surplus was channelled through village-trader-mediated pathways, primarily due to the logistical constraints of marginal and small-scale producers unable to independently transport low volumes to distant regulated markets. Similarly, [Laishram *et al.*, \(2022\)](#), in a study contextually adjacent to the present investigation within Prayagraj district itself, demonstrated that systemic intermediary involvement significantly diminished farmer economic agency while inflating consumer prices.

[Ram Tirath *et al.*, \(2022\)](#) furnished analogous evidence from Sultanpur district, arguing that the lack of institutional procurement mechanisms structurally predisposes cultivators to price exploitation.

The literature on marketing constraints consistently employs Garrett's Ranking Technique to elicit farmer perceptions. [Verma *et al.*, \(2023\)](#) identified low selling price (Garrett score: 75.90) as the paramount constraint in Eastern U.P., while [Kumar *et al.*, \(2022\)](#) found price fluctuations and middlemen involvement to be the foremost impediments in a Prayagraj-specific study, yielding a maximum score of 71.22. [Raj Singh, Supriya, Omar, and Tripathi \(2025\)](#) and [Devegowda, Kushwaha, and Badal \(2021\)](#) further corroborated the role of transportation bottlenecks and the absence of scientific storage infrastructure as primary drivers of distress sales and suppressed farmgate prices across Eastern U.P.

Collectively, the extant literature firmly establishes the theoretical and empirical framework within which the present study is situated, validating the selection of marketing efficiency analysis and Garrett's Ranking Technique as the primary analytical instruments, while confirming the critical need for granular, block-level empirical data from the Prayagraj district.

Material and Methods

Study Area and Sampling Design

The data used for this study were collected from the

Pratapapur block of Prayagraj district, Uttar Pradesh, India - a geographically representative wheat-producing zone situated approximately 39 to 53 km from the district headquarters. The district is characterized by fertile alluvial soils irrigated by the Ganga-Yamuna River system, with a population of 5,954,391 distributed across 3,178 villages. A multi-stage, purposive-cum-random sampling design was adopted. At Stage I, Prayagraj district was selected purposively based on its maximum area under wheat cultivation. At Stage II, Pratappur block was purposively selected for its agronomic suitability.

At Stage III, 12 villages were randomly selected from the 150 villages in the block, representing 5% of the total, arranged in descending order of wheat cultivation area. At Stage IV, 10% of the total wheat cultivators from each selected village were randomly drawn, stratified into five farm-size categories — Marginal (< 1 ha), Small (1–2 ha), Semi-medium (2–4 ha), Medium (4–10 ha), and Large (> 10 ha) — yielding a primary sample of 120 wheat cultivators. Additionally, 10 market intermediaries (wholesalers, retailers, village traders, and commission agents) were randomly selected from primary (Pratapapur Haat) and secondary (Mundera Mandi) markets, bringing the total sample size to 130.

Data Collection

Primary data were collected through structured personal interview schedules administered during multiple field visits to respondent households and market yards between October 2024 and March 2025. Secondary data were sourced from block development offices, district agricultural offices, the Ministry of Agriculture and Farmers Welfare (GoI), USDA-FAS, FAO, and peer-reviewed academic journals. The interview schedule captured socio-economic indicators (educational level, family size, farm size, age, occupation, irrigation source) and economic data pertaining to input costs, transportation charges, market fees, selling prices, and purchase prices at each node of the marketing channel.

Analytical Framework

Marketing Efficiency (Acharya's Method): $E = (\text{Net Price Received by Producer}) / (\text{Total Marketing Costs} + \text{Total Intermediary Margins})$. A higher index denotes a more efficient channel.

Price Spread: $PS = \text{Consumer Price} - \text{Net Price Received by Producer}$ (expressed in Rs. /Quintal and as a

percentage of consumer price).

Producer's Share in Consumer's Rupee: $PS\% = (PF / Pr) \times 100$, where PF = farmgate price; Pr = retail price.

Garrett's Ranking Technique: Used to rank farmer-perceived marketing constraints. Percent position = $100(R_{ij} - 0.5) / N_j$, converted to Garrett scores via standard conversion table, then averaged to establish a cardinal ranking.

Results and Discussion

Socio-Economic Profile of Respondents

The socio-economic characterization of the 120 respondent wheat farmers revealed a farming community typified by moderate educational attainment, medium-to-large family structures, fragmented landholdings, middle-aged demographics, and near-total agricultural dependence with predominantly groundwater-based irrigation.

Marketing Channel Identification and Utilization

Field investigation identified two primary marketing channels for wheat disposal in the study area:

Channel I (Direct): Producer → Retailer → Consumer

Channel II (Extended): Producer → Village Merchant/Wholesaler → Retailer → Consumer

Despite the documented economic advantages of Channel I, a majority of respondents (62.50%, n=75) utilized Channel II, while only 37.50% (n=45) employed Channel I. The predominant reliance on Channel II was attributed to immediate liquidity constraints, inability to independently transport produce to retail markets, and existing credit-linked obligations to village traders.

Price Spread and Marketing Efficiency

The data in Table 3 reveal a stark divergence in channel performance. Channel I's price spread of Rs. 205/quintal was 53.4% lower than Channel II's Rs. 440/quintal. The Marketing Efficiency index of Channel I (11.19) was

2.23 times higher than that of Channel II (5.02), unequivocally establishing the economic superiority of the direct channel. The producer's realization in Channel I (Rs. 2,295) was Rs. 85 higher per quintal compared to Channel II (Rs. 2,210) — a differential that, when aggregated across a typical marginal farmer's marketable surplus, represents a significant proportional income loss.

Interpretation of Findings

The findings of this study clearly show that the wheat marketing system in the Pratappur block of Prayagraj district is characterized by a fundamental paradox: the channel that offers superior economic returns to producers (Channel I) is systematically under-utilized, while the demonstrably less efficient Channel II commands the allegiance of 62.50% of the farming community. This paradox is not unique to the study area; analogous patterns have been consistently documented across Eastern Uttar Pradesh and other agrarian regions of India (Yadav *et al.*, 2020; Ram Tirath *et al.*, 2022; Gandhi, 2006).

Evaluation and Contextualization

One explanation for the persistent dominance of Channel II lies in the structural vulnerability of marginal and small farmers, who constitute 50% of the study sample. As documented by Yadav *et al.*, (2020) in Azamgarh district, marginal farmers are logistically constrained from independently transporting low volumes of grain to distant regulated markets (mandis), making village merchants the de facto default buyer. The credit and loan dependencies that smallholders maintain with village traders further institutionalize their reliance on Channel II, as documented by Laishram *et al.*, (2022) and Ram Tirath *et al.*, (2022). This creates a structural lock-in that is not purely a function of market information or rational choice, but rather a manifestation of asset poverty and infrastructure deficit. The dominance of "frequent price fluctuation" (Garrett Score: 72.4) as the paramount constraint resonates strongly with Katoch and Singh (2021), who documented significant price instability in Prayagraj markets, characterizing post-harvest price collapses in April as a function of simultaneous glut-market offloading by liquidity-constrained farmers.

Table.1 Socio-Economic Profile of Respondent Wheat Farmers (n=120)

Characteristic	Category	n	%
Education	High School (dominant)	35	29.17%
	Primary School	24	20.00%
	Intermediate	25	20.83%
	Illiterate	21	17.50%
Family Size	5–8 Members (dominant)	65	54.17%
	1–4 Members	30	25.00%
	≥ 9 Members	25	20.83%
Farm Size	Marginal (<1 ha) dominant	36	30.00%
	Small / Semi-med / Med	24 each	20.00% each
	Large (>10 ha)	12	10.00%
Age Group	36–50 yrs (dominant)	52	43.34%
	51–65 yrs	30	25.00%
Occupation	Agriculture Only	65	54.17%
Irrigation	Tube well / Bore well	85	70.83%
	Canal	30	25.00%

Source: Primary Survey Data, Pratappur Block, Prayagraj, 2024–25.

Table.2 Comparative Marketing Cost Analysis (Rs. /Quintal)

Cost Node	Particulars	Ch. I	Ch. II
Producer	Cleaning + Packing + L/U + Transport	55.00	40.00
Wholesaler	L/U + Transport + Commission + Misc.	—	65.00
	Wholesaler Margin	—	135.00
Retailer	L/U + Transport + Shop Rent + Misc.	45.00	50.00
	Retailer Margin	105.00	150.00
TOTALS	Total Marketing Cost	100.00	155.00
	Total Intermediary Margin	105.00	285.00

L/U = Loading and Unloading. Source: Primary Survey Data, 2024–25.

Table.3 Price Spread, Producer Share & Marketing Efficiency (Rs. /Quintal)

Indicator	Channel I	Channel II
Net Price Received by Producer	Rs. 2,295	Rs. 2,210
Consumer Price (Retail)	Rs. 2,500	Rs. 2,650
Price Spread	Rs. 205	Rs. 440
Producer's Share in Consumer's Rupee	91.80%	83.39%
Marketing Efficiency (Acharya's Index)	11.19	5.02

Source: Computed from Primary Survey Data, 2024–25.

Table.4 Constraints in Wheat Marketing - Garrett's Ranking (n=120)

Rank	Constraint	Garrett Score
I	Frequent price fluctuation in open market	72.4
II	High transportation charges	68.5
III	Lack of market information at farm level	65.2
IV	High commission charges by middlemen	61.8
V	Lack of awareness of govt. schemes	58.3
VI	Delay in cash payments by traders	52.1
VII	Weighing loss and grading issues	47.9
VIII	Lack of infrastructure in the mandi	41.4

Source: Computed from Primary Survey Data using Garrett's Ranking Technique, 2024–25.

The second-ranked constraint — high transportation charges — is consistent with [Raj Singh *et al.*, \(2025\)](#), who identified transportation bottlenecks as the foremost operational impediment in the Lucknow district, and with [Kumar *et al.*, \(2022\)](#), whose Prayagraj-specific study similarly elevated transportation and information asymmetry as critical barriers. The third-ranked constraint — lack of farm-level market information (Garrett Score: 65.2) — is particularly consequential, as it inhibits rational price discovery and temporal arbitrage by producers who might otherwise defer sales to capitalize on seasonal price appreciation.

The marketing efficiency differential observed between the two channels (11.19 vs. 5.02 on Acharya's index) is consistent in magnitude with findings from analogous studies. [Kumar *et al.*, \(2023\)](#) documented a comparable 25-percentage-point differential in producer share between direct and wholesale channels in Hardoi district. [Bhargava \(2024\)](#) corroborated this with a four-fold disparity in marketing costs between channels. The convergent evidence across multiple districts of U.P. strongly suggests that the pattern identified in this study is structurally systemic rather than locally idiosyncratic, reflecting the broader pathologies of the traditional intermediary-dominated agricultural marketing architecture in Northern India.

Limitations and Delimitations

This study was limited by several methodological and contextual constraints that warrant acknowledgment. First, the geographical scope was confined to a single block (Pratappur) within one district, and caution must be exercised in extrapolating findings to other agro-ecological zones within Uttar Pradesh. Second, the cross-sectional nature of the data collection (2024-25 season) precludes temporal analysis of price trends and

channel dynamics across multiple agricultural cycles. Third, the marketing cost data were based on recall-based self-reporting by respondents, which may be subject to social desirability and memory recall biases. Fourth, the study did not capture intra-seasonal price variation, which is critical given that price fluctuation was identified as the primary constraint. Future research should employ panel data designs, GIS-based market access mapping, and integration of digital transaction data from e-NAM to develop a more granular and dynamic understanding of the wheat supply chain in this region.

This study provides a rigorous, empirically grounded characterization of the wheat marketing system in the Pratappur block of Prayagraj district, Uttar Pradesh. The investigation conclusively establishes that Channel I (Producer → Retailer → Consumer) is significantly superior to Channel II across all measured parameters of marketing efficiency, price spread, and producer's realization. The Marketing Efficiency index of Channel I (11.19) is more than twice that of Channel II (5.02), and the price spread in Channel II (Rs. 440/quintal) is more than double that of Channel I (Rs. 205/quintal). Despite this, structural vulnerabilities rooted in asset poverty, infrastructure deficit, information asymmetry, and credit dependency lock the majority of farmers (62.50%) into the less efficient extended channel.

Based on the empirical findings, the following policy interventions are recommended:

(i) Village-Level Procurement Infrastructure: Establishing MSP-based procurement centres at the gram panchayat level will eliminate the logistical barriers that prevent marginal farmers from accessing Channel I, directly addressing the structural determinants of channel-choice behaviour.

(ii) Subsidized Cooperative Transport: State government facilitation of FPO-owned or cooperative transport vehicles would substantially reduce the high transportation costs (Rank II constraint) while enabling collective bargaining and bulk marketing.

(iii) Digital Market Intelligence Integration: Mandatory extension of e-NAM connectivity and digital price display boards at the village level would directly mitigate information asymmetry (Rank III constraint) and empower farmers to make temporally rational selling decisions.

(iv) Farmer Producer Organizations (FPOs): Policy-driven formation and capacity building of FPOs would enable smallholder aggregation, transforming the logistical calculus of channel choice by making direct marketing to retailers economically viable for individually sub-threshold producers.

(v) Mandi Regulatory Reform: Strict enforcement of mandi bye-laws to cap commission charges and eliminate unauthorized deductions for weighing and grading would address Ranks IV and VII constraints, improving the net price realization of producers who do engage with the regulated market system.

In summation, the persistent underperformance of the wheat supply chain in the Pratappur block of Prayagraj district is not an agronomic problem but a structural one, rooted in institutional failures, infrastructure deficits, and information asymmetries.

Targeted, evidence-based policy interventions addressing these structural drivers hold the potential to fundamentally reorient the marketing system toward greater equity and efficiency, ensuring that the primary producer captures a larger and more equitable share of the consumer's rupee.

Author Contributions

Prem Yadav: Investigation, formal analysis, writing—original draft. Jayant Zechariah: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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