



RESEARCH ARTICLE

An economic analysis of wheat production and marketing efficiency in Basti District of Eastern Uttar Pradesh

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Abstract

This study attempts to identify the economic viability of wheat production and marketing efficiency in Eastern Uttar Pradesh, with special emphasis on cost structures, profitability and market dynamics across varying farm sizes. Employing a descriptive research design, a multistage stratified random sampling method was used to select 200 farmers from two blocks and five villages of the Basti District. Data was collected through semi-structured interviews, group meetings and focus group discussions, focusing on production costs, marketing efficiency and price spread. The study employs various cost concepts, such as Cost A_1/A_2 , B_1 , B_2 , C_1 , C_2 and C_3 and income measures, such as gross income, net income and benefit-cost ($B : C$) ratio, to evaluate the profitability of wheat cultivation. The total cost of wheat cultivation averaged ₹60778.2/ha, while gross income ranged between ₹93765 and ₹101707, yielding a $B : C$ ratio of 1.59–1.60. Marketing channel analysis indicated that 34.5 % of farmers preferred intermediary-heavy routes, with marketing costs varying from ₹39.25/q to ₹316.75/q depending on the channel. The study concludes that despite relatively favorable $B : C$ ratios, inefficiencies in marketing structures limit farmers' income potential. Consequently, policy measures that advocate direct marketing and minimise intermediation are important for improving economic returns and ensuring fair value distribution throughout the wheat supply chain.

Keywords: cost of cultivation; Eastern Uttar Pradesh; marketing efficiency; profitability; wheat production

Introduction

Wheat is a cornerstone of India's agricultural economy, ranking the second-largest crop behind rice in area and output. In the 2023–24 rabi season, India produced a record wheat output of 113.92 million metric tons, signifying a 2.9 % gain over the previous year, with an expected record output of 115.3 million metric tons in the 2024–25 agricultural year (1). This record production was attained despite a modest decline in the area under cultivation, from 31.40 million hectares to 31.23 million hectares. The average national output also set an all-time high of 3615 kg/ha, reflecting an increase over the previous season's 3521 kg/ha (2). These records are mainly due to favourable climatic conditions, exceptionally prolonged cold spells and the development of more climate-resilient and insect-pest-resistant seed varieties such as DBW-303 and DBW-370 (3). Uttar Pradesh, a major wheat-growing state, contributed considerably to this record, producing almost 34 million metric tons in 2022–23 and yielding an average of 3804 kg/ha. Alongside other major states like Punjab and Haryana, Uttar Pradesh plays a significant role in preserving national food security (4).

The significance of wheat cultivation extends beyond its contribution to food security; it is essential to rural livelihoods and economic stability. Eastern Uttar Pradesh, distinguished by

smallholder farms and varied agro-climatic zones, presents significant opportunities and challenges for wheat production and marketing efficiency (5, 6). The farmer's experience in that region had limitations such as unpredictable market pricing, restricted access to infrastructure and high input costs which impact profitability and marketing dynamics (7). Furthermore, the marketing system for wheat involves multiple intermediaries, leading to price spreads that often damage producers. Addressing these inefficiencies is crucial for raising farmers' income and ensuring equitable distribution of benefits across the supply chain (8, 9).

The economic dynamics of wheat production extend beyond cultivation costs to include post-harvest management and marketing channels. Wheat marketing in Eastern Uttar Pradesh typically involves multiple intermediaries such as village traders, commission agents and wholesalers, leading to significant price spreads and reduced profitability for farmers (10, 11). Efficient marketing strategies enhance farmers' income by minimising transaction costs and improving their share in the consumer's rupee (12). This study addresses important aspects of wheat production and marketing efficiency in Eastern Uttar Pradesh during 2023–24. Using descriptive research design and multistage stratified random sampling techniques, data will be collected from selected farmers

across various villages to analyse production costs, profitability measures and marketing dynamics.

The objectives of this study are to assess the cost structure and profitability measures associated with wheat cultivation in Eastern Uttar Pradesh and to examine the marketing costs, margins and price spreads across different wheat supply chains in order to identify the most effective marketing channels for maximising farmers' economic returns.

Materials and Methods

The study, conducted in Eastern Uttar Pradesh during 2023–24, followed a descriptive research design (13–15). Basti District was purposively selected and a multistage stratified random sampling method was employed to ensure representativeness and reliability. Two blocks, Sadar and Harraiya, were chosen, from which 10 villages (five from each block) were selected. A total of 200 farmers participated in the study. The sample size was determined based on practical feasibility, resource availability and the need to ensure adequate representation of different farm size groups; it is considered sufficient to generate reliable and meaningful statistical inferences for the study area.

Primary data were collected on variables such as cost of production, marketing efficiency, marketing cost and marketing margins based on prevailing wheat market prices. Data collection was carried out during the rabi season of 2023–24 using semi-structured interviews, group meetings and focus group discussions to obtain comprehensive and reliable information from the sampled respondents.

Measures of cost concepts

The cost concept approach is widely used in India for evaluating crop profitability in production. The cost concepts in brief are Cost A₁, A₂, B₁, B₂, C₁, C₂ and Cost C₃.

Cost A₁: This cost includes actual expenditure incurred in cash and kind

1. Value of hired human labour and machinery labour.
2. Value of seed (both forms produced and purchased).
3. Value of manure (owned and purchased).
4. Value of insecticides, pesticides and chemical fertiliser.
5. Depreciation on implements, farm machinery and farm buildings.
6. Irrigation charges.
7. Land revenue and other taxes.
8. Interest on working capital.
9. Miscellaneous expenses.

Cost A₂: Cost A₁ + rent paid for leased in land

Cost B₁: Cost A₂ + interest on value of owned fixed capital assets (including land)

Cost B₂: Cost B₁ + rental value of owned land

Cost C₁: Cost B₁ + imputed value of family labour

Cost C₂: Cost B₂ + imputed value of family labour

Cost C₃: Cost C₂ + 10 % of C₂ (managerial cost)

Measures of farm profit

Gross income: Yield in quintal × Price per tonne

Net income: Gross income - Cost C

Farm business income: Gross income - Cost A₂ or net income + imputed value of family labour

Family labour income: Gross income - Cost C

Farm investment income: Net income + Rental value of owned land + Interest on fixed capital

Benefit-cost ratio: Cost C / Gross income

Marketing cost

The movement of the products from the producers to the ultimate consumers involves costs, taxes and cess which are called marketing costs. These costs vary with the channels through which a particular commodity (wheat). Marketing costs indicate the extent of costs incurred in the movement of a commodity from producer to consumer (16). Marketing cost was worked out using the following formula:

$$\text{Marketing cost} = T_c = C_p + \sum_{i=1}^n M_{ci}$$

Where,

T_c = Total cost of marketing

C_p = Cost incurred by the producer in marketing of his produce

M_{ci} = Marketing costs incurred by middlemen or traders

Marketing margin of middlemen

This is the difference between the total payment (cost + purchase price) and receipts (sale price) at the middlemen (*i*th agency). The following formula was used,

Absolute margin of *i*th middlemen (A_{mi}):

$$A_{mi} = P_{ri} - (P_{pi} + C_{mi})$$

Percentage margin of *i*th middleman (P_{mi}):

$$P_{mi} = \frac{P_{ri} - (P_{pi} + C_{mi})}{P_{pi}} \times 100$$

Where,

P_{ri} = Total value of receipts per unit (sale price)

P_{pi} = Purchase value of produce per unit (purchase price)

C_{mi} = Cost incurred on marketing per unit

The marketing efficiency index (MEI) and the producer's share in the consumer's rupee were calculated following the methodology suggested by Acharya and Agarwal (2016). The MEI was computed using the formula:

$$MEI = \frac{\text{Value of output (at consumer price)}}{\text{Total marketing costs + Marketing margin}}$$

The producer's share in the consumer's rupee (P_o) was calculated as:

$$P_o = \frac{P_p}{P_r} \times 100$$

Where,

P_o = The producers share in the consumers rupee

P_p = The producer's price for their produce

P_r = The price paid by the consumers or sale price of the retailers

Results

Economics of wheat cultivation

The different cost concepts like cost A_1/A_2 , cost B_1 , cost B_2 , cost C_1 , cost C_2 and cost C_3 were considered for the analysis of the data. Similarly, the various income measures such as gross income, net income, farm business income and family labour income were also calculated for the sample farms. The cost of cultivation of wheat (₹/quintal) and the input-output relationship has also been worked out based on different costs.

Cost of cultivation

The per-hectare costs of input used in wheat production across farm sizes in the study area were evaluated in Table 1. Human labour displayed as an important cost component, with expenditures ranging from ₹12812.0 (21.7 %) on marginal farms to ₹13974.4 (22.0 %) on medium farms, maintaining an overall average of ₹13182.2 (21.7 %). Notably, family labour costs were highest on marginal farms at ₹6822.9 (11.6 %), but small and medium farms depend more on hired labour, which accounted for ₹9185.3 (14.8 %) and ₹10115.8 (15.9 %) respectively. Seed expenses varied marginally, with an overall average of ₹5691.0 (9.4 %), whereas manure and fertiliser expenditures remained similar across farm sizes, totaling ₹6733.4 (11.1 %). Plant protection measures added ₹1143.4 (1.9 %) to total costs, representing a slightly smaller cost share. The percentage distribution of various cost components is presented in Fig. 1. Machinery charges averaged ₹7015.8 (11.5 %), exhibiting homogeneity across all farm categories. Irrigation expenses, vital for wheat cultivation, averaged ₹5571.0 (9.2 %), with somewhat higher costs on medium farms at ₹6115.9 (9.6 %). The total working capital,

representing a large share of operational expenditure, ranged from ₹37776.5 (64.0 %) on marginal farms to ₹41686.3 (65.7 %) on medium farms, with an overall mean of ₹39336.7 (64.7 %). Interest in working capital remained low at ₹355.8 (0.6 %). Land rental values were universally ₹15000.0 (24.7 %), showing a significant fixed cost burden across all farm sizes. Interest in fixed capital was quite low, averaging ₹560.4 (0.9 %). Managerial costs, estimated as 10 % of the subtotal, amounted to ₹5525.3 (9.1 %) across all categories. The total cost per hectare ranged from ₹58991.0 on marginal farms to ₹63455.7 on medium farms, with an overall average of ₹60778.2, demonstrating cost variances dependent on farm size. These findings underlined the financial consequences of input use, indicating scale-dependent cost savings and limitations in wheat farming.

Profitability measure

The gross income ranged from ₹93765 on marginal farms (Table 2) to ₹101707 on medium farms, with small farms earning ₹99066/ha. Net income over total costs (Cost C_3) followed a similar pattern, amounting to ₹34773.96, ₹36874.81 and ₹38251.32 for marginal, small and medium farms respectively. Family income, which accounts for returns to family labour, was highest for medium farms at ₹47878.66, while small and marginal farms earned ₹46753.69 and ₹46959.63 respectively. Farm business income, representing profit over Cost A_1 , indicated efficiency across all categories, with values of ₹62483.12 for marginal, ₹62346.90 for small and ₹63480.91 for medium farms. The cost of production per quintal declined slightly with increasing farm size, ranging from ₹1195.36 on marginal farms to ₹1185.42 on medium farms. The benefit-cost (B:C) ratio exhibited minor variation, with values of 1.59 for marginal and small farms and 1.60 for medium farms, signifying consistent profitability. Input-output ratios demonstrated the highest efficiency based on Cost A_1 , with values of 3.0, 2.7 and 2.66 for marginal, small and medium farms respectively. However, as total costs increased,

Table 1. Per hectare costs of different inputs used in wheat production on different size groups of sample farms (₹/ha)

Sl. No.	Particulars	Marginal	Small	Medium	Overall
1.	Total human labour	12812.0 (21.7)	13410.4 (21.6)	13974.4 (22.0)	13182.2 (21.7)
a.	Family labour	6822.9 (11.6)	4225.1 (6.8)	3858.6 (6.1)	5444.7 (9.0)
b.	Hired Labour	5989.1 (10.2)	9185.3 (14.8)	10115.8 (15.9)	7737.5 (12.7)
2.	Seed	5420.3 (9.2)	5902.7 (9.5)	6105.1 (9.6)	5691.0 (9.4)
3.	Manure and fertiliser	6485.5 (11.0)	6954.8 (11.2)	7011.5 (11.0)	6733.4 (11.1)
4.	Plant protection	1012.3 (1.7)	1256.4 (2.0)	1304.9 (2.1)	1143.4 (1.9)
5.	Machinery charge	6896.8 (11.7)	7115.2 (11.4)	7174.5 (11.3)	7015.8 (11.5)
6.	Irrigation charges	5149.6 (8.7)	5927.5 (9.5)	6115.9 (9.6)	5571.0 (9.2)
7.	Total working capital	37776.5 (64.0)	40567.0 (65.2)	41686.3 (65.7)	39336.7 (64.7)
8.	Interest on working capital	328.3 (0.6)	377.3 (0.6)	398.4 (0.6)	355.8 (0.6)
9.	Rental value of land	15000.0 (25.4)	15000.0 (24.1)	15000.0 (23.6)	15000.0 (24.7)
10.	Interest on fixed capital	523.5 (0.9)	593.2 (1.0)	602.3 (0.9)	560.4 (0.9)
11.	Sub total	53628.2 (90.9)	56537.4 (90.9)	57687.0 (90.9)	55252.9 (90.9)
12.	Managerial cost at 10 % of sub total	5362.8 (9.1)	5653.7 (9.1)	5768.7 (9.1)	5525.3 (9.1)
	Grand total	58991.0 (100.0)	62191.2 (100.0)	63455.7 (100.0)	60778.2 (100.0)

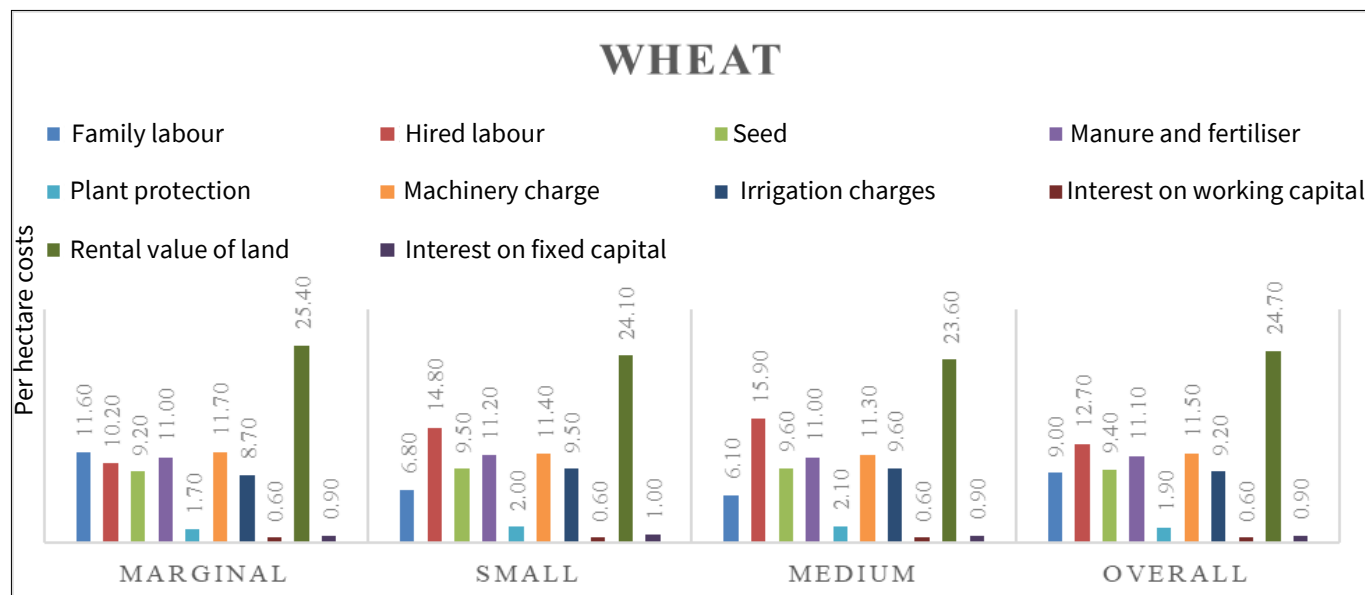


Fig. 1. Per hectare costs of different inputs used in wheat production on different size group of sample farms (%).

Table 2. Per hectare measures of costs and returns of wheat (₹/ha)

Sl. No.	Particulars	Marginal	Small	Medium
1.	Cost A ₁ /A ₂	31281.88	36719.10	38226.09
2.	Cost B ₁	31805.37	37312.31	38828.34
3.	Cost B ₂	46805.37	52312.31	53828.34
4.	Cost C ₁	38628.22	41537.45	42686.98
5.	Cost C ₂	53628.22	56537.45	57686.98
6.	Cost C ₃	58991.04	62191.19	63455.68
7.	Yield (q/ha.)	49.35	52.14	53.53
8.	Gross income	93765	99066	101707
9.	Net income	34773.96	36874.81	38251.32
10.	Family income	46959.63	46753.69	47878.66
11.	Farm business income	62483.12	62346.90	63480.91
12.	Cost of production (₹/q)	1195.36	1192.77	1185.42
13.	B : C Ratio	1.59	1.59	1.60
14.	Input – output ratio			
a.	On the basis of Cost A ₁	3.00	2.70	2.66
b.	On the basis of cost B ₁	2.95	2.66	2.62
c.	On the basis of Cost B ₂	2.00	1.89	1.89
d.	On the basis of Cost C ₁	2.43	2.38	2.38
e.	On the basis of Cost C ₂	1.75	1.75	1.76
f.	On the basis of Cost C ₃	1.59	1.59	1.60

profitability declined, as seen in the Cost C₃-based ratios of 1.59, 1.59 and 1.60. These findings indicate that medium-sized farms achieved the highest absolute returns, while smaller farms remained competitive in efficiency and profitability.

Marketing of wheat

Table 3 depicts the distribution of wheat growers among various marketing channels in the research area, classified by farm size categories. The most often deployed channel was through wholesalers, commission agents, retailers and consumers, with 69 producers (34.5 %), which revealed a large reliance on intermediaries for efficient market access. This trend was observed across all farm size categories, with 41 marginal, 25 small and 3 more prominent farmers selecting for this choice. The second most favoured option, incorporating village traders or merchants (64 farmers, 32 %), was predominantly chosen by 39 marginal and 23 small farmers, underlining the reliance on localised marketing networks. Direct sales to consumers were modest, accounting for only 9 farmers (4.5 %), mainly among 5 small and 4 medium growers, suggesting little adoption of direct marketing tactics. The channel involving millers, wholesalers, retailers and consumers constituted 19 % (38 farmers), with a substantially higher share of 17 small and 8 medium farmers, indicating a preference for structured

processing and distribution networks. Online trading platforms were utilised by 10 % (20 farmers), with 11 small farmers being the primary consumers, reflecting an emerging trend towards digital marketing methods. The sample was composed of 200 wheat growers, including 97 marginal, 81 small and 22 medium farmers, emphasising the predominance of smaller farm sizes in the study area.

Marketing cost of wheat under different channels

As presented in Table 4, the marketing costs demonstrated great variety across different channels, with Channel-IV incurring the highest cost (₹316.75/q) and Channel-III the lowest (₹39.25/q). The charges borne by manufacturers formed a vital component, as cleaning fees ranged between ₹1.60/q in Channel-I and ₹2.75/q in Channel-V. Producers in Channel III experienced higher miscellaneous expenses (₹10.25/q), substantially raising their subtotal (₹39.25/q) relative to other channels. Village traders incurred marketing expenses exclusively in Channel-I, where transportation (₹7.25/q) and market fees (₹10.50/q) were the primary contributors, summing up to ₹41.25/q. Wholesalers operated in Channels II and IV, with uniform costs of ₹63.50/q, where gunny bags (₹18.50/q) and storage (₹12.75/q) were key cost drivers. Commission agents engaged mainly in Channel-II, charging ₹9.50/q

Table 3. Number of sample wheat growers who sold wheat through different channels in different farm size groups

Channel No.	Different channel	Number of farmers in different farm size groups			Total
		Marginal	Small	Medium	
1	Producer → Village trader/Merchant → Miller → Retailer → Consumer	39	23	02	64 (32)
2	Producer → Wholesaler → Commission agents → Retailer → Consumer	41	25	03	69 (34.5)
3	Producer → Consumer	-	05	04	09 (4.5)
4	Producer → Miller → Wholesaler → Retailer → Consumer	13	17	08	38 (19)
5	Producer → Online miller/Trader → Consumer	04	11	05	20 (10)
	Total	97	81	22	200 (100)

Table 4. Analysis of marketing charges under channel-I, II, III, IV and channel-V in study area

Sl. No.	Particulars	Marketing charges				
		Channel-I	Channel-II	Channel-III	Channel-IV	Channel-V
	Charges paid by producers					
i.	Transportation	-	8.50	5.25	6.25	-
ii.	Loading and unloading	-	2.50	2.50	2.50	-
iii.	Cleaning	1.60	2.25	1.75	2.00	2.75
iv.	Weighing	-	1.00	1.00	1.00	-
v.	Gunny bags	-	15.00	18.50	15.00	-
vi.	Others	1.25	1.25	10.25	1.25	1.25
	Sub total	2.85	30.5	39.25	28	4
	Charges paid by the village traders					
i.	Transportation	7.25	-	-	-	-
ii.	Loading and unloading	2.50	-	-	-	-
iii.	Weighing	2.25	-	-	-	-
iv.	Gunny bags	17.25	-	-	-	-
v.	Market fee (2.5 %)	10.50	-	-	-	-
vi.	Others	1.50	-	-	-	-
	Sub total	41.25	-	-	-	-
	Charges paid by wholesaler					
i.	Transportation	-	7.75	-	7.75	-
ii.	Loading and unloading	-	2.75	-	2.75	-
iii.	Market fee (2.5 %)	-	12.25	-	12.25	-
iv.	Commission (2 %)	-	9.50	-	9.50	-
v.	Storage	-	12.75	-	12.75	-
vi.	Gunny bags	-	18.50	-	18.50	-
	Sub total	-	63.50	-	63.50	-
	Charges paid by commission agents					
i.	Commission (2 %)	-	9.50	-	-	-
	Sub total	-	9.50	-	-	-
	Charges paid by miller					
i.	Transportation	9.25	-	-	9.25	-
ii.	Bagging	25.50	-	-	25.50	-
iii.	Processing	150	-	-	150	-
iv.	Loading and unloading	8.50	-	-	8.50	-
v.	Others	10.25	-	-	10.25	-
	Sub total	203.50	-	-	203.50	-
	Charges paid by retailer					
i.	Transportation	9.00	9.00	-	9.00	-
ii.	Loading and unloading	4.25	4.25	-	4.25	-
iii.	Weighing	3.50	3.50	-	3.50	-
iv.	Others	5.00	5.00	-	5.00	-
	Sub total	21.75	21.75	-	21.75	-
	Charges paid by online miller/trader					
i.	Transportation	-	-	-	-	9.50
ii.	Loading and unloading	-	-	-	-	10.25
iii.	Weighing	-	-	-	-	2.50
iv.	Gunny bags	-	-	-	-	22.25
v.	Storage	-	-	-	-	15.00
vi.	Others	-	-	-	-	5.50
	Sub total	-	-	-	-	65.00
	Total marketing charges (A+B+C+D+E+F)	269.35	125.25	39.25	316.75	69.00

as commission charges. Millers accounted for substantial marketing expenses in Channels I and IV, with costs exceeding ₹203.50/q due to processing (₹150/q) and bagging (₹25.50/q). Retailers incurred consistent expenditures throughout Channels I, II and IV (₹21.75/q) mainly for transportation and weighing. Online millers and merchants worked exclusively in Channel-V, where marketing charges reached ₹65.0/q, mostly due to storage (₹15.00/q) and gunny bags (₹22.25/q). The analysis revealed the variances in marketing charges between channels, impacted by the engagement of intermediaries and the breadth of services provided. The findings demonstrated the importance of selecting cost-efficient marketing channels to enhance profitability and efficiency in wheat marketing within the study area.

Producer's share in consumer's rupee, price spread and marketing efficiency of wheat under different channels

The producer's selling price varied dramatically across several marketing channels, ranging from ₹1900 in Channel-I to ₹2650 in Channel-III, as shown in Table 5. The marketing expenditures made by manufacturers were largest in Channel-III at ₹39.25, while the lowest was reported in Channel-I at ₹2.85. Consequently, the net price gained by producers was largest in Channel-III at ₹2610.75, followed by ₹2296 in Channel-V, suggesting that routes with fewer intermediaries achieved greater returns for farmers. Village merchants were active primarily in Channel-I, obtaining wheat for ₹1900 and selling it for ₹2100, generating a profit of ₹158.75 after paying ₹41.25 in marketing charges. Wholesalers participated in Channels-II and IV, procuring wheat for ₹2100 and ₹2350 and selling it for ₹2350 and ₹2550 respectively, with margins of ₹186.50 in Channel-II and ₹136.50 in Channel-IV. Commission agents were present primarily in Channel-II, producing a margin of ₹10.50 after paying ₹9.50 in marketing costs. Millers operated in Channels-I and IV, with buying costs of ₹2100 and ₹2000 and selling prices of ₹2450 and ₹2350 respectively, whereas retailers worked in multiple channels, earning margins between ₹84.00 and ₹94.00. Online millers and merchants were exclusive to Channel-V, procuring wheat for ₹2300, paying marketing fees of ₹69.00 and creating a profit of ₹331 before selling for ₹2700. The producer's share in the consumer's price was most outstanding in Channel-III at 98.49 % and lowest in Channel-I at 74.50 %, demonstrating that direct marketing channels were more advantageous to producers. The price discrepancy varied among channels, with Channel-III having the lowest at 1.50 % and Channel-I the most at 25.49 %. Marketing efficiency was likewise the greatest in Channel-III at 67.51 and lowest in Channel-I at 9.46, underlining the benefits of fewer intermediaries in boosting producer profitability.

Discussion

The findings of the present study indicate that human labour constitutes a major share of the total cost of wheat cultivation across all farm size groups, highlighting the labour-intensive nature of production. This result is consistent with earlier empirical studies on wheat cultivation, in which labour cost has been reported as one of the dominant components of total cost (8, 16). The relatively high ratio of family labour in marginal farms and increased use of hired labour in small and medium farms reflects differences in availability of resource, which is a common feature observed in smallholder farming systems.

The relatively uniform distribution of input costs such as seeds, fertilisers and plant protection chemicals across farm sizes suggests that farmers follow similar production practices regardless of landholding size. Such uniformity in input use has also been reported in farm-level studies, indicating limited variation in technology adoption among different categories of farmers (8). The moderate share of machinery cost further suggests partial mechanisation, indicating that wheat cultivation in the region is still a mix of traditional and modern practices.

The dominance of working capital in total cost (around 64–66 %) indicates that wheat cultivation is highly dependent on variable inputs. Similar findings have been documented in empirical studies, where operational or variable costs account for the largest share of total cost of cultivation (17). Irrigation also emerged as a significant cost component, underlining its importance in ensuring stable wheat production, particularly in regions where timely water supply is essential.

The substantial share of land rental value in total cost reflects the increasing economic importance of land as a production factor. Previous studies have also reported that land-related costs constitute a major portion of fixed costs in crop production, especially in areas where land leasing is prevalent (16). The observed increase in total cost with farm size suggests higher input use by larger farms; however, the relatively small differences across farm sizes indicate limited economies of scale in wheat cultivation.

The profitability analysis showed that wheat cultivation is economically viable across all farm sizes, as reflected in positive net returns and favourable B : C ratios. Medium farms recorded relatively higher returns, which may be attributed to better access to inputs and more efficient resource utilisation. Similar results have been reported in earlier studies on wheat production (8). However, the minimal variation in B : C ratio across farm sizes indicates that small and marginal farmers are equally efficient in managing their resources.

The decline in cost of production per quintal with increasing farm size indicates the presence of slight economies of scale. However, the reduction in profitability when accounting for full costs (Cost C₃) highlights the impact of imputed costs such as family labour and land, which has also been observed in farm management studies (17).

The marketing pattern revealed that most farmers rely on traditional marketing channels involving intermediaries such as village traders, wholesalers and retailers. This dependence is more pronounced among marginal and small farmers due to constraints such as limited marketable surplus and lack of storage facilities. Similar patterns have been observed in agricultural marketing studies, where small farmers depend heavily on intermediaries for market access (7).

The analysis of marketing costs showed that channels involving more intermediaries incur higher costs due to additional handling, transportation and value addition activities. This finding is in line with earlier studies which reported that marketing costs increase with the number of intermediaries involved (18). The results also indicated that channels with fewer intermediaries provide a higher share of the consumer's price to producers, thereby improving marketing efficiency.

The highest producer's share and marketing efficiency observed in direct or less intermediated channels clearly

Table 5. Price-spread analysis in marketing of wheat under different channels

Table 5. Price spread analysis in marketing of wheat under different channels						
Sl. No.	Particulars	Marketing charges				
		Channel-I	Channel-II	Channel-III	Channel-IV	Channel-V
Producer's						
i.	Sale price	1900	2250	2650	2200	2300
ii.	Marketing charges	2.85	30.5	39.25	28	4
iii.	Net price received	1897.15	2219.50	2610.75	2172	2296
Village trader's						
i.	Purchase price	1900	-	-	-	-
ii.	Marketing price	41.25	-	-	-	-
iii.	Margin	158.75	-	-	-	-
iv.	Sale price	2100	-	-	-	-
Wholesaler's						
i.	Purchase price	-	2100	-	2350	-
ii.	Marketing price	-	63.50	-	63.50	-
iii.	Margin	-	186.50	-	136.50	-
iv.	Sale price	-	2350	-	2550	-
Commission agent's						
i.	Purchase price	-	2350	-	-	-
ii.	Marketing price	-	9.50	-	-	-
iii.	Margin	-	10.50	-	-	-
iv.	Sale price	-	2370	-	-	-
Miller's						
i.	Purchase price	2100	-	-	2000	-
ii.	Marketing price	203.50	-	-	203.50	-
iii.	Margin	146.50	-	-	146.50	-
iv.	Sale price	2450	-	-	2350	-
Retailer's						
i.	Purchase price	2450	2370	-	2550	-
ii.	Marketing price	16.00	16.00	-	16.00	-
iii.	Margin	84.00	94.00	-	84.00	-
iv.	Sale price	2550	2480	-	2650	-
Online millers/Trader's						
i.	Purchase price	-	-	-	-	2300
ii.	Marketing price	-	-	-	-	69.00
iii.	Margin	-	-	-	-	331
iv.	Sale price	-	-	-	-	2700
Producer's share in consumer's price (Percent)		74.50	90.72	98.49	83.01	85.18
Price spread		25.49	9.27	1.50	16.98	14.81
Marketing efficiency		9.46	19.80	67.51	8.36	39.13

demonstrate the advantage of reducing marketing layers. Similar conclusions have been drawn in previous studies, which emphasise that minimising intermediaries enhances farmers' income and reduces price spread (7).

The findings on price spread, producer's share and marketing efficiency provide important implications for agricultural marketing policies in the study area. The results clearly show that Channel-III, which involves minimal or no intermediaries, recorded the highest producer's share (98.49 %) and marketing efficiency (67.51), along with the lowest price spread (1.50 %). In contrast, Channel-I, characterised by multiple intermediaries, exhibited the lowest producer's share (74.50 %) and highest price spread (25.49 %). This indicates that a substantial portion of the consumer's price is absorbed by intermediaries in traditional marketing channels.

These findings suggest that promotion of direct marketing mechanisms such as farmer markets, Farmer Producer Organizations (FPOs) and contract farming can significantly enhance farmers' income by reducing intermediary margins, a result also supported by previous studies emphasising the role of reduced intermediation in improving producer welfare (18). The very low adoption of direct sales (only 4.5 % farmers) in the study area highlights the need for improving market access, infrastructure and farmer awareness.

In addition, the moderate use of digital platforms (10 % farmers) indicates untapped potential of online marketing systems such as National Agriculture Market (e-NAM), which can improve price discovery and reduce marketing inefficiencies.

Since small and marginal farmers dominate the study area and depend heavily on intermediaries, strengthening collective marketing through FPOs can improve bargaining power and reduce transaction costs. Overall, the study demonstrates that reducing the number of intermediaries through institutional and digital interventions can significantly improve marketing efficiency and increase the producer's share in the consumer's rupee, thereby contributing to higher farm income.

Conclusion

The present investigation elucidates the economic and marketing dynamics of wheat production across diverse farm sizes in Eastern Uttar Pradesh. The cost analysis indicated that total cost per hectare varied from ₹58991.0 on marginal farms to ₹63455.7 on medium farms, with an average of ₹60778.2. Labour, land rent and machinery emerged as dominant cost components, accounting for over 50 % of total expenditure. Despite higher fixed costs, medium farms achieved greater financial returns, with gross incomes of ₹101707

and net profits over Cost C_3 of ₹38251.32, while marginal farms secured ₹93765 in gross income and ₹34773.96 in net returns. The input-output ratio and benefit-cost (B : C) ratio confirmed consistent profitability across all sizes, with medium farms attaining the highest economic efficiency. Marketing analysis showed that 34.5 % of farmers relied on intermediate channels involving wholesalers and commission agents, reflecting the prevailing dependency on indirect marketing. Channel-III offered the most favorable outcomes, with a producer's share of 98.49 % in the consumer's rupee and a marketing efficiency index of 67.51, while Channel-I lagged at 74.50 % and 9.46 respectively. These findings accentuate the critical need to promote direct and digital marketing platforms to enhance producers' returns and ensure a more efficient, inclusive and economically viable wheat supply chain in the study area.

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Authors' contributions

S was involved in conceptualisation. PK and AKT carried out the formal analysis and investigation. AKT and DCN prepared and wrote the original draft. S was responsible for supervision. All authors have read and approved the final manuscript.

Compliance with ethical standards

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References

- Pandey H, Barker N, Kale PS. Study of marketing of milk in Hardoi district of Uttar Pradesh, India. *Asian J Agric Ext Econ Soc.* 2024;42(5):170–6. <https://doi.org/10.9734/ajaees/2024/v42i52424>
- Singh PK, Raj S, Singh R, Singh OP, Singh S. Resource use and marketing efficiency of Kalanamak rice cultivation in Uttar Pradesh, India. *Indian J Agric Mark.* 2024;38(2):24–33.
- Kumar N, Kushwaha RR, Meena NR, Mishra H, Yadav AP. Costs and returns of paddy cultivation in Ambedkar Nagar district of Uttar Pradesh. *Int J Stat Appl Math.* 2023;8(3):107–11. <https://doi.org/10.22271/math.2022.v7.i3b.828>
- Mishra H, Singh KK. Marketing analysis of bitter gourd (*Momordica charantia* L.) in Sultanpur district of Uttar Pradesh. *J Appl Hortic.* 2024;26(1):1–6. <https://doi.org/10.37855/jah.2024.v26i01.08>
- Yadav RS, Kushwaha RR, Maurya K, Yadav B. Economic study of marketing channels and efficiency of cereals and oilseeds in Azamgarh district of Eastern Uttar Pradesh. *Int J Chem Stud.* 2020;8(5):83–9. <https://doi.org/10.22271/chemi.2020.v8.i5b.10388>
- Khati KS, Bhandari AK, Mukherjee D. Productive efficiency of agricultural sector in Uttar Pradesh. In: *Contemporary issues in sustainable development.* New Delhi: Routledge India; 2020. p. 50–71. <https://doi.org/10.4324/9781003141020-5>
- Srivastava SK. Marketing efficiency and marketing channels for paddy crop in eastern Uttar Pradesh. *Econ Aff.* 2017;62(2):289–94. <https://doi.org/10.5958/0976-4666.2017.00011.0>

- Tripathi AK, Singh JP. Economic analysis of production and marketing of wheat in Ghazipur district of Eastern Uttar Pradesh. *J Pharmacogn Phytochem.* 2018;7(1):1–5.
- Mishra D, Singh KK, Mishra H, Srivastava AB. Resource use efficiency of lentil cultivation in Sultanpur district of Uttar Pradesh. *Environ Ecol.* 2023;41(2B):1209–16. <https://doi.org/10.60151/envec/MNJS3471>
- Srivastava AB, Singh KK, Supriya HM, Yadav DN, Nishad DC. Economic study on costs and returns of sugarcane in Ghazipur district of Uttar Pradesh. *Int J Res Agron.* 2024;7(5):751–7. <https://doi.org/10.33545/2618060X.2024.v7.i5j.847>
- Yadav V, Pandey AK, Qidwai S, Kumar P, Kaushik S, Kumar P, et al. Response of nutrient management on yield and economics in potato-based cropping system in Eastern Uttar Pradesh. *Int J Plant Soil Sci.* 2024;36(6):117–21. <https://doi.org/10.9734/ijpss/2024/v36i64612>
- Ramadhan AJ, Tiwari AK, Kumar B, Supriya S, Mishra H, Gautam S, et al. Comparative economics of maize crop in kharif and rabi season. *BIO Web Conf.* 2024;97:00134. <https://doi.org/10.1051/bioconf/20249700134>
- Srivastava AB, Singh KK, Supriya SK, Mishra H, Ahmad R. Production and export dynamics of wheat in India. *Mathematics.* 2023;11(3):206. <https://doi.org/10.22271/math.2023.v8.i3Sc.1023>
- Mishra H. Production and marketing of cucumber and bitter gourd in Sultanpur district of Uttar Pradesh [thesis]. Ayodhya: Acharya Narendra Deva University of Agriculture and Technology; 2022.
- Mishra H, Neerugatti MP, Gautam S, Mishra D. Economic analysis of cucumber market performance in Sultanpur district of Uttar Pradesh. *Asian J Agric Ext Econ Soc.* 2023;41(4):82–95. <https://doi.org/10.9734/ajaees/2023/v41i41882>
- Yadav H, Singh SK, Singh GP, Singh KK. Economic analysis of wheat cultivation in Etawah district of Uttar Pradesh. *Plant Arch.* 2014;14(1):393–9.
- Udhayan N, Naik AD, Hiremath GM. An economic analysis of wheat cultivation in North Karnataka, India. *Int J Plant Soil Sci.* 2023;35(20):939–45. <https://doi.org/10.9734/ijpss/2023/v35i203887>
- Acharya SS, Agarwal NL. *Agricultural marketing in India.* 5th ed. New Delhi: Oxford & IBH Publishing Co Pvt Ltd; 2011.

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