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Value chain of wheat: A case in north western plain zone of India

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Abstract

An assessment was conducted in 2023 to analyse the various value chains of wheat (*Triticum aestivum*) in North Western Plain Zone of India. In all, 101 respondents were selected using multistage random sampling method. The respondents included 60 farmers, eight traders, eight commission agents, eight millers, eight wholesalers, eight retailers and one FPO. Analysis of value chain was done on the basis of value addition, marketing efficiency and net marketing margin. Moreover, the study also calculated cost of cultivation, net farm income and return on investment from wheat farming. Results demonstrated four value chains of wheat in the study area. The chain involving farmers, FPO bodies and government agencies had the highest marketing efficiency (17.48) wherein farmers fetch ₹2770 per quintal of wheat in the fourth chain, compared to ₹2100/q, ₹2150/q and ₹2350/q in other value chains. The average cost of cultivation of wheat in study area was ₹35,089.67 per acre (Cost C₂). The average net income was ₹10,777 per acre, highest for medium farmers (₹11,315/acre) and lowest for marginal farmers (₹10,147/acre). Finally, the average ROI for wheat cultivation was 0.305. Results indicated that a smaller number of stakeholders in the chain enhances the income of farmers. The findings may benefit researchers in analyzing value chains in other crops, helping to optimize value chains of various crops and vegetables.

Keywords: Wheat, value addition, marketing efficiency, net farm income

Introduction

India, an agrarian economy in South East Asia where wheat plays a crucial role in its economy (Sendhil *et al.*, 2022) ^[28]. With a total estimated food grain production of 329.6 million tonnes in 2023, wheat constitutes 110.5 million tonnes, representing a significant portion of the overall output. (Press Information Bureau, 2023). North Western Plain Zone, an agro-climatic zone of India comprising of states like Punjab, Haryana, and parts of Uttar Pradesh and Rajasthan is the largest contributor to national wheat production (Singh *et al.*, 2023) ^[31]. Thus, wheat and its overall value chain plays significant importance in the economy of this zone (Kumar *et al.*, 2023) ^[19].

A value chain is a series of production, processing, and marketing operations in which products go through different chain activities in a certain order and gain value with each action (Jain, 2016; Cohen and Kouvelis, 2022) ^[13, 6]. Farmers, commission agents, processors, wholesalers, retailers are the main agents in the value chain (Kumari *et al.*, 2021) ^[18]. Stakeholder linkage in value chains (Senthil *et al.*, 2018) and government agencies, FPOs and NGOs also do play a part in some value chain (Saxena, Singh and Raman, 2021) ^[26]. All of these actors help to create the value chain and value chain help them economically (Hofstetter *et al.*, 2021) ^[12].

Despite the significance of wheat value chain, it suffers

persistent problems in North Western Plain Zone, including marketing inefficiencies, huge price spread and farm income disparity (Dhanda *et al.*, 2022) ^[8]. Farmers often receive less share in consumer spending due to high marketing margins by the intermediaries in the value chain (Barrett *et al.*, 2022) ^[3]. In addition to that, insufficient infrastructure facilities, such as lesser number of cold storage and processing facilities, further reduce farmers profitability (Kaur and Watson, 2024) ^[16]. These problems ultimately lead to thwarting financial well-being of farmers and collective reduction in agricultural productivity.

This research targets to deliver an overall analysis of wheat value chain, particularly focusing on marketing margins, value addition, marketing efficiency and farm income measure in order to handle these issues. Analyzing marketing margins will help to grasp profit distribution among stakeholders (Kuajala, Sachs and Leinonen, 2022), while value addition will reveal the extent of transformation of the product for enhancing the marketing value (Eze, Machario and Ngare, 2021) ^[9]. Investigating marketing efficiency is crucial for recognizing the areas where assistance is necessary for enhancing the profitability (Hasan and Khalequzzaman, 2017) ^[11]. Finally, by scrutinizing farm income measures, this study will throw light on the economic status of farmers in this zone (Das and Ganesh-Kumar, 2017) ^[7].

The principal questions steering the study are: what is the level of value addition in each level of value chains? What are the marketing margins in each level of value chain? Which value chain is most efficient? What is the financial outcome of farmers in terms of farm income? By addressing these questions, the study intends to focus on farmers share in consumer rupees and overall price spread in different value chains of the study area.

Materials and Methods

The research was done for analyzing the value chains of wheat in North Western Plain Zone utilizes ex-post facto design in 2023. Multistage random sampling method was implemented for selecting the state, district, village and ultimately respondents from the study area. Uttar Pradesh was chosen randomly from the NWPZ. Furthermore, Aligarh district and finally Bhamraula and Madhola villages were randomly taken up. The sample comprised of 101 respondents, incorporating 60 farmers, eight traders, eight commission agents, eight millers, eight wholesalers, eight retailers and one FPO. Respondents were personally interviewed for gathering primary data. The value chain analysis comprised of evaluating cost of cultivation, value addition at different stages, marketing margin of stakeholders, marketing efficiency of various chains and farmer's share in consumers price with respect to several wheat value chains in study area. Furthermore, farm income measures were taken up for calculating the overall income of farmers in a cultivating season of wheat.

The cost of cultivation calculated by using CACP's method of cost calculations shown below.

- Cost A1 comprised hired labour cost, hired and owned tractor cost, manures cost, seed cost, fertilizer cost, pesticide cost, Interest on working capital, farm implement depreciation, land revenues and miscellaneous costs.
- Cost A2 = Cost A1 + Rent paid for leased land
- Cost B1 = Cost A2 + Fixed capital interest
- 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 D = Cost C2 + Management cost (10% of cost C2)

Marketing margin was calculated using Acharya's formula.

Marketing margin = Selling price - (Purchase price + Marketing cost)

Value addition by various stakeholders, is the amount of change a product was done in order to enhance its price in market, was calculated using the following formula.

$$\text{Value addition} = \frac{\text{Marketing margin}}{\text{Purchasing price}} \times 100$$

In a value chain, marketing efficiency refers to each stakeholder's capacity to deliver the product from producer

to consumer at the lowest feasible cost while maintaining quality. The marketing efficiency was calculated using the Acharya's (2003) ^[1] formula below.

$$\text{Marketing efficiency} = \frac{\text{Farmers' price}}{\text{Marketing cost} + \text{Marketing margin}}$$

The returns on farming were calculated by using farm income measures.

- Net farm income = Gross Income - Cost C2
- Farm business income = Gross income - Cost A2
- Family labour income = Gross income - Cost B2
- Farm investment income = Farm business income - imputed value of family labour

The depreciation was measured using straight line method, whereas the working capital's interest rate was adjusted to 7 per cent and for fixed capital it was determined at 12 per cent.

Results and Discussion

According to Kaplinsky and Morris (2000) ^[15], value chain outlines the complete series of activities necessary to take a product or service from its initial concept, through various stages of production (including physical transformation and the contribution of different producer services), to its delivery to end consumers and eventual disposal after use. The assessment of the existing value chain was conducted by evaluating various parameters, including the cost of cultivation, value addition at different stages, market margins, market efficiency, and the producer's share in the consumer rupee across different value chains.

Cultivation cost of wheat in North Western Plain Zone

The cost of cultivation is estimated using the standard methodology prescribed by the Commission for Agricultural Costs and Prices (CACP). It is calculated separately for marginal, small, and medium farmers and expressed in Rs/acre.

Table 1 represents the wheat cultivation cost among various kinds of farmers in North Western Plain Zone. All respondents in the study area own their land and had not leased any. For marginal farmers, the Cost A1 was ₹4,563 per acre, while for small and large farmers, it was ₹25,396 and ₹27,197 per acre, respectively. On average, Cost A1 across all farmer categories amounted to ₹25,718.67 per acre. The average cost of cultivation (A2+ Imputed cost of family labour) in the study area was ₹28,718.67 per acre, with medium farmers bearing the highest cost at ₹30,197 per acre. These results resonate with the study by Sachan *et al.* (2020) ^[27], which reported the cost of wheat cultivation in Punjab to be ₹64,608 per hectare. In addition to that, the average comprehensive cost (Cost C2) in the study area was ₹35,089.67 per acre, consistent with the findings of Singh (2016) ^[30], who reported a comprehensive cost of ₹52,063.63 for wheat cultivation under conventional farming practices in Uttar Pradesh.

Table 1: Cost of wheat cultivation in the NWPZ for marginal, small, and medium farmers.

Particulars	Cost of wheat cultivation in the North Western Plain Zone (in Rupees/acre).			
	Marginal farmer	Small farmer	Medium farmer	Average
Cost A1				
Hired labour	6680.0	8360.0	10900.00	8646.66
Owned and hired labour	6500.0	5360.0	4500.00	5453.33
Seed	1633.0	1727.0	1761.00	1701.00
Cost of fertilizers	4131.0	4240.0	4336.00	4235.66
Weedicides and Pesticides	517.0	552.0	597.00	555.33
Revenue of land	0.0	35.0	35.00	23.33
Cost of irrigation	2463.0	2230.0	1768.00	2153.66
Depreciation	1032.0	1231.0	1521.00	1261.33
Overall working capital	22596.0	23735.0	25418.00	24036.33
Working capital's interest @7%	1607.0	1661.0	1779.00	1682.33
Sub total	24563.0	25396.0	27197.00	25718.67
Cost A2				
Cost A1	24563.0	25396.0	27197.00	25718.67
Rental value of leased land	-	-	-	-
Sub total	24563.0	25396.0	27197.00	25718.67
Cost B1				
Cost A2	24563.0	25396.0	27197.00	25718.67
Fixed capital's interest @12%	1010.0	1197.0	1421.00	1209.33
Sub total	25573.0	26593.0	28618.00	26928.00
Cost B2				
Cost B1	25573.0	26593.0	28618.00	26928.00
Rental value of owned land	6000.0	6000.0	6000.00	6000.00
Sub total	31573.0	32593.0	34618.00	32928.00
Cost C1				
Cost B1	25573.0	26593.0	28618.00	26928.00
Estimated cost of family labour	3000.0	2118.0	1367.00	2167.67
Sub total	28573.0	28711.0	29985.00	29089.67
Cost C2				
Cost B2	31573.0	32593.0	34618.00	32928.00
Estimated cost of family labour	3000.0	2118.0	1367.00	2161.67
Sub total	34573.0	34711.0	35985.00	35089.67
Cost D				
Cost C2	34573.0	34711.0	35985.00	35089.67
Management value	3457.3	34711.0	3598.50	3508.96
Sub total	38030.0	38182.0	39583.50	38598.63

Returns from wheat cultivation

Table 2: Average wheat returns in the North Western Plain Zone.

Particulars	Average wheat returns in the North Western Plain Zone (Rupees/acre).			
	Marginal farmer	Small farmer	Medium farmer	Average
Yield (quintal/acre)	20.80	21.20	22.00	21.33
Price (rupees/quintal)	2150.00	2150.00	2150.00	2150.00
Gross return (in Rupees)	44720.00	45580.00	47300.00	45866.67
Net farm income	10147.00	10869.00	11315.00	10777.00
Farm business income	20147.00	20184.00	20103.00	20144.66
Family labour income	13147.00	12987.00	12682.00	12398.66
Farm investment income	17147.00	18066.00	18736.00	17983.00
Input-output ratio	1:1.29	1:1.313	1:1.314	1:1.305
Return on investment	0.290	0.313	0.314	0.305

Table 2 shows, various factors, including yield, gross returns, net farm income, farm business income, farm labor income, farm investment income, input-output ratio and return on investment from wheat cultivation in the North Western Plain Zone (NWPZ). The average yield of the study area was 21.33 quintal per acre, harmonize with the result of Kumari *et al.*, 2022 ^[20], who have stated that HD 2967 yielded 51.63 quintal per hectare. Net farm income was highest for medium farmers, followed by small and

marginal farmers, with values of ₹11,315, ₹10,869, and ₹10,147 per acre, respectively. As per Kumar *et al.* (2021) ^[18], the net farm income of KCC farmers from wheat cultivation in Uttar Pradesh was ₹29,070.58 per hectare. Farm business income for marginal, small, and medium farmers was ₹20,147, ₹20,184, and ₹20,103 per acre, respectively. The family labour income was recorded at ₹13,147 per acre for marginal farmers, ₹12,987 per acre for small farmers, and ₹12,682 per acre for medium farmers,

with an overall average of ₹12,983 per acre. These findings align with those of Jwala *et al.* (2018)^[14], who reported that family labour income in wheat cultivation in Punjab amounted to ₹28,042.21 per hectare. Regarding farm investment income, marginal farmers earned ₹17,417 per acre, while small and medium farmers earned ₹18,066 and ₹18,736 per acre, respectively, with an average farm investment income of ₹17,983 per acre. The input-to-output ratio was lowest for marginal farmers at 1:1.29, whereas small farmers had a ratio of 1:1.313. Medium farmers recorded the highest input-to-output ratio at 1:1.314 and highest return on investment.

Value chains of wheat in North Western Plain Zone

Study area in the North Western Plain Zone (NWPZ) of India contains four distinct wheat value chains. The first chain commences with farmer-to-local trader transactions which then lead to commission agent acquisition followed by millers, wholesalers and retailers until finally reaches to consumer. Second chain begins with farmers directly selling their wheat to commission agents who subsequently forward it to millers, wholesalers and retailers who reach consumers. In the third chain farmers sell wheat directly to millers who process the grain until it reaches wholesalers and retailers prior to having it sold to consumers. Finally, in the fourth chain farmers offer their produce to Farmer Producer Organizations (FPOs) who sell the produce to government agencies for further value addition and distribution.

Table 4: Analysis of wheat value chains in the North Western Plain Zone (Rupees/quintal)

Particular	Value chain 1	Value chain 2	Value chain 3	Value chain 4
A. Farmer				
Net price received by farmer	2100.00	2150.00	2350.00	2770.00
Transportation cost	0.00	85.00	0.00	0.00
Packaging cost	0.00	47.50	0.00	0.00
Loading/Unloading cost	0.00	10.00	0.00	0.00
Cleaning	0.00	7.50	0.00	0.00
Commission charge	0.00	0.00	0.00	0.00
Mandi tax	0.00	0.00	0.00	0.00
Farmers selling price	2100.00	2300.00	2350.00	2770.00
Net marketing cost	0.00	150.00	0.00	0.00
B. Local trader				
Purchasing price of local trader	2100.00	-	-	-
Labour cost	4.50	-	-	-
Packaging cost	20.00	-	-	-
Transportation cost	30.00	-	-	-
Commission cost	126.00	-	-	-
Market fee	21.00	-	-	-
Miscellaneous cost	6.50	-	-	-
Total marketing cost	208.00	-	-	-
Selling price	2420.00	-	-	-
Marketing margin	112.00	-	-	-
Degree of value addition (%)	5.20	-	-	-
C. Commission agent FPO				
Acquiring price	2420.00	2300.00	-	2770.00
Marketing fee given	0.00	0.00	-	0.00
Labour cost	0.00	0.00	-	0.00
Packaging cost	-	-	-	25.00
Stitching cost	-	-	-	4.90
Loading/unloading	-	-	-	8.00
Transportation cost	-	-	-	28.00
Miscellaneous cost	-	-	-	30.00
Commission charge received	126.00	120.00	-	40.00
Selling price	2420.00	2300.00	-	2928.40
Margin earned	126.00	120.00	-	62.50
Total marketing cost	0.00	0.00	-	0.00
Degree of value addition (%)	5.20	5.21	-	2.13
D. Millers-				
Purchase price-	2420.00	2300.00	2350.00	-
Commission price	126.00	120.00	0.00	-
Market fee	36.80	35.50	0.00	-
Packaging cost	31.50	31.50	30.50	-
Stitching cost	4.70	4.75	4.75	-
Loading/unloading	7.50	7.50	7.50	-
Transportation cost	20.80	20.80	110.25	-
Milling cost of Atta/Flour	135.30	135.30	130.50	-
Milling cost of Dalia	165.25	165.25	163.25	-
Milling cost of Maida	215.30	215.30	210.30	-

Net marketing cost of flour	362.65	355.35	283.50	-
Net marketing cost of Dalia	392.60	385.30	316.25	-
Net marketing cost of Maida	442.65	435.35	363.25	-
Average marketing cost	339.30	392.00	321.11	-
Production of four from 1q of wheat (in Kg)	92.00	92.00	92.00	-
Wheat bran (Kg)	8.00	8.00	8.00	-
Production of Dalia from 1q of wheat (in Kg)	75.00	75.00	75.00	-
Wheat bran (Kg)	25.00	25.00	25.00	-
Production of Maida from 1q of wheat (in Kg)	80.00	80.00	80.00	-
Wheat bran (in Kg)	20.00	20.00	20.00	-
Revenue generated from Atta/flour (₹34/Kg)	3128.00	3128.00	3128.00	-
Revenue generated from Dalia (₹41/Kg)	3120.00	3120.00	3120.00	-
Revenue generated from Maida (₹44.4/Kg)	3552.00	3552.00	3552.00	-
Revenue generated from Atta bran (₹14/Kg)	112.00	112.00	112.00	-
Revenue generated from Dalia bran (₹14/Kg)	350.00	350.00	350.00	-
Revenue generated from Maida bran (₹14/Kg)	280.00	280.00	280.00	-
Gross revenue from Atta/flour	3240.00	3240.00	3240.00	-
Gross revenue from Dalia	3470.00	3470.00	3470.00	-
Gross revenue from Maida	3832.00	3832.00	3832.00	-
Net margin from Atta/flour	457.32	584.65	606.50	-
Net margin from Dalia	657.40	784.70	803.75	-
Net margin from Maida	969.35	1096.65	1118.70	-
Average marketing margin	694.70	822.00	842.98	-
Degree of value addition (%)	28.70	35.70	35.87	-
E. Wholesaler				
Purchasing price of Atta/flour	3400.00	3400.00	3400.00	-
Purchasing price of Dalia	4160.00	4160.00	4160.00	-
Purchasing price of Maida	4440.00	4440.00	4440.00	-
Transportation cost	47.35	47.35	47.35	-
Packaging cost	7.50	7.50	7.50	-
Labour cost	5.50	5.50	5.50	-
Total marketing cost	60.35	60.35	60.35	-
Selling price of Atta/flour	3650.00	3650.00	3650.00	-
Selling price of Dalia	4420.00	4420.00	4420.00	-
Selling price of Maida	4710.00	4710.00	4710.00	-
Marketing margin of Atta	189.65	189.65	189.65	-
Marketing margin of Dalia	199.68	199.68	199.68	-
Marketing margin of Maida	209.68	209.68	209.68	-
Average marketing margin	199.67	199.67	199.67	-
Degree of value addition (%)	4.99	4.99	4.99	-
F. Retailer				
Purchase price of Atta/flour	3650.00	3650.00	3650.00	-
Purchase price of Dalia	4420.00	4420.00	4420.00	-
Purchase price of Maida	4710.00	4710.00	4710.00	-
Transportation cost	25.00	25.00	25.00	-
Labour cost	7.50	7.50	7.50	-
Net marketing cost	32.50	32.50	32.50	-
Selling price of Atta/flour	4200.00	4200.00	4200.00	-
Selling price of Dalia	5000.00	5000.00	5000.00	-
Selling price of Maida	5250.00	5250.00	5250.00	-
Marketing margin of Atta	517.50	517.50	517.50	-
Marketing margin Dalia	547.50	547.50	547.50	-
Marketing margin of Maida	507.50	507.50	507.50	-
Average market margin	524.16	524.16	524.16	-
Degree of value addition (%)	12.30	12.30	12.30	-
G. Government bodies-				
Purchasing price-	-	-	-	2928.40
Total marketing cost by all stakeholders	700.15	634.85	413.96	95.40
Net marketing for all stakeholders	1656.53	1665.83	1566.82	62.50
Price received by farmers	2100.00	2150.00	2350.00	2770.00
Marketing efficiency	0.891	0.934	1.186	17.48

In value chain 1 of NWPZ, the grain transitioned through farmers, local traders, commission agents, millers, wholesalers, retailers and finally to consumers. Farmers

received ₹2100 per quintal for selling the grain to local traders. Local traders accumulated ₹208 in marketing cost and sold the wheat at ₹2420 per quintal to commission

agents, earning ₹112 per quintal. Commission agents charged ₹126 per quintal and passing the produce to millers. Millers bought it for ₹2420 per quintal, spending ₹399.33 as marketing cost. Millers processed the grains into Atta, Maida and Dalia, selling them at ₹3400/q, ₹4160/q and ₹4440/q respectively. Thus, earning an average margin of ₹694.70 per quintal. Wholesalers take the processed produce from millers. Furthermore, incurring ₹60.35 in marketing cost and selling Atta, Dalia and Maida at ₹3650/q, ₹4420/q and ₹4710/q respectively. Retailers bought these and added ₹32.50 in marketing cost and sold Atta, Dalia and Maida at ₹4200/q, ₹5000/q and ₹5250/q respectively. Millers had the highest value addition at 28.70 per cent followed by retailers at 12.13%. Total marketing costs were ₹700.15 per quintal, and the net marketing margin was ₹1656.53. Marketing efficiency of the first value chain, calculated using Acharya's formula, was 0.891.

In the second value chain of wheat in NWPZ, wheat progressed through farmers, commission agents, millers, wholesalers, retailers and consumers. Here, Farmers sold their grains directly to commission agents at ₹2300/q, spending ₹150 rupees as marketing cost and thus gaining a net margin of ₹2150 per quintal. Commission agents charged ₹120 and pass the wheat to millers at ₹2300 per quintal. Millers incurred a sum of ₹392 as marketing costs and gained an average net margin of ₹822 by selling the processed produce i.e., Atta, Dalia and Maida to wholesalers. Wholesalers bought Atta, Dalia and Maida from millers at ₹3400/q, ₹4160/q and ₹4440/q respectively. Moreover, wholesalers incurred a total marketing cost (packaging, labour and transport charges) of ₹60.35 and earning an average margin of ₹199.67 by selling the products to retailers. Retailers bought Atta, Dalia and Maida at ₹3650/q, ₹4420/q and ₹4710/q respectively. They added ₹32.50 in costs and sold three products at ₹4200/q, ₹5000/q and ₹5250/q. Millers achieved the highest value addition at 35.70%. Total marketing costs across stakeholders were ₹634.85 per quintal, with a net marketing margin of ₹1665.83. Farmers received ₹2150 per quintal. Using Acharya's formula, marketing efficiency was calculated at 0.934.

The third value chain of wheat in NWPZ, involves farmers, millers, wholesalers, retailers as stakeholders. Farmers sold their grains directly to millers at ₹2300 per quintal, leaving local traders and commission agents. Millers bore and additional ₹321.16 as marketing cost and sold the Atta, Dalia and Maida to wholesalers at ₹3400/q, ₹4160/q and ₹4440/q respectively, earning a margin of ₹842.98. Wholesalers added ₹60.35 in marketing costs and sold the products at ₹3650/q, ₹4420/q, and ₹4710/q, earning ₹199.67. Retailers incurred ₹32.50 in costs and sold at ₹4200, ₹5000, and ₹5250. Millers contributed the highest value addition at 35.87%. Total marketing costs were ₹413.96 per quintal, and the net marketing margin was ₹1566.82. Farmers received ₹2350 per quintal. Using Acharya's formula, marketing efficiency was calculated at 1.186.

Fourth and final value chain of NWPZ, assembles farmer, FPOs and government bodies as stakeholders. In this chain farmers sold their wheat to FPO bodies (Farmer Producer Organization) at ₹2770/q. In addition to accumulating the purchasing cost of wheat, FPO bodies incurred a net

marketing cost of ₹95.90/quintal. Finally, FPO bodies sold the wheat grains to government bodies at ₹2984.40 per quintal, achieving a net marketing margin of ₹62.50. The value addition was only contributed by FPOs, amounting to 2.13 per cent. Total marketing cost across stakeholders was ₹95.9 per quintal, while the net marketing margin stood at ₹62.5. Farmers received ₹2770 per quintal. Applying Acharya's formula, the marketing efficiency was calculated to be 17.48.

Analysing all of the four value chains in North Western Plain Zone, one can conclude that the fourth one between farmers, FPOs and government bodies is the most efficient one. It has the highest marketing efficiency of 17.48, much better than the others, which range from 0.891 to 1.186. Better income is assured to farmers as the price paid to them is ₹2770 per quintal, compared to ₹2100 in first value chain, ₹2150 in second value chain and ₹2350 third value chain. At ₹95.9 per quintal, the marketing cost is significantly lower than other three chains which ranges from ₹413.96 to ₹700.15. Government involvement in the fourth value chain guarantees stability and fair pricing. Moreover, the streamlined structure with fewer intermediaries indicates higher returns to farmers (Nedumaran *et al.*, 2020; Thakur *et al.*, 2024)^[24, 32]. Even though third chain shows relatively high farmer prices, it does not perform well in all aspect as the fourth chain. Less favourable are the first and second chains with more intermediaries making it more costly (Bhatia *et al.*, 2024; Grant and Startz, 2022)^[4, 10]. The fourth value chain is the most efficient, cost effective, farmer friendly, making it the best.

Conclusion

The study sheds light on marketing efficiency, value addition and farm income. Results unveiled that the study area in the North Western Plain Zone had four value chains of wheat. The fourth value chain, having direct farmer-to-FPO sales, was most optimal in terms of marketing efficiency (17.48), highest farmer price (₹2770 per quintal) and lowest cost of marketing (₹95.90 per quintal). The other value chains had much lower efficiency ranging from 0.891 to 1.186. Medium farmers had the highest cost of cultivation (₹35,985 per acre) and marginal farmers had the lowest (₹34,573 per acre). The average net farm income was ₹10,777 per acre, medium farmers had the highest (₹11,315 per acre) and marginal farmers had the lowest (₹10,147 per acre). Strengthening FPOs, enhancing marketing infrastructure and endorsing direct procurement from farmers can optimize the wheat value chain, guaranteeing higher farm returns and economic stability for farmers.

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