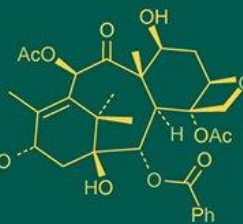
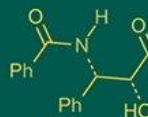


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Economic analysis of potato (*Solanum tuberosum* L.) production and marketing in Ballia district of Uttar Pradesh, India

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Abstract

Potato is an economically important staple crop in both developed and developing countries. Potato is grown about 150 countries throughout the world. China ranks 1st followed by India and Russia. India's ranks 3rd in area and it are the 2nd largest country in the world in potato production. The study was confined to the Ballia district of Uttar Pradesh. The district was selected purposively. 160 farmers were selected by simple random sampling method. There are 40 marginal 40 small, 40 medium and 40 large farmers from eight selected villages of the two block of the district. The farm level data and required information of potato growing farmers pertaining to crop year 2024-2025. Overall per hectare total cost of potato cultivation Rs 109425.81 varies directly with the farm size. Which was highest for large (Rs. 122148.02) size of holding followed by medium (Rs. 112533.45), small (Rs. 105370.40) marginal (Rs. 97852.80) size of holdings. Overall cost of production of Potato was estimated Rs. 452.67 per quintal. Per hectare gross income received by marginal, small, medium and large farms was Rs. 236617.50 Rs. 244125.00 Rs. 251863.50 and Rs. 260715.00 respectively with an overall average of Rs. 248335.50. The net income on potato production was highest for the large farmers (Rs. 138566.98) followed by medium (Rs. 139330.05) small (Rs. 138754.60) and marginal (Rs. 138764.70) farmers. The B: C which indicates the profitability of investment was observed to be 1:2.27 at the overall level. In Channel I, the highest marketing efficiency value of 9.75, In Channel II, the marketing efficiency declined sharply to 4.45 and Channel III, the lowest marketing efficiency of 2.38.

Keywords: Cost of production, potato, farm income measures, Benefit-cost ratio, Marketing Cost, Margin and Price Spread and efficiency

Introduction

The potato is a crop of significant economic importance, serving as a staple food source in both developed and developing nations. This versatile tuber is cultivated in approximately 150 countries worldwide. China holds the foremost position in production, followed by India and Russia. India ranks third in terms of cultivated area and is the second-largest producer of potatoes globally. Annually, approximately 380 million metric tonnes of potatoes are produced across more than 100 nations, with 50 percent of this yield being consumed in its fresh form. The tuber plays a crucial role in ensuring food security for millions of individuals in South America, Africa, Europe, and Asia. In the agricultural year 2018-19, India produced around 53 million metric tonnes of potatoes. The nation exports approximately 350,000 metric tonnes of potatoes annually, generating revenue in the range of Rs. 350-400 crore. (potatopro.com 2018-19) [9].

In India, potato cultivation occurs across various agro-climatic regions. Approximately 85 percent of the potato is produced in the Indo-Gangetic plains of northern India. Uttar Pradesh, West Bengal, Bihar, and Gujarat contribute to over 70 percent of the overall production. Within Uttar Pradesh, Ballia district holds considerable importance for vegetable cultivation. Located in the eastern part of the state, Ballia lies in the Middle Gangetic Plains agro-climatic zone and is characterized by fertile alluvial soils, favorable climate, and relatively abundant water resources. These conditions support year-round cultivation of vegetables such as potato, onion, okra, pointed gourd, green pea, and green chillies. According to official estimates, vegetables are grown over approximately 12,860 hectares in

the district, producing around 244,876 metric tonnes annually.

The potato (*Solanum tuberosum*) represents the most significant alimentary crop globally. This tuber is classified as a temperate crop, cultivated predominantly under the subtropical climatic conditions prevalent in India. Historically, the potato has been regarded as the 'friend of the impoverished'. The cultivation of this crop has a documented history extending over three centuries within the nation. In terms of vegetable applications, it has emerged as one of the most favored crops in this region. Potatoes serve as a cost-effective source of nourishment, supplying an economical form of energy within the human diet. They are an abundant source of starch, vitamins, particularly C and B₁, as well as essential minerals. The nutritional composition includes 20.6 percent carbohydrates, 2.1 percent protein, 0.3 percent fat, 1.1 percent crude fiber, and 0.9 percent ash. Additionally, they provide a substantial quantity of vital amino acids such as leucine, tryptophan, and isoleucine.

The potato, often referred to as 'The King of Vegetables,' has ascended to the status of the fourth most significant food crop in India, following rice, wheat, and maize. The inclusion of potatoes is indispensable in the Indian vegetable repertoire. This is attributable to the fact that the dry matter, edible energy, and edible protein content of potatoes render them a nutritionally superior vegetable and a staple food, not only within our nation but also on a global scale. Currently, it constitutes a fundamental component of breakfast, lunch, and dinner across various cultures worldwide. As a crop with a relatively short growth duration, it generates a greater yield of dry matter, edible energy, and edible protein in a shorter time frame compared to cereals such as rice and wheat. Consequently, potatoes may serve as an effective instrument for enhancing the nutritional security of the nation.

The crop is highly capital and labour intensive due to significant expenses on seed, fertilizer, and labour. Human labour constituted approximately 30 percent of the total cost of Rs. 74,461, with seed accounting for 18 percent. Consequently, the cost benefit ratio was 1:2.51 (Harbans and Sharma 2006) [3]. The total cost C₃ of potato cultivation was Rs. 86523.78 per hectare. The gross income averaged Rs. 188370 for farms (Singh et.al. 2019) [10]. The average cost of potato cultivation was Rs. 47408.91 per hectare. The gross and net returns from potato cultivation were Rs. 92766.74 and Rs. 45357.83, respectively. The overall input-output ratio was 1:1.96 (Sinha and Singh 2019) [12]. The total cost of potato cultivation was calculated to be Rs 96272.30 per hectare. This was highest for large holdings (Rs. 109402.21), followed by medium (Rs. 101713.80), small (Rs. 90349.28), and marginal (Rs. 83623.96) holdings. The cost C₃, accounting for managerial functions performed by farmers, was Rs. 105899.53. The gross income, net income, farm business income, and family labour income per hectare amounted to Rs. 257440.38, Rs. 161168.08, Rs. 192972.85, and Rs. 170435.55, respectively. The B: C ratio, indicating investment profitability, was observed to be 2.67 overall (Kumar et.al. 2021) [5]. The average cost of cultivation was estimated at Rs. 82560.79 per hectare, with a net income of Rs. 88993.96 and an input-output ratio of 1:2.08, indicating crop profitability (Kumar et.al. 2022) [4]. On average, Rs. 92552.03 was spent per hectare on potato cultivation. In the medium farm category, the highest

expenditure was Rs. 100166, followed by small farms at Rs. 92867 and marginal farms at Rs. 84623.09. (Kumari and Maurya 2023) [7]. Producers received approximately 70.80% and 68.60% of consumer prices in Channel-I and Channel-II, respectively. Likewise, the shares were 70.90% and 68.30% for Channel-I and Channel-II (Balaji, et.al. 2010) [1]. The total marketing costs and margins were Rs.100 for Channel-I, Rs.466.42 for Channel-II, Rs.731.19 for Channel-III, and Rs.154 for Channel-IV (Kumar et.al. 2015) [6]. The farmer's share of the consumer's expenditure is approximately 25.00% for carrots and 41.00% for tomatoes. The marketing efficiency indices of 0.33 for carrots and 0.71 for tomatoes are notably low (Chand et.al. 2020) [2].

Materials and Methods

Selection of Study Area

Uttar Pradesh is broadly divided into nine agro-climatic regions, namely: Tarai and Bhabar Region, Western Plain Zone, Mid-Western Plain Zone, South-Western Semi-Arid Zone, Upper Gangetic Plain Zone, Central Plain Zone, Bundelkhand Zone, Eastern Plain Zone (also known as the North-Eastern Plain Zone or Poorvi Maidan Kshetra), and Vindhyan Zone.

Selection of District

The Eastern Plain Zone of Uttar Pradesh comprises nine districts, namely Azamgarh, Mau, Ballia, Faizabad, Ghazipur, Jaunpur, Sant Ravidas Nagar, and Varanasi. From these districts, Ballia district was selected for the study. The selection was made purposively due to the district's considerable area under potato cultivation.

Selection of blocks

A list of all 17 blocks were prepared on the basis of Potato growing area. Two block namely Murlichhapra and Bairia block were purposively selected for the study.

Selection of Villages

A comprehensive list of villages under Murlichhapra and Bairia blocks was prepared in consultation with Block Development Officers and arranged based on the number of Potato growers. From this list, eight villages were selected randomly for detailed investigation. These villages were Sonbarsa, Bhojpur, Lakshimpur, Dalan Chhapara, Upadhyapur, Chakiya Jamalpur, Madhubani, and Karmanpur.

Selection of Sample Size and Farmers

A complete list of Potato growing farmers was prepared for each selected village. Farmers were classified into four categories based on landholding size: marginal farmers (below 1 ha), small farmers (1-2 ha), medium farmers (2-4 ha), and large farmers (above 4 ha). From each category, five farmers were selected randomly from each village, resulting in a total sample size of 160 farmers.

Sources of data

Primary data were collected directly from the selected farmers through personal interviews using a pre-structured and pre-tested schedule.

Period of Study

The study was conducted in year 2024-25.

Analytical tools

The data of selected farmers is analyzed using the Tabular analysis, Simple averages and Percentages. These formula helped in easy interpretation and comparison of the results.

Arithmetic Mean

$$\text{Arithmetic Mean} = \frac{\sum X}{N}$$

Where,

$\sum X$ = Sum of all observations

N = Number of observations

Percentage

$$\text{Percentage} = \frac{\text{Part}}{\text{Total}} \times 100$$

Where,

Part = Value of a specific item

Total = Overall total value

The cost and returns of Potato crops:

For calculating the cost and returns, tabular analysis, averages, and percentages were used. The standard Cost Concepts Method recommended by the Commission for Agricultural Costs and Prices (CACP) were used.

CACP Cost Concepts:

The following cost components were calculated:

Cost A₁: Includes all actual cash and kind expenses, such as:

1. Value of hired human labour.
2. Value of owned bullock labour.
3. Value of hired bullock labour.
4. Value of owned machine labour.
5. Hired machinery charges.
6. Value of fertilizers.
7. Value of manure (produced farm and purchased).
8. Value of seed (both farm-produced and purchased).
9. Value of insecticides, pesticides and fungicides.
10. Irrigation charges.
11. Canal water charges.
12. Land revenue, cusses and other taxes.
13. Depreciation on implements and farm building.
14. Interest on the working capital.

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

Cost B₁: Cost A₁ + Interest on owned fixed capital (excluding 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 Cost C₂ (managerial cost)

Farm Income Measures

Gross Income = Total value of produce

Net Income = Gross Income - Cost C₃

Farm Business Income = Gross Income - Cost A₁

Family Labour Income = Gross Income - Cost B₂

Benefit-Cost Ratio (BCR) = Gross Returns/Total Cost

Return per Rupee of Investment = Gross Returns/Total Cost

Results and Discussion

The Per hectare costs of different inputs used in potato cultivation (Rs/ha) is presented in table1. Overall per hectare total cost of potato cultivation Rs 109425.81 varies directly with the farm size. Which was highest for large (Rs.122148.02) size of holding followed by medium (Rs. 112533.45), small (Rs. 105370.40) marginal (Rs. 97852.80) size of holdings. Overall per hectare operational cost was Rs.68855.43 (62.92 percent of the total cost). The per hectare fixed/overhead cost came out to be Rs.99478.01 (90.91 percent of the total cost).

Table 1: Per hectare costs of different inputs used in potato cultivation (Rs./ha)

Sl. No.	Particulars	Size group of farm				Overall average
		Marginal (40)	Small (40)	Medium (40)	Large (40)	
1.	Human Labour	17492.62 (17.88)	20221.37 (19.19)	21232.53 (18.87)	23043.71 (18.86)	20497.56 (18.73)
a)	Family labour	8895.40 (09.09)	7457.65 (07.08)	5668.55 (05.04)	4550.00 (03.72)	6642.90 (06.07)
b)	Hired labour	8597.22 (08.79)	12763.72 (12.11)	15563.98 (13.83)	18493.71 (15.14)	13854.66 (12.66)
2.	Tractor charges/ machinery charges	5849.90 (05.98)	6784.80 (06.44)	7579.54 (06.74)	8167.45 (06.69)	7095.42 (06.48)
3.	Potato tubers (seeds)	21250.00 (21.72)	22950.00 (21.78)	25500.00 (22.66)	29750.00 (24.36)	24862.50 (22.72)
4.	Manure & fertilizer	11750.90 (12.01)	12005.55 (11.39)	12953.70 (11.51)	13970.45 (11.44)	12670.15 (11.58)
5.	Irrigation	5655.50 (05.78)	6478.05 (06.15)	6990.50 (06.21)	7540.40 (06.17)	6666.11 (06.09)
6.	Plant protection	3054.48 (03.12)	3407.60 (03.23)	4005.75 (03.56)	4358.51 (03.57)	3706.59 (03.39)
7.	Total working/ Operational cost	56158.00 (57.39)	64389.72 (61.11)	72593.47 (64.51)	82280.52 (67.36)	68855.43 (62.92)
8.	Interest on working capital	1123.16 (01.15)	1287.78 (01.22)	1451.87 (01.29)	1645.61 (01.35)	1377.11 (1.25)
9.	Rental value of land	22500.00 (22.99)	22500.00 (21.35)	22500.00 (19.99)	22500.00 (18.42)	22500.00 (20.56)
10.	Interest on fixed capital	280.53 (0.29)	156.12 (0.15)	89.25 (0.08)	67.52 (0.06)	102.57 (0.09)
11.	Fixed/overhead cost	88957.09 (90.91)	95791.27 (90.91)	102303.14 (90.91)	111043.65 (90.91)	99478.01 (90.91)
12.	Managerial cost @ 10 of sub total	8895.71 (09.09)	9579.13 (09.09)	10230.31 (09.09)	11104.37 (09.09)	9947.80 (09.09)
	Grand total	97852.80 (100)	105370.40 (100)	112533.45 (100)	122148.02 (100)	109425.81 (100)

(*Figures in parentheses indicate percent to total number of farmers)

The percent share of seed cost to the total cost was as high as 24.36, 22.66 and 21.78 percent on large farms, medium and small as low as 21.72 percent on marginal farm size group. Overall highest cost was seed of potato (22.72 percent) followed by rental value of own land (20.56 percent), human labour (18.73 percent), Manure & fertilizer (11.58 percent), irrigation charges (06.09 percent) and plant protection charges (03.39 percent) respectively.

Table 2: Measures of per-hectare cost and profits of potato (Rs./ha)

Sl. No.	Particulars	Size group of farm				Overall average
		Marginal (40)	Small (40)	Medium (40)	Large (40)	
1.	Cost A ₁ /A ₂	57281.16	65677.50	74045.34	83926.13	70232.54
a	Cost B ₁	57561.69	65833.62	74134.59	83993.65	70335.11
b	Cost B ₂	80061.69	88333.62	96634.59	106493.65	92835.11
2.	Cost C ₁	66457.09	73291.27	79803.14	88543.65	76978.01
3.	Cost C ₂	88957.09	95791.27	102303.14	111043.65	99478.01
4.	Cost C ₃	97852.80	105370.40	112533.45	122148.02	109425.81
5.	Yield (q/ha)	225.35	232.50	239.87	248.30	236.51
6.	Gross Income	236617.50	244125.00	251863.50	260715.00	248335.50
7.	Net return over cost C ₃	138764.70	138754.60	139330.05	138566.98	138909.69
8.	Family Income	156555.81	155791.38	177818.16	176788.87	178102.96
9.	Farm business income	179336.34	178447.50	155228.91	154221.35	155500.39
10.	Farm investment income	170440.94	170989.85	172149.61	172238.87	171460.06
11.	Cost of production (qt./ha)	434.23	453.21	469.14	491.94	462.67
12.	Input-Output ratio					
a.	On the basis of Cost A ₁ /A ₂	1:4.13	1:3.72	1:3.40	1:3.11	1:3.54
b.	On the basis of cost B ₁	1:4.11	1:3.70	1:3.39	1:3.10	1:3.53
c.	On the basis of cost B ₂	1:2.96	1:2.76	1:2.61	1:2.45	1:2.68
d.	On the basis of cost C ₁	1:3.56	1:3.33	1:3.16	1:2.94	1:3.23
e.	On the basis of cost C ₂	1:2.66	1:2.55	1:2.46	1:2.35	1:2.50
f.	On the basis of cost C ₃	1:2.42	1:2.32	1:2.24	1:2.13	1:2.27
13.	B:C Ratio	1:2.42	1:2.32	1:2.24	1:2.13	1:2.27

Table 2. indicates that per hectare, overall total cost C₃ of potato was Rs. 109425.81. Per hectare gross income received by marginal, small, medium and large farms was Rs. 236617.50 Rs. 244125.00 Rs. 251863.50 and Rs. 260715.00 respectively with an overall average of Rs. 248335.50. Overall cost of production of Potato was estimated Rs. 452.67 per quintal being Rs. 434.23, Rs. 453.21, 469.14 and Rs. 419.94 on marginal, small, medium and large farms. respectively. The net income on potato production was highest for the large farmers (Rs.138566.98) followed by medium (Rs.139330.05) small (Rs.138754.60) and marginal (Rs.138764.70) farmers. The B: C which indicates the profitability of investment was observed to be 1:2.27at the overall level. The benefit-cost ratio was highest in large size farm (1:2.13) followed by medium (1:2.24), small (1:2.32) and marginal (1:2.42) farmers.

Existing Marketing Channels for vegetables in the Study Area

The commonly observed marketing channels in the study area were as follows:

Channel I

Producer → Consumer

This channel was mainly adopted by marginal and small farmers who sold their produce directly in local markets, village haats, or roadside markets. Although this channel involved minimal marketing costs and no intermediary margins, it required farmers to spend more time and effort on marketing activities.

Channel II

Producer → Retailer → Consumer

This was one of the most widely used channels in the study area. Farmers sold their vegetables directly to retailers in nearby markets. This channel reduced marketing costs compared to longer channels, but farmers still received a lower price than the consumer price due to retailer margins.

Channel III

Producer → Wholesaler → Retailer → Consumer

This channel was predominantly used by medium and large farmers who marketed larger quantities of vegetables. While it ensured quick disposal of produce and access to larger markets, the presence of multiple intermediaries increased marketing costs and reduced the producer's share in the consumer's rupee.

Price Spread of Potato under Different Marketing Channels:

The table 3. presents the price spread of potato under different marketing channels in the study area. It is evident that the price received by producers decreased with an increase in the length of the marketing channel.

Under Channel I (Producer → Consumer), farmers received the highest price of ₹1050 per quintal, as no intermediaries were involved. The marketing cost incurred by the producer in this channel was Rs. 120 per quintal, and the consumer paid Rs.1170 per quintal.

In Channel II (Producer → Retailer → Consumer) the price received by the producer declined to Rs. 1000 per quintal due to the involvement of the retailer. The retailer incurred a marketing cost of Rs.110 per quintal and earned a margin of Rs. 180 per quintal, resulting in a consumer price of Rs. 1380 per quintal. Consequently, the producer's share in the consumer's rupee declined to 72.46 percent.

Channel III (Producer → Wholesaler → Retailer → Consumer) involved both wholesalers and retailers, leading to higher marketing costs and margins. The producer received the lowest price of Rs. 950 per quintal. The wholesaler incurred a marketing cost of Rs. 100 per quintal with a margin of Rs. 110 per quintal, while the retailer incurred a marketing cost of Rs. 85 per quintal and earned a margin of Rs. 200 per quintal. As a result, the consumer paid the highest price of Rs. 1635 per quintal, and the producer's share further declined to 58.10 percent.

Marketing Cost, Margin and Price Spread under Different Channels

The table 4. shows the marketing cost, marketing margin, and price spread of potato under different marketing channels in the study area. It is evident that marketing costs and margins increased with an increase in the number of

intermediaries involved in the marketing process. In Channel I (Producer to Consumer), the total marketing cost was the lowest at Rs. 120 per quintal, as there were no intermediaries. Consequently, the price spread was also minimum at Rs. 120 per quintal, and the consumer paid the lowest price of Rs.1170 per quintal.

Table 3: Price Spread of potato under Different Marketing Channels (Rs./quintal)

Sl. No.	Particular	Channel I	Channel II	Channel III
1.	Price received by producer	1050	1000	950
2.	Marketing cost incurred by producer	120	110	100
3.	Sale price of wholesaler	-	-	1050
4.	Marketing cost of wholesaler	-	-	80
5.	Margin of wholesaler	-	-	110
6.	Sale price of retailer	-	1110	1350
7.	Marketing cost of retailer	-	90	85
8.	Margin of retailer	-	180	200
9.	Price paid by consumer	1170	1380	1635
10.	Producer's share in consumer's rupee (%)	89.75	72.46	58.10

In Channel II (Producer to Retailer to Consumer), the total marketing cost increased to Rs. 110 per quintal due to the involvement of the retailer. In addition, the retailer earned a marketing margin of Rs. 200 per quintal, which resulted in a higher price spread of Rs. 380 per quintal. As a result, the consumer price increased to Rs.1380 per quintal.

Channel III (Producer to Wholesaler to Retailer to Consumer) involved both wholesalers and retailers, leading to the highest marketing cost and margin. The total marketing cost amounted to Rs. 100 per quintal, while the combined marketing margin was Rs. 310 per quintal. This led to the widest price spread of Rs. 685 per quintal and the highest consumer price of Rs.1635 per quintal.

Table 4: Marketing Cost, Margin and Price Spread under Different Channels (Rs./quintal)

Sl. No.	Particulars	Channel I	Channel II	Channel III
1.	Total marketing cost	120	110	100
2.	Total marketing margin	-	200	310
3.	Price spread	120	380	685
4.	Consumer price	1170	1380	1635

Marketing Efficiency of Different Marketing Channels

The table 5. presents the marketing efficiency of vegetables under different marketing channels in the study area. It is evident that marketing efficiency declined with an increase in the number of intermediaries involved in the marketing process.

Channel I (Producer to Consumer) recorded the highest marketing efficiency value of 9.75, owing to the lowest combined marketing cost and margin of ₹120 per quintal. The absence of intermediaries in this channel resulted in minimal price spread and maximum benefit to the producers.

In Channel II (Producer to Retailer to Consumer), the marketing efficiency declined sharply to 4.45 due to a higher total marketing cost and margin amounting to ₹310 per quintal. The involvement of the retailer increased marketing expenses and reduced the efficiency of the channel.

Channel III (Producer to Wholesaler to Retailer to Consumer) showed the lowest marketing efficiency of 2.38, as it involved the highest total marketing cost and margin of ₹685 per quintal. The presence of multiple intermediaries

led to increased marketing costs, wider price spread, and reduced efficiency.

Table 5: Marketing Efficiency of Different Marketing Channels

Sl. No.	Marketing Channel	Value of goods sold (Rs./q)	Total marketing cost + margin (₹/q)	Marketing Efficiency
1.	Channel I	1170	120	9.75
2.	Channel II	1380	310	4.45
3.	Channel III	1635	685	2.38

Conclusion

Overall per hectare total cost of potato cultivation Rs 109425.81 varies directly with the farm size. Which was highest for large (Rs. 122148.02) size of holding followed by medium (Rs. 112533.45), small (Rs. 105370.40) marginal (Rs. 97852.80) size of holdings. Overall highest cost was seed of potato (22.72 percent) followed by rental value of own land (20.56per cent), human labour (18.73 percent), Manure & fertilizer (11.58 percent), irrigation charges (06.09 percent) and plant protection charges (03.39 percent) respectively. Overall cost of production of Potato was estimated Rs. 452.67 per quintal. Per hectare gross income received by marginal, small, medium and large farms was Rs. 236617.50 Rs. 244125.00 Rs. 251863.50 and Rs. 260715.00 respectively with an overall average of Rs. 248335.50. The net income on potato production was highest for the large farmers (Rs. 138566.98) followed by medium (Rs. 139330.05) small (Rs. 138754.60) and marginal (Rs. 138764.70) farmers. The B: C which indicates the profitability of investment was observed to be 1:2.27at the overall level. Gross income, farm business income and family labour income and net income over cost C₁, C₂ and C₃ vary directly with the farm size. The production cost exhibits an upward trend from marginal to large farmers. This is attributed to the ability of large farmers to invest more in modern agricultural inputs such as high-quality seeds, hired labor, fertilizers, manure, plant protection, and machinery. An analysis of costs among potato growers reveals a rising trend in C₃ costs corresponding with large farm sizes. Channel I (Producer to Consumer) recorded the highest marketing efficiency value of 9.75, owing to the lowest combined marketing cost and margin of ₹120 per quintal. In Channel II (Producer to Retailer to Consumer),

the marketing efficiency declined sharply to 4.45 due to a higher total marketing cost and margin amounting to ₹310 per quintal. Channel III (Producer to Wholesaler to Retailer to Consumer) showed the lowest marketing efficiency of 2.38, as it involved the highest total marketing cost and margin of ₹685 per quintal.

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