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Marketing channels, price spread and marketing efficiency of fish marketed through fishermen's cooperatives in the Tribal districts of Chhattisgarh, India

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Abstract

Fish marketing in tribal regions of central India remains structurally fragmented, and little empirical evidence exists on how the marketing system erodes producer incomes among cooperative-based tribal fish farmers. This study estimates the marketing channels, marketed surplus disposal pattern, price spread and marketing efficiency of fish in four tribal-dominated districts of Chhattisgarh, namely Jashpur, Balrampur, Kanker and Bastar, situated in the Northern Hills and Bastar Plateau agro-climatic zones. Primary data were collected from 552 members of fishermen's cooperative societies selected through multistage cluster sampling with purposive selection of five cooperatives per district. Price spread was decomposed by cost component, and marketing efficiency was evaluated using the conventional output-input ratio, Shepherd's index and Acharya's index. Three marketing channels were identified: Channel I (Producer-Consumer), Channel II (Producer-Retailer-Consumer) and Channel III (Producer-Wholesaler-Retailer-Consumer). The producer's share in the consumer rupee declined consistently with channel length, from 80.60–82.24 per cent in Channel I to 64.45–67.19 per cent in Channel III across districts. Transportation was the dominant marketing cost in Channel I (34.09–45.35 per cent), while retailer margins absorbed 45.39–48.79 per cent of the spread in Channel II. Shepherd's and Acharya's indices consistently ranked the direct channel as most efficient in all four districts. The findings support policy investment in cooperative-owned cold storage, refrigerated transport, regulated rural fish markets with direct producer access, and digital farm-gate aggregation platforms to compress the price spread and raise producer shares.

Keywords: Fish marketing, price spread, producer's share, marketing efficiency, Shepherd's index, Acharya's index, fishermen's cooperatives, tribal livelihoods, Chhattisgarh

1. Introduction

Inland fisheries have emerged as an important source of livelihood, income and nutritional security for tribal households in Chhattisgarh, a state whose fish production expanded from 1.395 lakh tonnes in 2007–08 to an anticipated 7.30 lakh tonnes in 2023–24. This growth, however, has been concentrated in the Central Plains agro-climatic zone, where productivity reached 4.77 metric tonnes per hectare in 2023–24, against only 1.802 and 2.168 metric tonnes per hectare in the Northern Hills and Bastar Plateau zones, respectively. Together, these two tribal-dominated zones account for approximately 49 per cent of the state's geographical area yet contribute less than 27 per cent of its fish production. The state also produces a large seed surplus, with about 418.07 crore fish seeds against a local requirement of roughly 153 crore, underscoring the need to examine how the marketable output and surplus of tribal producers move through marketing channels and how the resulting price spread is distributed among market functionaries.

Evidence from other Indian states shows that the structure of fish marketing strongly conditions producer welfare. Direct or short channels have been repeatedly found most efficient, whether in unregulated markets of Srinagar (Gawa *et al.*,

2017) ^[4], coastal Gujarat (Parmar *et al.*, 2018) ^[5], the Northern Dry Zone of Karnataka (Uday Raj *et al.*, 2022) ^[6] or Telangana (Sindhu *et al.*, 2022) ^[7], while intermediary-heavy chains transfer a disproportionate share of the consumer rupee to retailers and wholesalers (Das *et al.*, 2023) ^[3]. Within Chhattisgarh, Banjare and Joshi (2023) ^[2] reported a fisher's share of 98.33 per cent in the direct channel in Raipur district against 69.52 per cent in the wholesaler-mediated channel. Comparable evidence for the tribal districts of the state, where fish is marketed largely through cooperative societies of Particularly Vulnerable Tribal Groups and other Scheduled Tribe communities, is virtually absent.

The present study addresses this gap by pursuing the fourth objective of a broader economic analysis of fish production under fishermen's cooperatives in tribal Chhattisgarh: to estimate the marketing channels, surplus and price spread of fish in the study area. Specifically, the paper (i) identifies the marketing channels used by cooperative fish farmers and the frequency of their use, (ii) decomposes the price spread into its cost and margin components for each channel and district, and (iii) compares marketing efficiency across channels using the conventional, Shepherd's and Acharya's methods.

2. Materials and Methods

2.1 Study area

Chhattisgarh (17°46'–24°05' N; 80°15'–84°20' E) is divided into three agro-climatic zones: the Chhattisgarh Plains, the Northern Hills and the Bastar Plateau. The Northern Hills and Bastar Plateau zones were purposively selected because they concentrate the state's tribal population. Within these zones, the Sarguja division (27.29 per cent of the state's Scheduled Tribe population) and Bastar division (26.45 per cent) were selected, and from them four districts with consistent fish farming activity: Jashpur and Balrampur (Northern Hills) and Kanker and Bastar (Bastar Plateau). These districts are inhabited by tribal groups such as the Oraon, Pahadi Korwa, Birhor, Gond, Maria, Muria, Dhurwa, Halba and Bhatra, for whom pond aquaculture, community tank fisheries and capture fishing in streams constitute significant supplementary livelihoods.

2.2 Sampling design and data

A multistage cluster sampling design with purposive selection was adopted. Five active fishermen's cooperative societies (clusters) were selected in each district, each with a minimum of 25 members, yielding 552 sampled respondents across the four districts. Cochran's formula at the 95 per cent confidence level ($Z = 1.96$, $p = 0.5$, $e = 0.05$) indicated a minimum required sample of approximately 384 respondents; the design effect ($DEFF = n_1/n_0 = 552/384 \approx 1.44$) falls in the 1.0–1.5 range, indicating a good fit with minimal clustering effect. Primary data were collected with a pre-tested schedule administered through the KoboToolbox platform, covering producer sale prices, marketing costs by function, intermediary margins and channel choice. Secondary data on fish production and seed stocking for 2021–22 to 2023–24 were drawn from the Directorate of Fisheries, Chhattisgarh, and cooperative registers under the National Cooperative Database.

2.3 Analytical framework

The marketing channels were mapped from producer to final consumer and their frequency of use recorded district-wise. The producer's (fisherman's) share in the consumer rupee was computed as the ratio of the net price received by the producer to the retail price paid by the consumer, expressed in percentage terms. Price spread was estimated as the difference between the retail price and the net price received by the fisherman per kilogram of fish, and was decomposed into loading and unloading charges, transportation, market entry fee, storage, cleaning and processing, miscellaneous costs, and retailer and wholesaler margins.

Marketing efficiency was assessed by three complementary measures: (i) the conventional method, expressed as the ratio of value added (output, O) to marketing cost (input, I); (ii) Shepherd's index, computed as the ratio of the consumer's price to total marketing cost minus one, which treats a higher ratio of retail price to marketing cost as evidence of greater efficiency; and (iii) Acharya's modified measure, which relates the net price received by the farmer to the sum of marketing costs and marketing margins, thereby penalising channels in which intermediary margins are large relative to the producer's realisation.

3. Results and Discussion

3.1 Marketing channels and disposal of marketed surplus

Three marketing channels were found to operate across all sampled districts: Channel I (Producer → Consumer), Channel II (Producer → Retailer → Consumer) and Channel III (Producer → Wholesaler → Retailer → Consumer). Table 1 reports the district-wise frequency with which cooperative producers disposed of their marketed surplus through each channel. Direct sale (Channel I) dominated in Jashpur (57.14 per cent of transactions), Balrampur (57.14 per cent) and Kanker (50.00 per cent), indicating that a substantial part of the marketable surplus is absorbed by localised rural demand at or near the farm gate. In Bastar, Channels I and III shared dominance (44.44 per cent each), reflecting the dual character of its markets: direct rural sale coexisting with wholesaler-mediated movement of surplus fish to urban centres. Channel II had a comparatively limited presence everywhere except Kanker (33.33 per cent).

Table 1: District-wise frequency of marketing channels used by cooperative fish producers

District	Channel I	Channel II	Channel III
Jashpur	4 (57.14%)	1 (14.28%)	2 (28.57%)
Balrampur	4 (57.14%)	2 (28.57%)	1 (14.28%)
Kanker	3 (50.00%)	2 (33.33%)	1 (16.67%)
Bastar	4 (44.44%)	1 (11.11%)	4 (44.44%)

Note: Channel I: Producer→Consumer; Channel II: Producer→Retailer→Consumer; Channel III: Producer→Wholesaler→Retailer→Consumer. Source: Field survey.

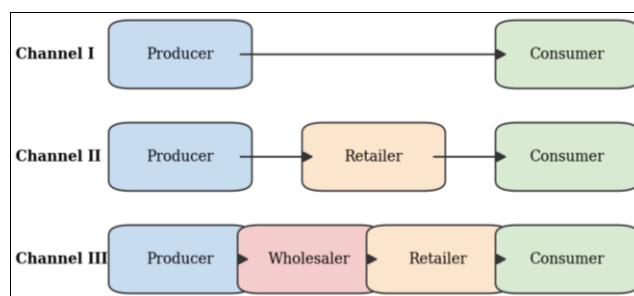


Fig 1: Structure of the identified fish marketing channels in the study area

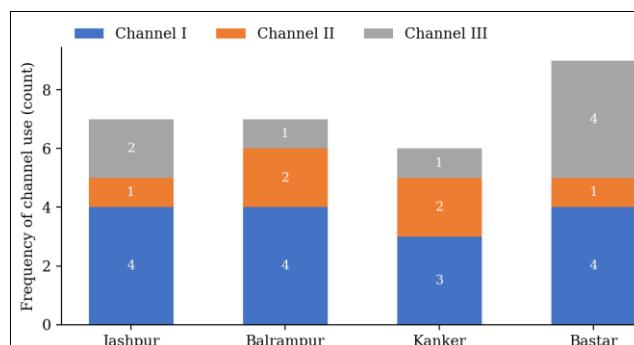


Fig 2: District-wise frequency of marketing channel use by cooperative producers

3.2 Price spread and marketing costs

Tables 2 to 5 decompose the price spread by district and channel. In every district the producer's sale price was invariant across channels, so the entire inter-channel difference in the consumer price is attributable to marketing costs and intermediary margins. In Jashpur (Table 2), the consumer price rose from Rs. 161.02 per kg in Channel I to Rs. 203.56 in Channel III, and the producer's share in the

consumer rupee fell correspondingly from 81.62 to 64.57 per cent. Transportation was the single largest cost item in Channel I (Rs. 13.29 per kg; 44.96 per cent of marketing cost), reflecting the spatial dispersion of production centres and markets in this hilly district, while the retailer's margin of Rs. 28.00 per kg absorbed 46.43 per cent of the spread in Channel II.

Table 2: Price spread and marketing cost analysis in Jashpur

Particulars	Channel I	Channel II	Channel III
Producer's sale price (Rs./kg)	131.43	131.43	131.43
Loading/unloading (Rs./kg)	2.00 (6.77)	3.57 (5.92)	5.00 (6.94)
Transportation (Rs./kg)	13.29 (44.96)	11.00 (18.24)	9.00 (12.48)
Market entry fee (Rs./kg)	0.50 (1.69)	0.50 (0.83)	0.50 (0.69)
Storage (Rs./kg)	6.00 (20.30)	8.00 (13.27)	10.00 (13.87)
Cleaning/processing (Rs./kg)	0.10 (0.34)	0.10 (0.17)	0.10 (0.14)
Miscellaneous (Rs./kg)	7.70 (25.94)	9.17 (15.14)	9.73 (13.44)
Retailer's margin (Rs./kg)	0.00 (0.00)	28.00 (46.43)	28.00 (38.84)
Wholesaler's margin (Rs./kg)	0.00 (0.00)	0.00 (0.00)	9.80 (13.59)
Consumer's price (Rs./kg)	161.02	191.77	203.56
Producer's share in consumer rupee (%)	81.62	68.54	64.57

Note: Figures in parentheses are percentages of the total marketing cost/margin component in the respective channel. Source: Field survey

Balrampur (Table 3) mirrored this pattern: transportation accounted for 45.35 per cent of Channel I marketing cost, storage and miscellaneous expenses were substantial (21.96 and 25.24 per cent), and regulatory charges such as the

market entry fee were negligible. The retailer's margin of Rs. 30.00 per kg dominated Channels II and III, and the producer's share fell from 80.60 per cent in Channel I to 64.45 per cent in Channel III.

Table 3: Price spread and marketing cost analysis in Balrampur

Particulars	Channel I	Channel II	Channel III
Producer's sale price (Rs./kg)	142.86	142.86	142.86
Loading/unloading (Rs./kg)	1.89 (5.66)	3.50 (5.29)	3.71 (4.77)
Transportation (Rs./kg)	15.14 (45.35)	12.56 (19.00)	11.20 (14.37)
Market entry fee (Rs./kg)	0.50 (1.50)	0.50 (0.76)	0.50 (0.64)
Storage (Rs./kg)	7.33 (21.96)	9.45 (14.30)	11.38 (14.60)
Cleaning/processing (Rs./kg)	0.10 (0.30)	0.10 (0.15)	0.10 (0.13)
Miscellaneous (Rs./kg)	8.43 (25.24)	9.99 (15.11)	10.55 (13.53)
Retailer's margin (Rs./kg)	0.00 (0.00)	30.00 (45.39)	30.00 (38.49)
Wholesaler's margin (Rs./kg)	0.00 (0.00)	0.00 (0.00)	10.50 (13.47)
Consumer's price (Rs./kg)	177.25	209.96	221.67
Producer's share in consumer rupee (%)	80.60	68.04	64.45

Note: Figures in parentheses are percentages of the total marketing cost/margin component in the respective channel. Source: Field survey.

In Kanker (Table 4), producers realised the highest share in the consumer rupee among the four districts in the direct channel (82.24 per cent). Transportation remained the largest cost component in Channel I (34.09 per cent), but storage costs were notably high (24.19 per cent), pointing to

longer holding periods and inadequate cold-chain facilities that raise both cost and the risk of post-harvest quality loss. In Channels II and III the retailer's margin of Rs. 29.33 per kg accounted for 48.79 and 40.75 per cent of the respective spreads.

Table 4: Price spread and marketing cost analysis in Kanker

Particulars	Channel I	Channel II	Channel III
Producer's sale price (Rs./kg)	145.00	145.00	145.00
Loading/unloading (Rs./kg)	3.67 (12.11)	4.20 (6.99)	4.90 (6.81)
Transportation (Rs./kg)	10.33 (34.09)	8.39 (13.96)	7.48 (10.39)
Market entry fee (Rs./kg)	0.50 (1.65)	0.50 (0.83)	0.50 (0.69)
Storage (Rs./kg)	7.33 (24.19)	7.79 (12.96)	8.10 (11.26)
Cleaning/processing (Rs./kg)	0.10 (0.33)	0.10 (0.17)	0.10 (0.14)
Miscellaneous (Rs./kg)	8.38 (27.65)	9.81 (16.31)	10.37 (14.40)
Retailer's margin (Rs./kg)	0.00 (0.00)	29.33 (48.79)	29.33 (40.75)
Wholesaler's margin (Rs./kg)	0.00 (0.00)	0.00 (0.00)	11.20 (15.56)
Consumer's price (Rs./kg)	176.32	206.12	217.82
Producer's share in consumer rupee (%)	82.24	70.35	66.57

Note: Figures in parentheses are percentages of the total marketing cost/margin component in the respective channel. Source: Field survey

Bastar (Table 5) recorded the highest producer sale price (Rs. 148.89 per kg) and a Channel I producer share of 82.22 per cent. Transportation constituted 37.78 per cent of Channel I marketing cost, and the combined burden of storage, cleaning and miscellaneous expenses again signalled post-harvest inefficiencies. In the wholesaler-

mediated Channel III, which handles a large part of Bastar's urban-bound surplus, the retailer (Rs. 28.80 per kg; 40.09 per cent) and wholesaler (Rs. 9.80 per kg; 13.64 per cent) together captured over half of the price spread, reducing the producer's share to 67.19 per cent.

Table 5: Price spread and marketing cost analysis in Bastar

Particulars	Channel I	Channel II	Channel III
Producer's sale price (Rs./kg)	148.89	148.89	148.89
Loading/unloading (Rs./kg)	3.00 (9.62)	3.87 (6.36)	4.10 (5.71)
Transportation (Rs./kg)	11.78 (37.78)	9.10 (14.96)	8.79 (12.24)
Market entry fee (Rs./kg)	0.50 (1.60)	0.50 (0.82)	0.50 (0.70)
Storage (Rs./kg)	7.20 (23.09)	8.46 (13.91)	9.20 (12.81)
Cleaning/processing (Rs./kg)	0.10 (0.32)	0.10 (0.16)	0.10 (0.14)
Miscellaneous (Rs./kg)	8.61 (27.61)	10.03 (16.48)	10.54 (14.68)
Retailer's margin (Rs./kg)	0.00 (0.00)	28.80 (47.32)	28.80 (40.09)
Wholesaler's margin (Rs./kg)	0.00 (0.00)	0.00 (0.00)	9.80 (13.64)
Consumer's price (Rs./kg)	181.08	210.75	221.59
Producer's share in consumer rupee (%)	82.22	70.65	67.19

Note: Figures in parentheses are percentages of the total marketing cost/margin component in the respective channel. Source: Field survey.

Figures 3 and 4 summarise these patterns visually. The producer's share in the consumer rupee (Figure 3) declines by roughly 13–18 percentage points as the channel lengthens in every district, while the consumer price build-up (Figure 4) shows that the gap between the producer's sale price and the consumer price widens from about Rs. 30 per kg in Channel I to Rs. 72–79 per kg in Channel III. Figure 5 decomposes the Channel I marketing cost, confirming the dominance of transportation (34.09–45.35 per cent) followed by miscellaneous and storage expenses across all four districts.

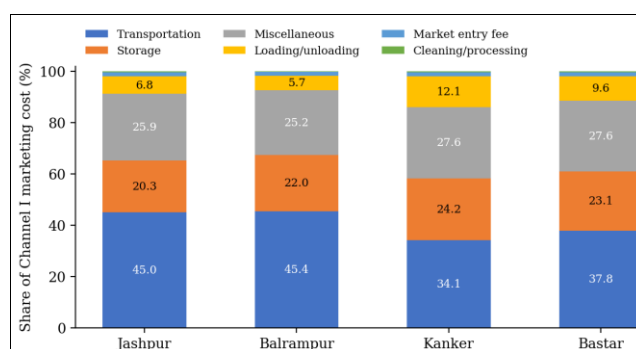


Fig 5: Composition of Channel I marketing costs by district (per cent of total marketing cost)

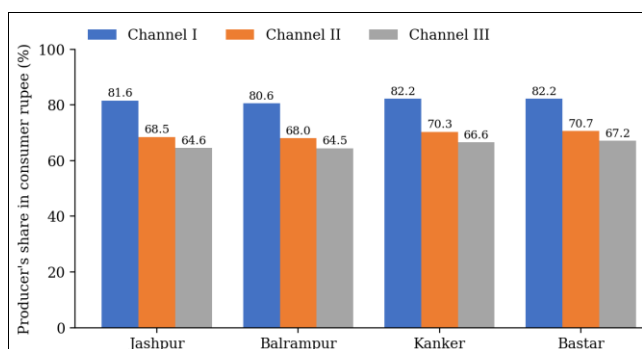


Fig 3: Producer's share in the consumer rupee by district and marketing channel

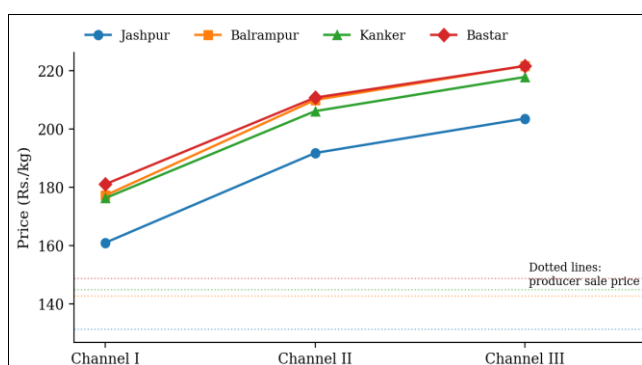


Fig 4: Consumer price build-up across marketing channels (dotted lines show producer sale prices)

3.3 Marketing efficiency across channels

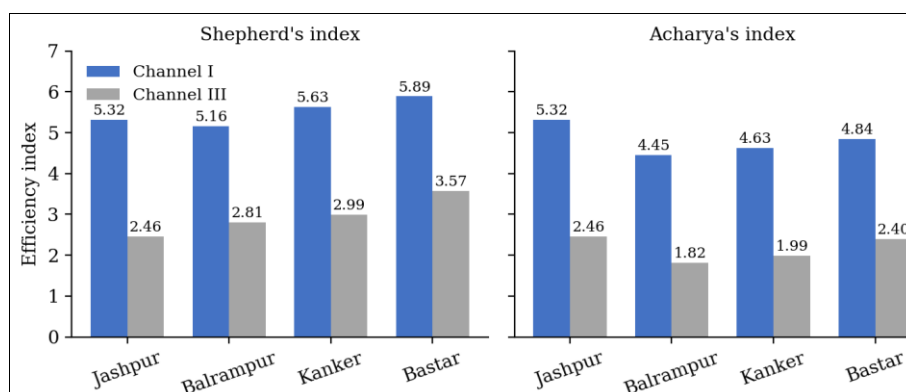
Table 6 summarises the marketing efficiency analysis. Under the conventional method, marketing cost rose steeply with channel length, from Rs. 16.30 to Rs. 52.88 per kg between Channels I and III in Jashpur and from Rs. 23.30 to Rs. 62.01 per kg in Bastar, with value added increasing in parallel. The output–input ratio therefore improved with channel length (for example, from 0.75 to 2.89 in Balrampur), but this apparent gain reflects intermediary value capture rather than producer benefit: marketing margins expanded sharply, from Rs. 7.96 to Rs. 48.05 per kg in Jashpur and from Rs. 8.68 to Rs. 51.57 per kg in Balrampur.

Shepherd's index and Acharya's index, which weight efficiency by the producer's realisation relative to marketing costs and margins, consistently identified Channel I as the most efficient in all four districts. Shepherd's index for Channel I was 5.32 in Jashpur, 5.16 in Balrampur, 5.63 in Kanker and 5.89 in Bastar, roughly double the corresponding Channel III values (for example, 5.63 against 2.99 in Kanker and 5.89 against 3.57 in Bastar). Acharya's index likewise declined monotonically with channel length: from 4.45 to 1.82 in Balrampur, 4.63 to 1.99 in Kanker, 4.84 to 2.40 in Bastar, and from 5.32 to 2.46 in Jashpur, confirming a consistent loss of efficiency as intermediaries are added.

Table 6: Marketing efficiency by district and channel (conventional, Shepherd's and Acharya's methods)

District	Conventional O/I ratio (Ch. I / II / III)	Shepherd's index (Ch. I / III)	Acharya's index (Ch. I / III)
Jashpur	0.55 / 1.39 / 1.36	5.32 / 2.46	5.32 / 2.46
Balrampur	0.75 / 2.53 / 2.89	5.16 / 2.81	4.45 / 1.82
Kanker	0.72 / 1.19 / 1.17	5.63 / 2.99	4.63 / 1.99
Bastar	0.72 / 1.20 / 1.17	5.89 / 3.57	4.84 / 2.40

Note: O/I = value added per rupee of marketing cost. Higher index values indicate greater efficiency. Source: Computed from field survey data

**Fig 6:** Shepherd's and Acharya's marketing efficiency indices: Channel I versus Channel III

3.4 Discussion

The superiority of the direct channel found here is consistent with a broad body of Indian evidence. Banjare and Joshi (2023) ^[2] reported the highest fisher share and marketing efficiency in the Producer–Consumer channel in Raipur district of Chhattisgarh, while Uday Raj *et al.* (2022) ^[8] found the shortest channel to have the lowest price spread and highest efficiency in Karnataka's Northern Dry Zone, and Gawa *et al.* (2017) ^[4] identified the direct channel as most efficient in Srinagar's unregulated markets. The producer shares observed in this study (roughly 65–82 per cent depending on channel) also lie within the range reported by Parmar *et al.* (2018) ^[5] for Navsari, Gujarat. The distinguishing feature of the tribal districts studied here is the weight of logistical costs: transportation alone accounted for 34 to 45 per cent of marketing costs in the direct channel, and post-harvest expenses of storage, cleaning and processing together contributed about 30 to 35 per cent of total costs. These figures point to an acute rural infrastructure deficit that forces individual tribal producers to bear disproportionately high transport burdens even when they sell directly, and to intermediary dependence, particularly in Bastar and Kanker, wherever distant or bulk urban markets must be accessed. Retailer margins of 45 to 49 per cent of the spread in Channel II across districts identify retail intermediation as the single largest source of consumer price inflation and producer income erosion.

4. Conclusion and Policy Implications

The fish marketing system serving tribal fishermen's cooperatives in Chhattisgarh operates through three channels, of which the direct Producer–Consumer channel is unambiguously the most efficient and equitable, delivering producer shares of 80.60 to 82.24 per cent of the consumer rupee, against 64.45 to 67.19 per cent in the wholesaler-mediated channel. The price spread is driven principally by transportation and post-harvest handling costs, and, in intermediated channels, by large retailer margins. The

structural disadvantage of multi-tier intermediation was uniform across all four tribal districts.

These findings make a case for targeted public and cooperative investment in: (i) cooperative-owned cold storage and refrigerated transport to compress post-harvest costs and losses; (ii) regulated rural fish markets with guaranteed direct producer access, reducing dependence on retail intermediaries; (iii) improvement of rural road and transport infrastructure in the Northern Hills and Bastar Plateau zones, since transport alone absorbs over a third of direct-channel marketing costs; and (iv) digital aggregation platforms enabling consumers and institutional buyers to purchase at the farm gate. Such interventions would compress the price spread, raise the producer's share in the final consumer price, and strengthen the role of fisheries cooperatives in tribal livelihood security.

5. Acknowledgements

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