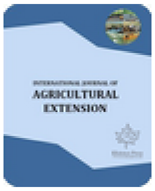
Int. J. Agr. Ext. 13 (02) 2025. 101-115

DOI:-10.33687/ijae.013.02.5763

Check for updates



Available Online at EScience Press

International Journal of Agricultural Extension

ISSN: 2311-6110 (Online), 2311-8547 (Print)

https://esciencepress.net/journals/IJAE

VALUE CHAIN ANALYSIS OF RICE (*ORYZA SATIVA* L.) IN STRUCTURE, CONDUCT AND PERFORMANCE FRAMEWORK IN TERAI BELT OF NEPAL

[a]Lal K. Shrestha*, [a]Yam B. Thapa, [a]Shiva C. Dhakal, [b]Devendra Gauchan

[a] *Agriculture and Forestry University, Chitwan, Nepal.*

[b] *Tribhuvan University, Kathmandu, Nepal.*

ARTICLE INFO

Article History

Received: March 02, 2025

Revised: June 10, 2025

Accepted: July 27, 2025

Keywords

Market conduct

Marketing efficiency

Marketing margin

Value chain performance

Value chain structure

ABSTRACT

Rice is Nepal's principal food crop. However, domestic rice production remains insufficient, resulting in significant imports. This study employed a Structure-Conduct-Performance (SCP) framework to analyze the rice value chain in the Terai belt, using primary data collected from 360 producers, 90 traders, and 30 key informants across Jhapa, Rupandehi, and Kailali districts, selected through a simple random sampling technique. Analytical tools included the calculation of the Herfindahl Index, marketing efficiency, price spread, Gini index, and marketing margin. The Herfindahl Index (0.262) and Lerner Index (0.71) indicate moderate to high market concentration and near-monopoly behavior, with wholesalers exercising strong price control. The study's findings indicate that producers have limited influence on the market, and the market exhibits a non-competitive structure. Marketing efficiency was low (0.58), and price spread was high (41.40%), reflecting marketing inefficiencies. The Gini index (0.75) shows significant income inequality among paddy producers. Large processors in the rice value chain were observed to capture a disproportionate share of profits. Furthermore, rice production was found to be profitable in the study area, warranting an increase in the area under rice cultivation. Strategic interventions, such as implementing Minimum Support Prices (MSP), reducing marketing margins, and strengthening value chain governance, are recommended. Government regulation is necessary, particularly in the processing. The study suggests a coordinated value chain structure, private sector involvement, increased investment in production, embedded service provision, and adoption of improved technology among producers and concerned stakeholders in the rice value chain of Terai belt for a competitive, efficient, and equitable rice market to ensure a sufficient domestic supply.

Corresponding Author: Lal K. Shrestha

Email: shresthalk2014@gmail.com

INTRODUCTION

Rice (*Oryza sativa* L.) is the most widely grown crop in the world, with an annual production of 513.68 million Metric Tons (MT) (FAO, 2023). It is considered a staple food crop for more than 50% of the world's population (Birla et al., 2017). However, the yield level of rice is less than the global need, and thus a substantial increase in rice yield is needed to meet future food requirements (Hashim et al., 2024). In the case of Nepal, rice is the primary staple food crop, contributing significantly to food and nutritional security (Thapa & Bhusal, 2020). Rice is cultivated in 1.42 million hectares (ha) of land in Nepal with a production of 5.95 million MT and a yield of 4.19 MT/ha in 2024 (MoALD, 2024). The contribution of rice to the national Gross Domestic Product (GDP) remained 3.25% and 13.6% to the Agricultural GDP for Fiscal Year 2022/23 (MoALD, 2023). The domestic production of rice is insufficient to fulfill the growing demand to ensure food security (Gairhe et al., 2021). Although Nepal used to export rice until 1982 (equivalent to US$16.54 million in 1982), it is currently among the top importers, importing a huge amount of rice annually. As of 2022, Nepal imported rice valued at US$625.68 million (FAO, 2023).

International rice prices have risen substantially. El Niño and export limits from India, the world's largest rice exporter, have been the primary drivers of global market prices during the past year (Poudel et al., 2024). During the initial years of this decade, the global market has undergone notable fluctuations (IRRI, 2024). The international rice market also influences domestic pricing and production policies in Nepal. In the traditional Structure-Conduct-Performance (SCP) model, market structure influences firm behavior, which in turn affects market performance. Concentration of exporting countries, market structure in terms of growth rate, exit barriers, fixed costs, and product differentiation (Delorme, 2002). A normative assessment—judging whether market behavior meets certain standards—is another key dimension of market performance (Frosen et al., 2013). Furthermore, the rice value chain in Nepal faces several challenges, including fragmented farming, poor post-harvest handling (resulting in 10-15% losses), weak market linkages, and inadequate infrastructure (Poudel et al., 2025). Additionally, limited access to credit, outdated milling technologies, and inconsistent government policies further hinder the efficiency and competitiveness of the rice value chain (Choudhary et al., 2022).

Enhancing agricultural crop marketing facilities, specifically for the rice industry, allows farmers to plan their output in response to market demand, harvest their crops at the most profitable times, select markets to send their produce to, and bargain with traders for the finest potential price (Dawit, 2005; Takele, 2010). An efficient rice marketing system is essential for boosting production and enhancing market efficiency. In the Terai region of Nepal, the rice market is less competitive due to the preference for higher-quality imported rice from India, which attracts consumers and leads rice dealers to favor it despite its higher price (Thapa and Dhakal, 2024). According to the Department of Customs (DoC, 2024), in 2023–2024, Nepal imported 48.98 thousand metric tons (MT) of Basmati rice at NPR 127.26 per kilogram, while non-Basmati rice imports amounted to 39.70 thousand MT at NPR 76.90 per kilogram. In contrast, during 2022–2023, Basmati rice imports stood at 50.80 thousand MT, priced at NPR 95.06 per kilogram, whereas non-Basmati rice imports were significantly higher at 174.24 thousand MT, costing NPR 61.96 per kilogram.

Mishra et al. (2018) reported that the Herfindahl Index for the maize seed market in Nepal was 0.44, indicating that the maize seed value chain was not concentrated. The price spread was 53% for the overall maize seed value chain. Another study by Rahman et al. (2021) on the rice sector of Bangladesh reported that rice millers and wholesalers charge 33% and 29% above the marginal cost, respectively, confirming the non-competitive behavior of the rice market, where wholesalers and millers wield substantial market power. Furthermore, Pramanik and Gyan (2010) analyzed the marketable surplus and marketing efficiency of vegetables (tomato, potato, and cauliflower) in Indore District, Madhya Pradesh, India. The study concluded that marketing efficiency is affected by market intermediaries and the perishable nature of the commodities. Mishra and Dey (2018) reported in their study on the governance of the agricultural value chain that governance of value chains is often riddled with overlapping and contradictory roles of actors, suggesting that policymakers should safeguard the interests of smallholder producers. However, these studies have not provided a detailed examination of the SCP framework in the rice sector. This study highlights the SCP of the rice value chain within the context of the rice sector in the Terai belt of Nepal.

The study on the SCP framework for value chain development is imperative to understand how the rice marketing system operates, its structure, the process of rice marketing, and the marketing margin and efficiency of rice market. This study is helpful for policymakers, planners, researchers, and other stakeholders. This study could provide essential documentation for future government interventions in the event of declining competitiveness.

Theoretical Framework

The SCP paradigm, developed by Joe S. Bain Jr. in 1959, is an initial analytical framework connecting market structure, conduct, and performance. It serves as a starting point for analyzing markets not only in economics but also in business management (Banson, 2015). According to the SCP paradigm, the structure of a market decides firm conduct, which in turn determines their performance. The market structure can be influenced by various factors, including the number of competitors in the industry, the degree of product differentiation, and the costs associated with market entry and exit. The SCP approach, developed initially in the U.S. to analyze industrial market structures, was later applied to agriculture. It posits that market structure influences participant behavior, which in turn determines market performance.

Adekanye and Olayide (1988) defined market conduct as the behavior of marketers with regard to their pricing and product policies, it refers to the behavior that firms pursue in adopting the market in which they sell or buy, for example advertising, price fixing policies, predatory or exclusionary tactics etc. According to Abbott and Makeham (1990), conduct refers to the market behavior of all firms. It involves how firms compete, whether they seek innovative technologies and apply them when applicable, and whether they pursue new investment opportunities. Essentially, conduct describes the strategies by market actors to achieve their goals and gain a competitive edge. An SCP causal relationship is supposed to exist, even though in the views of some data analysts, the relationship could happen in the opposite direction. (Pickering, 1974; Olukosi et al., 2005). The performance of a certain market depends on the conduct of its sellers and buyers, which in turn, is strongly influenced by the structure of the related markets (Scarborough and Kydd, 1992; Abbott and Makeham 1990; Olukosi et al., 2005). The three pillars—structure, conduct (behavior), and performance—interact symbiotically, meaning market structure influences both behavior and performance. Moreover, market conduct and market structure developments are also influenced by market performance.

MATERIALS AND METHODS

This study examines Nepal's rice value chain through a comprehensive assessment of production, marketing, and distribution systems. Focusing on key rice-growing regions, the research employs a mixed-methods approach to analyze market structure, efficiency, and performance. The methodology ensures robust representation across all value chain actors while maintaining ethical research standards.

Study Area

The study was conducted in three major rice-producing districts of Nepal's Terai belt —Jhapa (Eastern region), Rupandehi (Central region), and Kailali (Western region). These districts are considered the storehouse of Nepal for rice production (Thapa et al., 2025) and represent geographic diversity.

Population and Sample Size

Using the sample size estimation determined by Daniel and Cross (2013), a sample size of 360 was maintained, and thereafter, a simple random sampling technique was adopted to collect primary data from producers, as the sample size is sufficient in case of a homogeneous population (Bartlett et al., 2001). Likewise, the sample size of other different value chain streams were 19 collectors, 21 retailers, 15 processors, 18 wholesalers, 30 key informants, and 17 exporters/ importers who were randomly selected from rice producers, input suppliers, collectors, processors, wholesalers, retailers, importers, and agriculture officers from study area.

Data Collection

Primary data were collected from various stakeholders in the rice value chain, including producers, collectors, processors, wholesalers, retailers, importers, and key informants. The study employed multiple tools to gather comprehensive information: pretested semi-structured interviews conducted face-to-face between February and May 2022, three Focus Group Discussions (FGDs) per district with 8–15 participants each to explore value chain mapping, governance, and barriers, embedded services and facilities, and direct observation of market practices. The written consent was obtained from the respondents before survey to ensure the confidentiality of their data.

In addition to primary data, secondary data were collected from published sources, including journals, articles, dissertations, and reports. These secondary sources provided contextual and supporting information, enriching the study's findings and validating the primary data. The combination of primary and secondary data allowed for a robust analysis of Nepal's rice value chain dynamics.

Analytical Tools

This study applied an integrated value chain assessment using the SCP framework, adapted from Junior et al. (2014), along with other relevant research. The rice value chain serves as the unit of analysis and is divided into five distinct value streams as follows. Each value stream was analyzed separately and comparatively using the SCP framework, with selected indicators assessing structure, conduct, and performance.

a. Rice producer stream
b. Rice collector stream
c. Rice processor stream
d. Rice wholesaler stream
e. Rice retailer stream

Rice production, processing, and marketing have a long history in the Terai belt of the country; however, there is a lack of government support, particularly in promoting the overall rice value chain. The primary purposes behind promoting the rice value chain are to substitute imports and enhance self-sufficiency, thereby promoting food security (Bishwajit et al., 2013).

Market structure denotes the organizational features of a market that shape competition and pricing dynamics**.** These include the number and relative size of buyers and sellers in the market, the degree of product differentiation, and the relative ease or difficulty with which buyers and sellers can enter or exit the market (Olukosi et al., 2005). The structure of the value chain is crucial in determining its effectiveness in achieving these strategic goals. While numerous indicators exist for value chain structure analysis, this study focused on a select set of measures. The selected indicators included demand, supply, infrastructure, entry barriers, and substitute products. The analysis also incorporated strategic, governance, financial, communication, and operational structures within the value chain. Lerner index and Herfindahl index were calculated to analyze the structure of the value stream and overall value chain. Market concentration was assessed using the Lerner and Herfindahl indices for both individual value streams and the overall value chain.

Market Power

The Lerner index, formalized in 1934 by Abba Ptachya Lerner, is a measure of a firm's market power (Chirat & Clerc, 2024**).** The Lerner index was computed for each value stream and the overall chain, where higher values indicate greater market power (tendencies toward monopolistic behavior), lower values suggest competitive markets, and intermediate levels reflect oligopolistic structures.

The weighted average of profit rates (Profit of firm/ Revenue of firm) is used as a proxy for the Lerner index (Hanekom et al., 2010**).** Due to data limitations, this study used weighted profit rates (profit margin/revenue) as a proxy for the Lerner index, since marginal production costs could not be calculated from the survey data**.** The Lerner index is expressed in the following formula:

$$\mathrm{L} = \frac{\mathrm{P} - \mathrm{MC}}{P}$$

Where,

L = Learner index used as proxy value chain power in the market

P = Market Price per kg of rice paddy

MC = Marginal cost of production of rice paddy per kg

The Lerner index (L) measures market power by comparing a commodity's price to its marginal cost. Ranging from 0 (perfect competition) to 1 (pure monopoly), it quantifies deviations from competitive markets.

Market Concentration

The Herfindahl-Hirschman Index (HHI) quantifies market concentration, serving as a measure of competition within an industry**.** It helps analyze and observe whether a specific industry is highly concentrated or approaching a monopoly, or whether there is some competition around it. Market concentration is measured by 1/n when firms or value chains have equal shares, where n is the number of value chains or firms; however, it becomes more complex when their market shares vary**.** The Herfindahl index measures and compares market concentration in Nepal's Terai region rice value chain. If n firms produce a total output 'q' in the value chain and the market share of value chain i is Si = qi/q.

Herfindahl index: $H = \mathrm{S1}^2 + \mathrm{S2}^2 + \ldots + \mathrm{Sn}^2$

A higher Herfindahl index indicates greater market concentration, regardless of the number of firms, highlighting that concentration depends on market share distribution, not just firm count.

Higher Herfindahl index values signal weaker competition and stronger market power, whereas lower values imply the opposite. The interpretation of the value obtained from HHI is shown in Table 1.

Table 1. Market Concentration Levels according to HHI.

HHI	Competition level
< 0.15	Unconcentrated market
0.15 to 0.25	Moderately concentrated market
> 0.25	Highly concentrated market

Source: Naldi and Flamini (2014)

The study examines the functioning of the rice value chain in Nepal's Terai region, evaluating market structure, pricing, promotion, vertical/horizontal linkages, support mechanisms, quality control, actor priorities, business communication, risk mitigation, decision-making, trust, commitment, and reporting. Similarly, the performance indicators include reduced food insecurity and poverty, enhanced social inclusion, and increased employment opportunities, particularly in the rice value chain. Details of selected measures for the SCP framework are mentioned in Annex 1. The following measures are used for value chain performance.

Price spread

The price spread represents the paddy producer's share as a percentage of the end buyer's price, serving as a key performance indicator for the value chain. In this study, calculations are performed using the following equation. A higher price spread value indicates greater value chain efficiency.

$$PS\ (\%) = \frac{\mathrm{Pf}}{\mathrm{Pc}} * 100$$

Where,
PS = Price spread (%)
Pf = Price received by the rice paddy Farmer (NPR)
Pc = Price paid by rice Consumer (NPR)

Marketing efficiency

Marketing efficiency serves as an indicator of market performance. The movement of goods from producers to consumers at the lowest cost while meeting consumer service expectations is called efficient marketing.

According to Acharya (2003), an ideal measure of marketing efficiency for comparing alternative market channels should include all of the following factors:

a) Total marketing costs (MC)
b) Net marketing margin (MM)
c) Prices received by the farmer (FP)
d) Prices paid by the consumer (RP)

Acharya (2003) has suggested the following measure,

$$\text{Marketing Efficiency (ME)} = \frac{FP}{\sum(MC+MM)}$$

Where,
ME = Marketing Efficiency,
MC = Marketing cost,
MM = Marketing margin,
FP= Prices received by the farmers

A higher marketing efficiency index shows that the value chain is performing well and efficiently.

Data Analysis

The data obtained from the survey were curated and carefully entered into MS Excel. Furthermore, the Statistical Package for the Social Sciences (SPSS) was used for data analysis.

RESULTS AND DISCUSSION

Socio-demographic and Economic Features

Rice producers in Nepal's Terai region are mostly middle-aged (average age 49.63 years) and come from male-headed households (91.4%). Despite this, women play key roles in production tasks such as transplanting and weeding. Education levels are low - 19.2% are illiterate, and 48.3% have only primary or secondary education. Households average seven members, with most relying on family labor. Producers are primarily smallholders, with an average landholding of 1.29 hectares. In the rice value chain, traders—encompassing collectors, processors, and wholesalers—are crucial intermediaries, managing storage and credit, influencing prices, and facing risks such as price fluctuations, storage losses, and payment delays.

Structure of Rice Value Chain

The rice value chain's primary structure is established within a framework comprising producers, collectors, processors, wholesalers, retailers, and consumers, in which different systems and functions are integral to each stage. The structural indicators of the rice value chain are as follows:

Market concentration

The Herfindahl index for market concentration in the Terai belt of Nepal is shown in Table 2. The index was found to be 0.262 for the rice market. This suggests that the rice value chain is highly concentrated, characterized by non-competitive practices. This could be due to the absence of competitive rice brands, limited traders, and limited value chain leaders.

Table 2. Market concentration of the rice value chain in the Terai belt of Nepal.

Value chain Category based on chain leader	Market Share (%)	Index (S_i^2)
Wholesalers Led	42	0.176
Processors led	20	0.040
Collectors led	17	0.029
Retailers led	10	0.010
Millers led	7	0.005
Cooperatives led	4	0.002
Herfindahl index	100	0.262

Sources: Computed from Field survey data, 2022

Similar findings were reported by Bassey et al. (2013) on the rice value chain in Akwa Ibom State, Nigeria. They reported that marketing margin, imported brands, and absence of competitive practices were the reasons for the lower value of the Herfindahl index (0.295), which revealed that the rice markets were highly concentrated with non-competitive practices showing differences in earnings. Along the same line, Raha et al. (2013) in their study on the rice value chain in Bangladesh, reported that the seller concentration in the paddy market was exceptionally low, while the buyer concentration ranged from 30% to 85%. Similarly, Shahana and Ushadevi (2024) in their study on the rice value chain in Kerala, India, reported that the market was moderately to highly concentrated (0.2125), meaning that a few firms have significant control over it. This finding suggests that the Government of Nepal should promote competitive brands and increase the value chain leaders in rice.

Market power

The Lerner index was derived and used to understand the market power of the five actors in the rice value chain. The Lerner Index was computed for each stage in the rice supply chain, including producers, collectors, processors, wholesalers, and retailers. The overall Lerner Index for the rice supply chain was 0.71, indicating near-monopoly conditions, as a higher value reflects greater market power. The index value indicates that the value stream exhibits a non-competitive market structure. Therefore, it suggests an effective price policy in the rice value chain, such as a minimum support price (MSP), to reduce the non-competitive market.

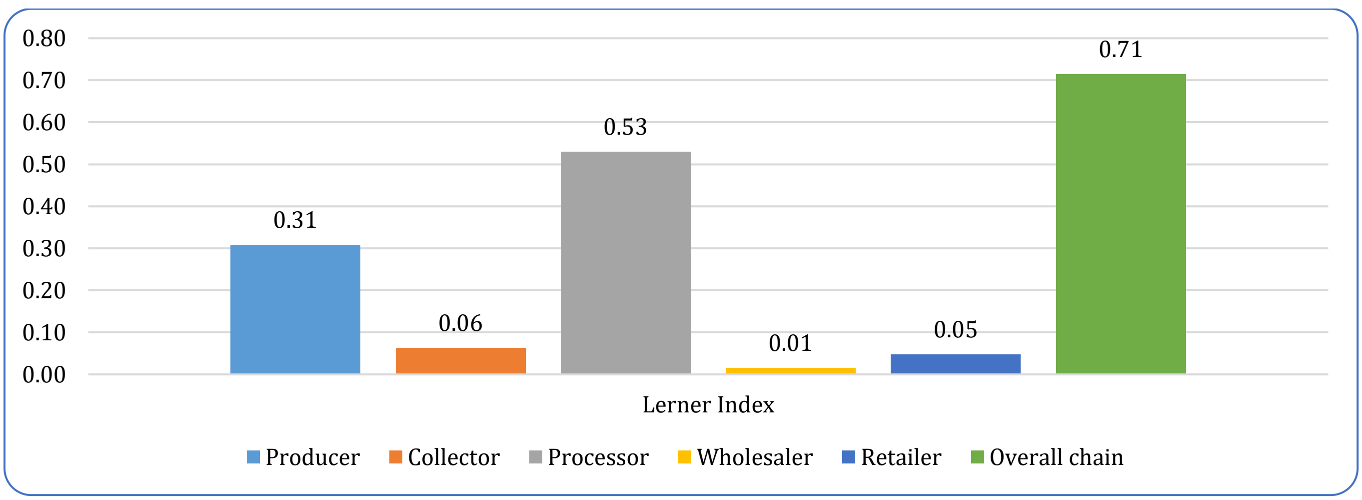


Figure 1. Lerner Index in Rice value chain in Terai belt Nepal 2022 (Source: Authors).

Local infrastructure and institutions

Due to a shortage of local paddy in the study areas, over 5 rice processors are operating at underutilized capacity. Limited cooperatives have provided processing facilities. There was a well-developed road network, both local and provincial, as well as federal technology service centers, including Palika-level Agriculture Service Centers, the Agriculture Knowledge Center (AKC), and PMAMP, in the study areas.

Chain leader and decision-making

The processors, wholesalers, and cooperatives create forward and backward linkages in the rice value chain and play the role of chain leader. Processors, wholesalers, and cooperatives lead the value chain by controlling key decisions such as rice variety, quality, size, color, production specifications, and regional supply management for both paddy and milled rice. Approximately 6 percent of farmers are unable to produce paddy until they obtain seed and fertilizer, primarily due to a lack of financial resources, and are linked with processors and cooperatives. Therefore, farmers produce according to the market's demand, which encompasses the needs of processors, wholesalers, cooperatives, and ultimately, consumers. There are weak linkages among the value chain actors due to the lack of a formal linkage mechanism.

Entry / Exit barriers

The rice value chain has both legal and operational barriers that restrict new entrants. Paddy producers either own their own land or lease land for rice production. To operate in the rice value chain, paddy collectors, processors, wholesalers, and retailers must obtain a government-issued license, which requires minimal fees and annual renewal but compliance with basic technical standards (Table 3). These formal requirements represent the only entry barriers, as no informal or associational restrictions hinder market access or exit. To promote rice enterprises, the government provides seed subsidies, fertilizer subsidies, and concessional loans to producers, processors, collectors, and retailers, as per prevailing financial institution policies.

Table 3. Barriers to entry and exit of rice value chain actors.

Value Chain Actors	Barriers to entry	Barriers to exit
Producers	Own land or leased land for production, small landholding size, fallow land, limited access to land, lack of capital, high input cost, market access changes	Investment in land and equipment: Land, irrigation systems, and machinery (like tractors or threshers), loans, government subsidies etc.
Collectors	Regulatory hurdles, Capital requirements, Market information asymmetry, Storage infrastructure, Trust and relationships are legally registered with a government concern authority.	Investment in business, supply agreement, relationship-based business, transportation and logistics investment, commission-based income structure, and pressure from the supply chain.
Processors	Legally registered firm in government concern authority and basic infrastructure, regulatory requirements, high initial investment, energy constraints, Scale inefficiencies, and technology gaps.	High capital investment, long-term contracts, lack of resale value, skilled labor specialization, significant investments in buildings, machines, tools, storage, and vehicles, etc.
Wholesalers	Stringent quality and safety standards, Bureaucratic export procedures, Trade competition, Currency and trade policy risks, a legally registered firm in a government concern authority, and basic infrastructure.	Huge investment in buildings, machines, storage, vehicles, market uncertainty, etc.
Retailers	Legally registered with the government concern authority.	Capital lock-in, established customer base, limited alternative opportunities, credit cycle, and dependency on seasonality.

Market Conduct of Rice Value Chain

Market conduct refers to the behavior of firms in the rice market, including their methods of competition, adoption of innovations, and pursuit of investment opportunities to gain a competitive edge.

Price Determination

The results in Figure 2 revealed that wholesalers of rice were ranked first in influencing rice marketing based on price determination, as indicated by 40.13% of the respondents, who cited this as part of the price determination process in rice marketing. Likewise, rural collectors, retailers, and processors also have 25.20%, 19.74%, and 9.79% influence on the distribution of rice marketers, respectively, in terms of price determination. This suggests that wholesalers and rural collectors play a significant role in determining prices, while producers have a limited influence. Therefore, it can be suggested that the government promote interventions through price policy and cooperative marketing.

Promotional strategies embarked upon by respondents

The results in Table 4 revealed that selling long-grain rice was ranked first by the marketers, as indicated by 86.67% of the respondents, as part of the strategies used to sustain customers in rice marketing. Selling non-adulterated rice was ranked second by the marketers, as indicated by 78.89% of the respondents, followed by a friendly attitude to customers in third place, as indicated by 76.67% of the respondents, as part of their strategies. Credit sales, distributing rice to customers' location/home delivery, retail and supermarkets, sales of quantity product, brand's Ads, website, social media, reducing the price while buying in bulk, and commission have ranked fourth, fifth, sixth, seventh, eighth and ninth by the marketers as indicated in Table 4, respectively. This trend can be attributed to several factors, including high demand for long-grain rice, increased consumer purchasing power, changing dietary preferences, and improved road infrastructure. Supporting this observation, Gona et al. (2020) found that market strategies reflected consumer and processor preferences: 92% of traders specialized in long-grain rice, 90.42% prioritized customer service, 81.67% guaranteed unadulterated rice, 78.80% offered delivery services, and 72.90% provided credit sales. These findings suggest that promoting long-grain rice cultivation through rice self-sufficiency programs (for both main and spring seasons) in mega irrigation project areas would be strategically advantageous.

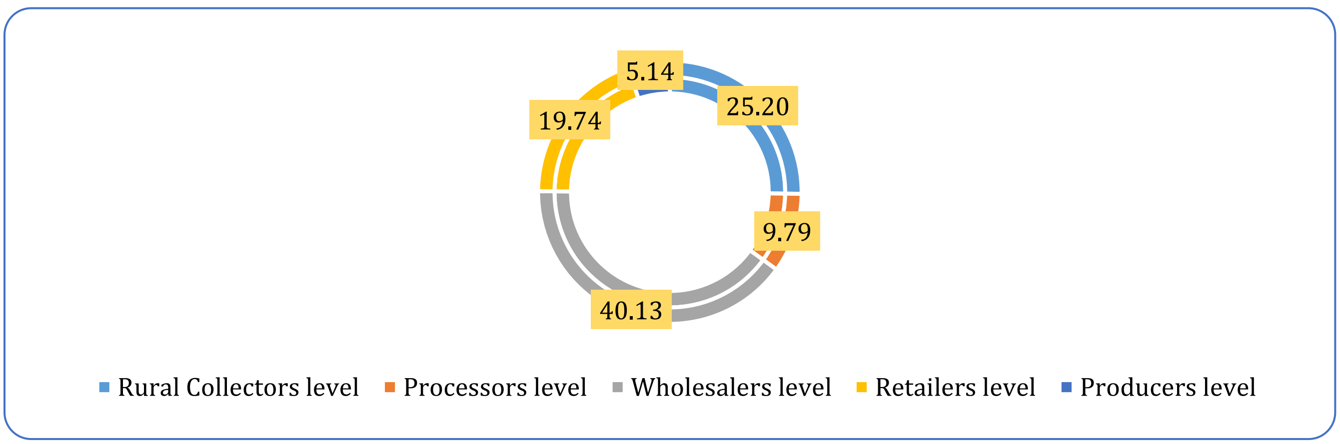


Figure 2. Distribution of marketing agents influencing the market price of Rice.

Table 4. Distribution of rice marketers based on market strategies adopted.

Market strategies	Frequency	Percentage	Ranking
Selling long grain rice (product)	78	86.67	1
Friendly attitude to customers (promotion)	69	76.67	3
Selling non-adulterated rice (product)	71	78.89	2
Credit sales (promotion)	65	72.22	4
Distributing rice to customers' locations/home delivery (place)	62	68.89	5
Reducing the price while buying in bulk (price)	55	61.11	9
Commission (price)	41	45.56	10
Sales of quality product (product)	59	65.56	7
Retail and supermarkets (place)	60	66.67	6
Brand's Ads, website, social media (promotion)	57	63.33	8

Source: Field survey 2022. Note: Multiple responses were allowed.

Means of Obtaining Price Information

The result in Table 5 revealed that a greater part of respondents (73.33%) uses their mobile phone to access stock orders and price information, while 34.44% obtain such details from fellow traders, and 14.44% receive updates from their commodity association. Similarly, only 4.44% of respondents reported obtaining price information through mass media. The predominant reliance on mobile phones (73.33%) underscores the transformative impact of digital technology on Nepal's Terai rice markets. So, rice marketers have easy access to price information. Similarly, Bassey et al. (2013) in their study on the rice value chain in Nigeria reported that 66.7% of respondents used their mobile phones to obtain price information, while 33.3% obtained updates through fellow traders and market associations.

Table 5. Distribution of rice marketers based on means of obtaining price information.

Sources of information	Frequency	Percentage	Ranking
Social media	4	4.44	4
Commodity association	13	14.44	3
Use of a mobile phone to call a supplier	66	73.33	1
Asking fellow traders	31	34.44	2

Source: Computed from Field survey data 2022 Note: Multiple responses were allowed.

Sources of market information for rice producers

Figure 3 indicates that most respondents (35.5%) rely on direct markets and those from neighbors or friends (28.7%) for market information. Other producers (21.5%) and media (16.8%) are also notable sources. In contrast, very few respondents use producer organizations (1.6%) or government offices (1%), indicating limited reliance on formal institutions for market insights.

Means of transporting stocks

Figure 4 illustrates the different transportation methods used for stock delivery in the markets. The study revealed that large-scale traders used shared hired trucks to minimize transportation costs (57.78%), while 23.33% hired trucks individually due to large volumes and distance, and 18.89% owned their trucks. This indicated that shared means of transportation were beneficial for traders. Therefore, it can be suggested that transportation facilities be promoted. Similarly, Bassey et al. (2013) in their study on the rice value chain in Nigeria reported that large-scale individual traders hire heavy-duty trucks, intending to reduce transportation costs. Due to transportation distances, most traders prefer bulk purchases per trip. The study found 61.47% use shared hired trucks, 25% hire individual trucks, and 13.3% own their transport vehicles.

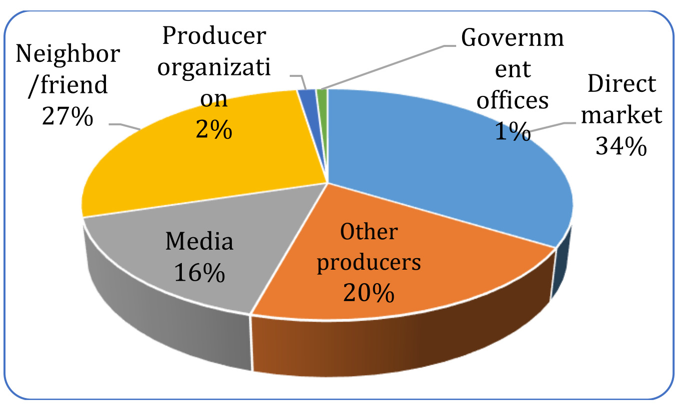


Figure 3. Sources of market information for rice producers.

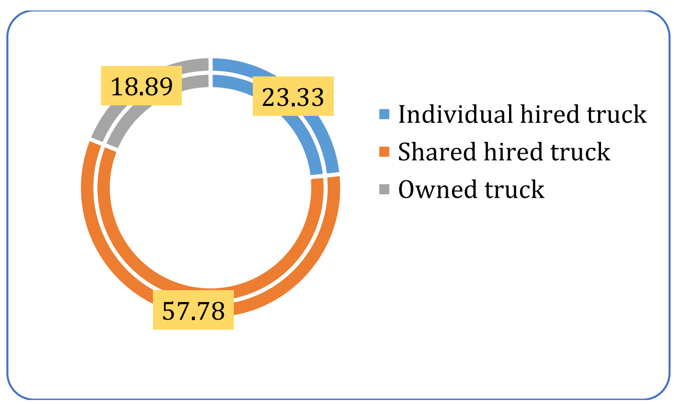


Figure 4. Distribution of rice marketers based on means of transporting stocks.

Horizontal linkage and vertical linkage

In all research sites, more than 90% of farmers are organized in groups and cooperatives. However, some farmers produced rice independently. These farmers collaborate to produce rice in their various communities by sharing labor, information, and other resources.

Similarly, there is the Association of Nepalese Rice, Oil and Pulses Industry (ANROPI) for the promotion of rice enterprises as well as the development of linkages among and coordination among the value chain actors. Across all study locations, a vertical supply chain connects rice producers with collectors, processors, cooperatives, retailers, and government agencies.

Embedded services and facilities

These represent the reciprocal services and facilities that value chain members provide within the system, encompassing both upstream and downstream linkages. Government organizations offer support for technical training, a 50% subsidy on improved rice seed and farm equipment for rice production, as well as support to processing enterprises. Approximately 80% of cooperatives/farmers' groups, and 10% of processors, provide rice seed to farmers who produce paddy. Some farmers also purchase paddy seed from agro vets. Within standard market operations, consumers typically receive certain services and protections, including maintenance, repairs, and warranty coverage, but in the value chain for rice, no such services are identified.

Value Chain Performance

The paddy rice value chain's performance is evaluated across multiple dimensions: economic viability, local job creation, poverty alleviation, social inclusion, and contributions to food security. Government interventions in the rice value chain aim to achieve social inclusion, poverty alleviation, and food security, the latter being operationalized through yield gains from improved varieties and increased household income from participation in paddy-rice production activities. So, it has contributed to poverty reduction. Value is created through any activity that enhances a product's marketability, functionality, or service quality. In today's business climate, it is essential to maximize the value of every business process (Jacoby, 2005).

Price spread

It represents the gap between the net income earned by the paddy-rice producer and the amount paid by the end consumer, expressed as a percentage of the consumer price within the rice value chain. All marketing costs and intermediary margins are calculated as a percentage of the final price paid by the rice buyer. The analysis determined that the average price spread across the entire paddy rice value chain in 2022 was 41.40%, as presented in Table 6. This indicates that there are more layers in the rice value chain. Thus, it can be suggested that strengthening farmer cooperatives, reducing intermediaries, and stabilizing the price can be beneficial. Shelke et al. (2019) reported that 58.38 percent of the price spread and 97.52 percent of the producer's share were in consumer rupees because the produce was directly marketed from producer to consumer. The price spread was higher in channel III due to a higher number of intermediaries.

Marketing cost and Marketing efficiency

The marketing efficiency index for the paddy-rice value chain was calculated to be 0.58, indicating suboptimal performance. This metric served as a proxy for overall value chain efficiency in the analysis. Results in Table 6 present the marketing costs and marketing efficiency for paddy rice marketing in the Terai region of Nepal. The result revealed that rice marketing in the study area is poor or inefficient. Similarly, Bidyasagar and Nicra (2017) in their study in India reported that marketing efficiency ranges from 0.675 to 0.880, depending on the marketing channel. Valery et al. (2022) in their study in Cameroon reported that market structure and conduct have a positive and significant influence on the performance of the Ndop rice marketing. Strategic investments in transportation infrastructure (such as farm-to-market roads), seed system development, and production subsidies emerge as critical drivers for enhancing market functionality. Thus, it can be suggested that farmers' cooperatives be strengthened, the supply chain streamlined by reducing intermediaries, value-added products promoted, technology utilized for market linkages, and collaboration fostered between stakeholders across the rice value chain.

Income and value distribution

The latest Nepal Living Standard Survey IV (NLSS IV) 2022/23 showed that 20.27 percent of the Nepali population lived below the poverty line as of 2023, it used the new poverty line. The predominance of small and medium-scale paddy farmers in economically vulnerable areas means that enhanced farm incomes play a significant role in poverty reduction. The 360 sampled households (comprising 2,572 individuals) generated an average annual income of NPR 130,929 per household. Furthermore, value chain participation created employment opportunities that simultaneously addressed poverty alleviation and food security objectives.

Table 6. Marketing cost, marketing margin, and marketing efficiency among rice value chain actors in Nepal.

Particulars	Total	Producers	Collectors	Processors	Wholesalers	Retailers
Net price received by farmers	30.00					
Buying cost per kg		20.75	30.00	32.00	68.00	69.02
Marketing cost per kg	8.50	1.50	0.5	5.0	0.5	1.0
Total cost per kg		22.25	30.5	37	68.5	70.02
Sales price per kg		30.00	32	68	69.02	72.47
Marketing margin (NPR)	43.22	7.75	1.5	31	0.52	2.45
Price Spread (%)				41.40		
Marketing Efficiency				0.58		

Source: Field Survey 2022

Paddy-producing farmers generated an aggregate output of 1,963.5 metric tons, with an estimated end-market value of NPR 47.13 million. This value is distributed across the various actors in the supply chain, contributing to poverty reduction. However, the Gini index of 0.75 (as shown in Annex 2) indicates a high level of income inequality, with a disproportionate concentration of income among small and medium-sized farmers. This disparity has significant implications for poverty alleviation. The Gini coefficient, based on annual household income, further shows that the inequality benefits low-income groups, which also reflects the poor performance of the paddy value chain. As a result, there is an increasing gap between the rich and the poor, along with monopolies among a few traders and overall inefficiency in the value chain. To address this, the government should focus on supporting small and medium-sized farmers by providing them with technology, inputs, and infrastructure through subsidies and subsidized loans. Additionally, developing a strategic plan and policy for promotional programs would help improve the situation.

Rice Value Chain Map

The rice value chain demonstrates progressive value addition at each stage of transformation, with the final product reaching its peak market value at the consumer level. This multi-tiered system involves diverse actors providing complementary goods and services throughout the chain. The value chain map illustrates key functions, participating actors, supporting enablers, and their interrelationships, reflecting a market structure that remains predominantly informal. Production, trading, processing, and distribution were the primary processes of the rice value chain, as illustrated in Figure 5.

Governance and policy of rice marketing and value chain in SCP framework

In the context of the SCP framework, which was used to analyze industries and markets, the governance and policy of rice marketing and value chains play a crucial role in shaping the overall performance of the rice sector.

Governance

In terms of governance, the coordination and management of the value chain are important. This was governed by the public sector (government), the private sector, and farmers' cooperatives. The role of government is to regulate rice prices, provide subsidies, set trade policies, and ensure that the value chain remains competitive and efficient. Governments also created buffer stocks or direct market interventions. Likewise, the role of private firms in managing the value chain includes their practices for sourcing rice, processing, and distribution. Similarly, farmer cooperatives played a role in improving the governance of rice marketing by helping farmers negotiate better prices and a collective voice in the market as well.

Major Constraints and Barriers in the Performance of Rice Value Chains

The rice value chain in Nepal faces multiple constraints that hinder its performance and modernization. Farmers struggle with price volatility, inadequate market access, and insufficient policy support, compounded by poor implementation of minimum support prices (MSP) due to delayed announcements and weak information dissemination. Market inefficiencies persist due to weak coordination, inadequate infrastructure (e.g., drying facilities), and limited private sector engagement. Information asymmetry among value chain actors further distorts market dynamics, while liberal trade policies (e.g. no tariff only 5% agriculture service tax) flood domestic markets with cheap imports, concentrating power among a few traders. Additionally, the sector suffers from outdated production, processing, and marketing technologies, reducing overall efficiency. Addressing these barriers is critical to enhancing competitiveness and ensuring sustainable growth in Nepal's rice sector.

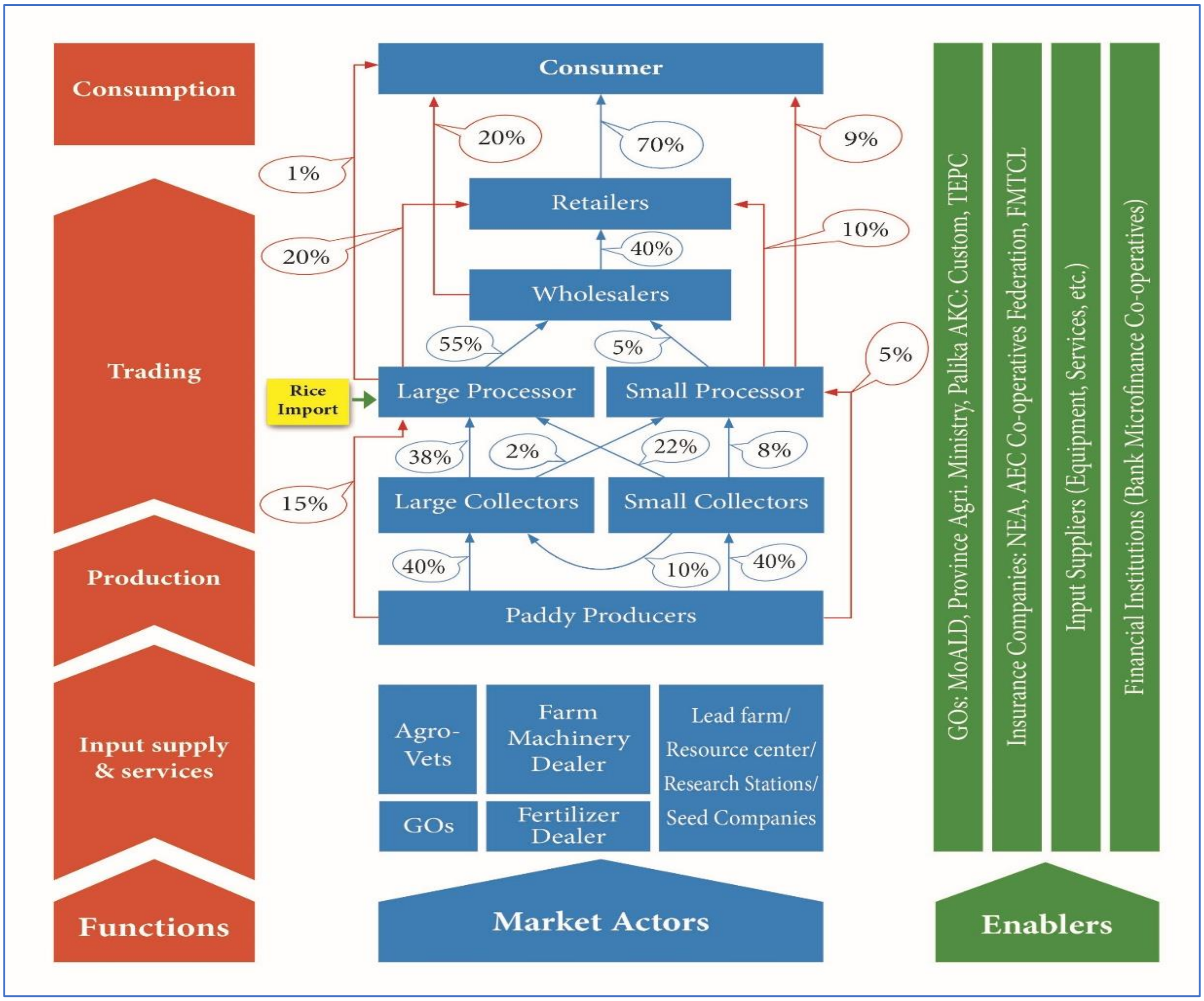


Figure 5. Value Chain Map of rice in the surveyed districts.

Key Policies Influencing Governance and the Rice Value Chain

The government provides subsidies to rice farmers, including fertilizer subsidies and price support schemes, to stabilize their income. It purchases rice at a minimum support price through Food Management and Trading Company Limited (FMTCL) and cooperatives to ensure market security. Support for mechanization and industrialization includes a 50% subsidy on equipment like harvesters and rice mills, along with custom hiring centers. Initiatives like community nurseries and the Digitally Enabled Seed Management System (DESES) enhance seed quality. Output-based incentives further encourage productivity. Improved rural infrastructure, such as roads and storage, boosts the efficiency of the rice value chain. Trade regulations on rice imports impact domestic market prices and competition. Investments in research, extension services, and farmer training promote better farming practices and higher productivity.

The governance and policies within the rice marketing and value chain, analyzed through the SCP framework, show how both public and private sector interventions influence market structure, conduct, and performance. Effective governance and policies, ranging from price stabilization to infrastructural development, were crucial to ensuring a competitive, fair, and efficient rice market that benefits all stakeholders, including farmers, consumers, and traders.

CONCLUSION AND RECOMMENDATIONS

This study concludes that rice marketing was highly concentrated in terms of the structural distribution of traded commodities among Terai belt rice traders. Herfindahl Index (HHI) revealed that the rice markets were highly concentrated with noncompetitive practices, showing differences in earnings. The value chain demonstrates inadequate communication, coordination, and linkage mechanisms. While cooperatives and processors serve as chain leaders, the absence of shared ownership or collective investment prevents the development of a more integrated and synchronized system.

In market conduct, rice traders employ various promotional strategies, with the selling of long-grain rice being a prominent approach among them. The paddy rice value chain largely relies on traditional technology (except in processing), has limited promotional efforts, weak horizontal coordination in production, modest vertical integration, and fragile actor relationships: multiple institutional actors and market factors, including rice varieties and cross-border paddy prices, shape pricing dynamics. No embedded services or facilities exist for value chain participants. The price spread and marketing efficiency were found to be 41.40 and 0.58, respectively. Ultimately, the rice sector's high market concentration created non-competitive conditions, as competitive practices were largely absent. There was a gap between effective governance and rice value chain promotion policies.

The SCP framework underscores systemic inefficiencies, necessitating structural improvements—including stakeholder coordination, private-sector mobilization, capital inflows, and technological upgrades—to enhance market resilience.

Thus, the government should focus on the assurance of inputs, improve technology, subsidize loans, build warehouses, and implement the minimum support price (MSP) effectively, and allocate more investment. Trade policy should be revised based on the present situation and the neighboring country's policy. Value chain leaders should focus on product diversification and quality. Similarly, rice production interventions should be strategically designed to minimize market distortions while achieving intended outcomes. The findings from this study can be helpful for researchers, policymakers, planners, concerned ministries, rural municipalities, and other stakeholders.

ACKNOWLEDGEMENTS

Paddy farmers, traders, and related stakeholders involved during the study purpose are highly acknowledged for their cooperation, support, time, and valuable information. We would also like to convey our sincere gratitude to the Agriculture and Forestry University. All those efforts from kind hearts involved directly and indirectly in this study were also appreciated.

ETHICAL APPROVAL STATEMENT

The study did not require ethical approval as it was carried out following appropriate ethical guidelines, adhering to the Declaration of Helsinki, World Medical Association.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Abbott, J.C. and Makeham, J. P. 1990. Agricultural Economics and Marketing in the Tropics. 2nd Edition. Intermediate Tropical Agriculture Series. London, UK. Longman Group UK Limited. Pp66 – 82

Acharya, S. S. 2004. Agricultural marketing in India. Oxford and IBH publishing. Retrieved from: http://ecoursesonline.iasri.res.in/mod/page/view.php?id=16979

Adekanye, T. O. and Olayide, S. O. 1988. "Definition of Some Marketing Terms". In Adekanye T. O. (Ed.) Agricultural marketing, Ibadan. Longman Pp 5-14.

Banson, K. E. 2015. Systemic approach to examine the structure, conduct and Performance model of agriculture in Africa, evidence from Ghana. In Proceedings of the 59th Annual Meeting of the ISSS-2015 Berlin, Germany (Vol. 1, No. 1).

Bartlett, J. E., Kotrlik, J. W. and Higgins, C. C. 2001. Organizational Research: Determining Appropriate Sample Size in Survey Research. Learning and Performance Journal, 19: 43-50

Bassey, N. E., Ibok, O. W. and Akpaeti, A. J. 2013. Rice market structure, conduct and performance in Nigeria: A survey of Akwa Ibom State rice marketers. Asian Journal of Agriculture and Food Sciences, 1(3):102.

Bidyasagar, T. and Nicra, S. R. F. 2017. Marketing channel and marketing efficiency analysis for rice in Nalbari district of Assam (India). International Journal of Conservation Science, 5(5): 1285-1289.

Birla, D. S., Malik, K., Sainger, M., Chaudhary, D., Jaiwal, R., and Jaiwal, P. K. 2017. Progress and challenges in improving the nutritional quality of rice (*Oryza sativa* L.). Critical Reviews in Food Science and Nutrition, 57(11): 2455-2481.

Bishwajit, G., Sarker, S., Kpoghomou, M. A., Gao, H., Jun, L., Yin, D. and Ghosh, S. 2013. Self-sufficiency in rice and food security: A South Asian perspective. Agriculture & Food Security, 2: 1-6.

Chirat, A. and Clerc, B. 2024. Convergence on inflation and divergence on price control among post Keynesian pioneers: insights from Galbraith and Lerner. Journal of Post Keynesian Economics, 47(1): 189-235.

Choudhary, D., Banskota, K., Khanal, N. P., McDonald, A. J., Krupnik, T. J. and Erenstein, O. 2022. Rice subsector development and farmer efficiency in Nepal: implications for further transformation and food security. Frontiers in Sustainable Food Systems, 5: 740546.

Delorme Jr, C. D., Kamerschen, D. R., Klein, P. G. and Voeks, L. F. 2002. Structure, conduct and performance: a simultaneous equations approach. Applied economics, 34(17): 2135-2141.

Daniel, W.W. and Cross, C.L. 2013. Biostatistics: A foundation for analysis in the health sciences. 10th edition. New York: John Wiley & Sons.

Dawit, A. 2005. The status and challenges of agricultural marketing in Ethiopia. PP.1 paper presented at a panel discussion organized by the Ethiopian Association of Agricultural Professionals (EAAP), the Ethiopian Agricultural Research Organization (EARO), and the Graduate Studies of Haramaya University.

De Figueirêdo Junior, H. S., Meuwissen, M. P. M. and Lansink, A. O. (2014). Integrating structure, conduct and performance into value chain analysis. Journal on Chain and Network Science, 14(1): 21-30.

FAO. 2023. Food and Agriculture Organization Statistics Division 2022/23. Food and Agriculture Organization Statistics Division. https://www.fao.org/faostat/en/#data/TCL

Frösén, J., Tikkanen, H., Jaakkola, M. and Vassinen, A. 2013. Marketing performance assessment systems and the business context. European journal of marketing, 47(5/6): 715-737.

Gairhe. S., Gauchan, D. and Timsina, K.P. 2021. Temporal dynamics of rice produc-tion and import in Nepal. Journal of Nepal Agricultural Research Council, 7: 97-108.

Gona, A., Khalid, A. and Maikasuwa, M. A. (2020). Structure, Conduct, and Performance of Rice Marketing in Kebbi State, Nigeria. European Journal of Agriculture and Forestry Research, 8(2):1-11.

Hanekom, J. W., Willemse, B. J. and Strydom, D. B. 2010. Structure, conduct and performance in the South African potato processing industry.

Hashim, N., Ali, M. M., Mahadi, M. R., Abdullah, A. F., Wayayok, A., Kassim, M. S. M. and Jamaluddin, A. 2024. Smart Farming for Sustainable Rice Production: An Insight into Application, Challenge, and Future Prospect. Rice Science, 31(1): 47-61.

IRRI. 2024. Ups and downs in the world rice market. [Online] Available: https://www.irri.org/news-and-events/news/ups-and-downs-world-rice-market (Accessed October 2024)

Jacoby, R. A. 2005. Achieving High Performance through Capabilities: What's Required to Dominate in the Service Business. Retrieved Novemeber, 6, 2024.

Ministry of Agriculture and Livestock Development, 2023. Statistical Information on Nepalese Agriculture 2021/2022. Minsitry of Agriculture and Livestock Development. Governement of Nepal, Kathmandu, Nepal.

Mishra, P. K. and Dey, K. 2018. Governance of agricultural value chains: Coordination, control and safeguarding. Journal of Rural Studies, 64: 135-147.

Mishra, R.J., Joshi, G.R. and Dutta, J. P. 2018. Integrating structure, conduct, and performance framework for maize seed value chain analysis in western Nepal. European Academic Research, 5(12): 6527–6562

Naldi, M. and Flamini, M. 2014. The CR4 index and the interval estimation of the Herfindahl-Hirschman Index: an empirical comparison. Available at SSRN https://ssrn.com/abstract=2448656

Olukosi, J. O., Isitor, S. U. and Moses, O. O. 2005. Agricultural Marketing and Prices: Principles and Applications 3rd Edition, Living Books Series, GU Publications, Abuja, FCT.

Pickering, J. F. 1974. Industrial Structure and Market Conduct. Martin Robertson and Co. Ltd, London.

Poudel, S., Karki, R. and Sharma, S. 2025. Government Intervention in Agriculture Market Management. Nepalese Journal of Agricultural Sciences, 29: 174.

Poudel, S., Thapa, R. and Mishra, B. 2024. A Farmer-Centric Cost–Benefit Analysis of Climate-Smart Agriculture in the Gandaki River Basin of Nepal. Climate, 12(9): 145.

Pramanik, R. and Prakash, G. 2010. Marketable Surplus and Marketing Efficiency of Vegetables in Indore District: A Micro-Level Study. IUP Journal of Agricultural Economics, 7(3): 84-93,

Raha, S. K., Moniruzzaman, M., Alam, M. M. and Awal, M. A. 2013. Structure, conduct and performance of the rice market and the impact of technological changes in milling. Institute of Agribusiness and Development Studies. Bangladesh Agricultural University, Mymensingh.

Rahman, M. C., Pede, V., Balie, J., Pabuayon, I. M., Yorobe, J. M. and Mohanty, S. 2021. Assessing the market power of millers and wholesalers in the Bangladesh rice sector. Journal of Agribusiness in Developing and Emerging Economies, 11(3): 280-295.

Scarborough, V. and Kydd, J. 1992. Economic Analysis of Agricultural Markets. A Manual Marketing Series 5, Chatham UK: Natural Resource.

Shahana, K. S. and Ushadevi, K. N. 2024. Market Concentration of Branded Rice in Kerala. *Asian* Journal of Agricultural Extension, Economics & Sociology, 42(11):176-185.

Shelke, R. D., Dhurve, S.R. and Meshram, D.U. 2019. Price Spread of Paddy in Chandrapur District of Maharashtra, India. International Journal Current Microbiology and Applied Science. 8(5): 1850-1856.

Takele, A. 2010. Analysis of rice profitability and marketing chain: The case of Fogera Woreda, South Gondar Zone, Amhara national regional state, Ethiopia (Doctoral dissertation, Haramaya University).

Thapa, R. and Bhusal, N. 2020. Designing rice for the 22nd century: Towards a rice with an enhanced productivity and efficient photosynthetic pathway. Turkish Journal of Agriculture-Food Science and Technology, 8(12): 2623-2634.

Thapa, R., & Dhakal, S. C. 2024. Technical efficiency of rice seed production and their determinants in Chitwan, Nepal–A one-step scaling stochastic frontier approach. Cogent Food & Agriculture, 10(1): 2353668.

Thapa, R., Dhakal, S. C. and Subedi, S. 2025. Profitability and resource use efficiency of rice seed production: A case of Chitwan, Nepal. Cogent Food & Agriculture, 11(1): 2444341.

Valery, N., Tiafack, O., Tieminie, R., Roland, N. and Kilian, T. 2022. Structure Conduct and Performance of Rice Marketing in Ndop, North West Region Cameroon. Saudi Journal of Humanities and Social Science, 7(10): 427-435.