

STRUCTURE, CONDUCT, AND PERFORMANCE ANALYSIS OF THE SEAWEED MARKET IN EASTERN INDONESIA: A CASE STUDY FROM ROTE NDAO

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Abstract. Rote Island holds significant potential for seaweed development; however, the existing marketing system has yet to provide adequate welfare guarantees for seaweed farmers, as well as for other market participants. This study aims to analyze the structure, conduct, and performance of the seaweed market in Rote Barat District, Rote Ndao Regency, using the Structure-Conduct-Performance (SCP) approach. A mixed-methods research design was employed, with primary data collected through questionnaires and interviews involving 38 seaweed farmers and other market actors. The findings indicate that the market structure is oligopsonistic, with a concentration ratio (CR4) of 17.49% and a Herfindahl-Hirschman Index (HHI) of 10,000, reflecting a highly concentrated market. Barriers to market entry are also substantial, as evidenced by a Minimum Efficiency Scale (MES) of 62%. In terms of market conduct, prices are determined unilaterally by large traders and aggregators, while farmers tend to act as price takers. Market performance reveals high marketing margins and low farmer shares, indicating an unequal distribution of profits that disadvantages producers. Therefore, policy intervention and institutional strengthening, such as the formation of seaweed cooperatives, are necessary to foster a more transparent and equitable market system.

Keywords: Market Structure, Market Conduct, Market Performance, Seaweed, SCP, Rote Ndao

INTRODUCTION

Seaweed is one of the leading commodities in the fisheries and marine sector, possessing high economic value. It is not only utilized as a raw material in the food industry but also plays a significant role in the pharmaceutical, cosmetic, and bioenergy sectors. As a maritime nation, Indonesia holds vast potential for seaweed development and currently ranks as the world's second-largest producer of seaweed, after China. According to data from the FAO (2016) and Statistics Indonesia (BPS, 2022), the three central regions in Indonesia with the highest seaweed production are South Sulawesi, East Nusa Tenggara (NTT), and Central Sulawesi. In particular, NTT has positioned seaweed farming as a key sector supporting the livelihoods of coastal communities.

Rote Ndao Regency, located in East Nusa Tenggara Province, is one of the regions with favorable geographical and ecological conditions for seaweed cultivation. The coastal area of Rote Barat District features clear waters, warm sea temperatures, and low pollution levels. These environmental characteristics make it highly suitable for seaweed farming, especially the species *Kappaphycus alvarezii*, which is the most widely cultivated type and accounts for approximately 90% of the total national seaweed production. A global report underscores the significant socioeconomic and ecological benefits of seaweed cultivation, indicating Indonesia's seaweed value chain remains underdeveloped despite its potential (World Bank, 2023). Nor et al. (2019) also emphasize the importance of integrating value chain efficiency in the seaweed sector to enhance competitiveness in regional markets.

However, despite this potential, seaweed farmers in Rote Barat District face several critical challenges, particularly in the marketing system. One of the main issues is the high price volatility and dependency on intermediaries or collectors who wield considerable power in determining purchase prices at the farm level. Data from BPS (2024) indicate that the price of dried seaweed is unstable, with

a recorded value of IDR 18,000 per kilogram in 2025. Farmers, however, often remain unaware of when prices rise or fall due to a lack of access to up-to-date market price information. In practice, prices are primarily dictated by a handful of large traders, creating a non-competitive market structure known as an oligopsony, where many sellers (farmers) face a few buyers with significant bargaining power. That further emphasizes that weak institutional support in coastal aquaculture systems affects farmer resilience and long-term sustainability (Rimmer et al., 2021).

This dependency on dominant buyers not only limits farmers' ability to negotiate fair prices but also exposes them to exploitative trading practices. In many cases, these middlemen extend credit or offer loans to farmers, creating a debt dependency cycle that forces them to sell their harvest at predetermined prices regardless of broader market conditions. This dynamic has been documented in recent field studies, which describe heterogeneity in production and marketing systems among Indonesian seaweed farmers (Langford et al., 2024). Documented in recent fieldwork in Indonesia, the study emphasizes the role of heterogeneity in production and marketing systems in sustaining smallholder resilience (Ludher & Woo, 2024). Institutional support is frequently lacking, which further entrenches these imbalances and weakens farmers' bargaining capacity. Tabrani et al. (2024) also note that the absence of structured agroindustry management in the Indonesian seaweed sector has led to inefficiencies and stagnation in farmer empowerment initiatives.

The fundamental concept of marketing, according to Kotler (2022), is a social and managerial process through which individuals and groups obtain what they need and want by creating and exchanging products of value. In the agricultural context, particularly seaweed, the marketing process encompasses all value distribution activities, involving not only producers and consumers but also intermediaries such as collectors and wholesalers. Imbalances in this value distribution can negatively affect farmers' production incentives.

Under such circumstances, the Structure-Conduct-Performance (SCP) approach becomes highly relevant for market analysis. This approach, developed by Bain (1959), enables a comprehensive examination of market structure (including the number of actors and entry barriers), market conduct (pricing mechanisms and distribution strategies), and market performance (efficiency, farmer welfare, and value distribution). A market structure dominated by large buyers tends to produce exploitative market behavior towards farmers, leading to poor market performance, particularly in terms of benefits for primary producers. This aligns with the view of Lipczynski et al. (2005), who emphasize that the relationships between structure, conduct, and performance are dynamic and mutually reinforcing. Porter (2020) also highlights how concentrated market power can reduce competitiveness and lead to unequal profit distribution.

To assess market entry barriers, the concept of the Minimum Efficient Scale (MES), as described by Jaya (2001), is utilized. A high MES indicates that new entrants face substantial challenges in entering the marketing system, thereby reinforcing the dominance of established, large-scale actors. Meanwhile, market performance can be evaluated through marketing margins and the share of price received by farmers (farmer share), which, according to Sudiyono (2002) and Sulastri (2016), reflect the efficiency and equity of value distribution across the supply chain. Recent advances in traceability and digital tools demonstrate that technological interventions can enhance transparency and reduce post-harvest losses in small-scale aquaculture markets (Koltiva & Coast 4C, 2025). The sector's global expansion into bioplastics, nutraceuticals, and carbon sequestration underscores the need for inclusive governance mechanisms. Janke (2024) supports this notion, identifying the need for clear policy frameworks and sustainable mass flow management for seaweed in industrial ecosystems. To assess market entry barriers, the concept of the Minimum Efficient Scale (MES), as described by Jaya (2001), is utilized. A high MES indicates that new entrants face substantial challenges in entering the marketing system, thereby reinforcing the dominance of established, large-scale actors. Meanwhile, market performance can be evaluated through marketing margins and the share of price received by farmers (farmer share), which, according to Sudiyono (2002) and Sulastri (2016), reflect the efficiency and equity of value distribution across the supply chain. Recent advances in traceability and digital tools demonstrate that technological interventions can enhance transparency and reduce post-harvest losses in small-scale aquaculture markets (Koltiva & Coast 4C, 2025). The sector's global expansion into bioplastics, nutraceuticals, and carbon sequestration underscores the need for inclusive governance mechanisms. Janke (2024) support this notion, identifying the need for clear policy frameworks and sustainable mass flow management for seaweed in industrial ecosystems.

Several previous studies, including those by Pagala et al. (2017) and Badriadi et al. (2020), found that the seaweed market structure in various Indonesian regions tends to be oligopsonistic. This phenomenon weakens the position of farmers as primary producers, often resulting in low selling prices. Masela and Lusnarnera (2022) further observed that farmers' dependence on collectors due to capital loans exacerbates their weak bargaining position. In conclusion, Nendissa and Anindita (2021) emphasize that the SCP approach is highly relevant for analyzing commodity markets in eastern Indonesia, where structural and informational constraints remain prevalent.

Moreover, the seaweed value chain in eastern Indonesia remains underdeveloped in terms of institutional support. The absence of farmer cooperatives or collective bargaining mechanisms often leads to fragmented marketing efforts. Strengthening farmer institutions is not only essential for improving bargaining power but also for promoting transparency and fairness in trade. Technological innovations such as mobile-based price monitoring platforms and cooperative-led aggregation systems have shown potential in other regions and could be replicated in Rote Barat. These solutions could offer farmers more flexibility and resilience against price manipulation and supply chain disruptions.

Previous studies have primarily focused on aspects of production and farming efficiency. Still, research addressing the dynamics of the market and farmers' bargaining positions within the seaweed value chain remains limited. Therefore, this study is significant as it provides an empirical overview of the seaweed market conditions in Rote Barat District and formulates policy recommendations to improve market structure and governance. This research contributes not only academically to the field of agricultural economics but also serves as a basis for developing local development policies grounded in regional potential.

The objective of this study is to analyze the seaweed market structure in Rote Barat District by assessing market concentration levels, entry barriers, and available market information. Additionally, the study aims to investigate the behavior of market actors in price setting and distribution systems, and to assess market performance in supporting the welfare of farmers. The findings are expected to inform stakeholders, including government agencies, non-governmental organizations, and private sector players, in building a fair and sustainable marketing system.

METHODS

This study employs a mixed-methods approach, integrating both quantitative and qualitative techniques to provide a comprehensive analysis of the market structure, conduct, and performance of the seaweed market in Rote Barat District. The research is designed as a case study focused on a single seaweed-producing area that faces distinctive marketing challenges. This approach was chosen to capture the complexity of interactions among market actors while also empirically measuring market indicators.

The population of this study includes all seaweed farmers in Oelolot Village, Rote Barat District, totaling 378 individuals. A sample of 38 respondents was selected using random sampling to reflect variations among farmers based on farm scale and experience. Additionally, several collectors and other market participants were purposively interviewed to enrich insights into market conduct.

Data collected consisted of both primary and secondary sources. Primary data were obtained through structured questionnaires and in-depth interviews, while secondary data were gathered from official documents, government reports, and relevant literature. The research instruments underwent basic validity and reliability testing to ensure credibility in the analytical outcomes.

The data analysis techniques used in this study include both descriptive and quantitative analysis. To assess market structure, the study employs the four-firm concentration ratio namely the concentration ratio for Biggest Four (CR₄) and the Herfindahl-Hirschman Index (HHI). The calculation of CR and HHI uses a formula as used by Nendissa & Anindita (2021), namely:

$$CR_i = \frac{Si}{\sum_{n=1}^n Sn} \times 100 = \frac{\text{Sales volume to } i}{\text{Total sales volume in the market}} \times 100 \dots\dots\dots (1)$$

$$CR_4 = CR_1 + CR_2 + CR_3 + CR_4$$

Criteria:

1. CR₄ < 20%: competitive market, approaching perfect competition
2. 20% ≤ CR₄ ≤ 80%: imperfect market, characteristic of an oligopsony or oligopoly
3. CR₄ > 80%: highly concentrated market, tending toward monopsony or monopoly

$$HHI = (CR_1)^2 + (CR_2)^2 + (CR_3)^2 + \dots + (CR_n)^2 \dots\dots\dots (2)$$

CR_{1-n} = Market shares of the top four seaweed producers from 1 to n

Criteria:

1. If HHI 0 – 1000 market concentration is low, competition in the market is tight
2. If HHI 1000 – 1800 is moderate, competition in the market is moderate
3. If HHI 1800 – 10,000 concentration is high, competition in the market is low.

Minimum Efficiency Scale (MES) is used to evaluate barriers to market entry. Market conduct is analyzed through pricing mechanisms, payment systems, and the nature of relationships between farmers and traders. Market performance is assessed using marketing margins and farmer share as indicators of distribution efficiency and price fairness at the producer level.

The analysis compares field findings with theoretical standards derived from the SCP framework. Thus, the study offers not only descriptive insights but also an interpretive assessment of farmers' bargaining positions and market conditions through a scientifically measurable framework.

RESULT AND DISCUSSION

4.1 General Regional Overview

Rote Ndao Regency, the southernmost archipelagic region of Indonesia, maintains an economic structure that remains heavily dependent on the primary sector. According to data from Statistics Indonesia (BPS) in 2023, the agriculture, forestry, and fisheries sector contributed 49.33% to the Gross Regional Domestic Product (GRDP) of Rote Ndao, making it the largest and most dominant economic sector in the region's economy (BPS Rote Ndao, 2023). Although this figure shows a slight decline compared to the previous year (49.59%), the sector's contribution remains significant, indicating a high dependency on local natural resources.

In terms of employment, more than half of Rote Ndao's population depends on agrarian livelihoods. The 2020 Population Census by BPS recorded that approximately 50.36% of the labor force is engaged in agriculture, forestry, and fisheries activities, underscoring the sector's dual role in contributing both to GRDP and as the primary source of employment (BPS, 2020). These findings align with Nendissa & Anindita (2021) dan Nendissa, et al, (2019) who emphasize the eastern Indonesian community's reliance on the agrarian sector in the context of local economic development.

Within the fisheries sector, seaweed cultivation is one of the region's leading commodities, particularly in coastal districts such as West Rote and East Rote. This activity has grown rapidly due to ideal geographic conditions clear seawater, calm currents, and relatively unpolluted coastal ecosystems. A study by Badriadi et al. (2020) revealed that *Kappaphycus alvarezii* dominates seaweed production and serves as the primary source of income for both fishermen and coastal farmers.

In addition to the agrarian sector, the education services sector (11.96%) and government administration (11.63%) also make substantial contributions to Rote Ndao's economy, though employment opportunities in these sectors remain concentrated in administrative centers and district capitals (BPS Rote Ndao, 2023). This reflects an economic dualism, where service sectors grow in urban centers while rural areas continue to rely on natural resource-based livelihoods.

In terms of economic infrastructure, land and sea transportation systems play a vital role. Well-developed road access and active ports such as Ba'a Port and Pantai Baru facilitate the distribution of agricultural and seaweed products, while also opening up opportunities for inter-island trade (Rote Ndao Port Authority, 2023). These infrastructures are key to ensuring efficient value distribution in local commodity markets, as highlighted by Kotler (2022), who emphasized that effective marketing is contingent upon a supportive distribution system.

Considering the geographic conditions, economic structure, and the social context of the population, it can be concluded that Rote Ndao Regency holds significant economic growth potential provided that the agriculture and fisheries sectors are supported by fair market systems, reliable infrastructure, and strong farmer institutions. The Structure-Conduct-Performance (SCP) framework is particularly relevant in analyzing this dynamic, as the interplay between market structure, actor behavior, and distribution performance critically influences the success of economic development in underdeveloped regions like Rote Ndao (Bain, 1959; Lipczynski et al., 2005).

4.2 Market Structure

With a Herfindahl-Hirschman Index (HHI) of 10,000 and a Concentration Ratio of the top four buyers (CR4) of 17.49%, the seaweed market structure in Rote Barat District is marked by a high degree of concentration. A highly concentrated oligopsonistic market, in which a few major buyers control the purchasing side, is evident from this exceptionally high HHI value. Under such circumstances, a small number of players hold the majority of the power to influence market prices, resulting in centralized decision-making and limiting the natural operation of competition. In reality, this implies that while many farmers cultivate seaweed, a small number of traders or aggregators control the routes that seaweed takes to reach larger markets or export destinations.

This market concentration pattern is not specific to seaweed; rather, it is consistent with patterns seen in other Eastern Indonesian agricultural commodities. According to research on cashew nuts (Luron et al., 2023), shallots (Husen et al., 2022), and kapok bananas (Bunga et al., 2020), marketplaces are usually controlled by a small number of large buyers, with farmers having a secondary influence on price. Deeper problems, such as poor market access, insufficient infrastructure, and a lack of inclusive institutions that can empower producers, are often reflected in these structural patterns.

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These farmers frequently use debt-credit programs or advance payments to establish patron-client relationships with nearby traders. These agreements frequently result in long-term dependency even if they could offer temporary financial respite. Regardless of the state of the market, farmers are forced to sell only to certain traders. This relationship not only restricts their ability to look for better offers elsewhere, but it also feeds the cycle of debt and subordination.

The lack of institutional support that may act as a check on buyer domination, such as operational farmer cooperatives, open pricing systems, or government market facilitation, is another worrying issue. According to institutional economics, the difficulties experienced by seaweed growers in Rote Barat are caused by both the lack of institutions that can guarantee fair and equal access to market possibilities as well as by imperfect markets. Without these institutions, farmers lack the tools to strengthen their position in the market or stabilize their income, and structural inequities go uncontrolled. Large purchasers have a significant advantage in this region's seaweed market structure. The development of a robust and competitive market ecology is hampered by this circumstance. In order to address this problem and foster a more equitable and balanced market environment, intentional interventions will be needed, such as government support, market transparency programs, and cooperative strengthening.

4.3 Market Conduct

The conduct of market participants in the highly concentrated seaweed market structure of Rote Barat District demonstrates expected non-competitive traits. According to field data, price formation is not influenced by open market mechanisms or negotiations; instead, it is unilaterally dictated by large dealers. These predominant purchasers frequently collude on pricing—either openly or informally—disregarding wider regional or national market dynamics. The pricing mechanism is hierarchical, resulting in minimal input from seaweed growers about the valuation of their products.

Survey findings indicate that 87% of interviewed farmers lack access to precise or timely market price information beyond their local village. This considerable knowledge asymmetry disadvantages farmers and effectively suppresses their involvement in price discovery. In this context, traders serve as the exclusive providers of market information, frequently leveraging this informational monopoly for their benefit. Prices are conveyed to farmers solely when transactions among buyers are finalized, and these amounts are deemed non-negotiable. As a result, the essential economic principle of supply and demand is perverted, as producers are entirely excluded from the negotiation process.

This environment promotes exploitative informal agreements between farmers and dealers. It is customary for traders to give advance loans, input assistance, or capital to farmers in return for assured future sales. Although these agreements provide immediate financial assistance, they frequently result in enduring patron-client relationships characterized by reliance and inequity. Farmers must sell their

produce to designated traders at fixed prices, with loan repayments automatically subtracted from the sales revenue. This not only restricts farmers' market alternatives but also sustains a cycle of indebtedness, further undermining their autonomy and economic stability.

These dynamics are not confined to seaweed markets in Rote Barat but reflect wider trends observed in rural economies throughout the Global South, where smallholders encounter analogous structural constraints and power disparities. Resolving these difficulties necessitates more than traditional regulatory supervision. There is a necessity for innovative and inclusive solutions, including the establishment of digital platforms for real-time price dissemination, community-oriented price monitoring systems, and farmer collectives capable of engaging in price negotiations. Such interventions can provide farmers with the necessary information and organizational capacity to negotiate equitably, diminish reliance on intermediaries, and eventually foster a more transparent, inclusive, and equitable seaweed selling system.

4.4 Market Performance

Market performance is assessed based on marketing margins and the farmer share. Calculations show that traders enjoy relatively high marketing margins, while the farmer share ranges from only 30–45%. This low share indicates that the profits from seaweed trade are not fairly distributed to the primary producers. Meanwhile, traders capture a significantly larger portion of profits without direct contribution to the production process. Such disproportionate profit distribution impacts not only farmer incomes but also the sustainability of seaweed cultivation. When farmers do not receive adequate economic incentives, their motivation to continue farming declines, potentially reducing national seaweed supply in the long term.

Empirical data also reveal the absence of price regulation at both local and regional levels. Without policy intervention, price mechanisms operate freely and tend to be dominated by powerful actors. This further strengthens the oligopsonistic structure and creates an unjust market system for farmers. Local government agencies, such as the Department of Marine and Fisheries, have yet to fully perform their role as market facilitators.

Institutionally, strong and independent seaweed farmer cooperatives have yet to be established. Cooperatives could serve as tools for price control, market information dissemination, and effective distribution. Without such balancing institutions, farmers struggle to access alternative markets or external price information. Cooperatives could also aggregate harvests on a larger scale, increasing farmers' bargaining power in negotiations with buyers.

Comparisons with previous studies such as those by Badriadi et al. (2020) and Masela & Lusnarnera (2022) indicate similar patterns in other seaweed-producing regions, where markets are dominated by a few actors and farmers serve only as price takers. This phenomenon underscores the need for systemic intervention in the national seaweed market, particularly in Eastern Indonesia.

In the long term, an unjust market system can reduce farmers' incentives to improve productivity. Farmers who feel their work yields insufficient economic value may reduce cultivation intensity or shift to other sectors. This could ultimately affect national production resilience and seaweed supply.

Given these findings, the current seaweed market structure in Rote Barat does not support the creation of an efficient and equitable market. Therefore, institutional reform and policy intervention are necessary, including price transparency, cooperative formation, and training for farmers in business and marketing management. These improvements aim to ensure that the seaweed market functions as a tool for welfare, rather than a source of inequality.

Furthermore, the relationship between market structure, conduct, and performance in this context is mutually reinforcing. A concentrated market structure gives rise to non-competitive pricing behavior and weakens farmers' bargaining position. This behavior, in turn, results in poor market performance, as reflected in high marketing margins and low farmer share. Conversely, poor market performance reinforces the dominant structure because farmers are unable to compete, ultimately strengthening the market power of established actors.

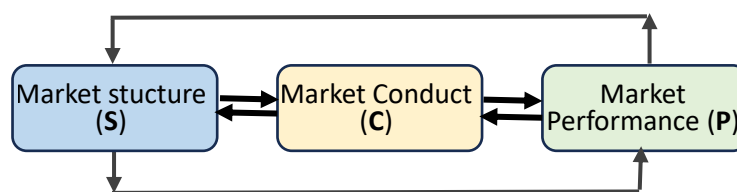


Figure 1. The Relationship Between S-C-P of the Seaweed Market in Rote Ndao, 2025

The interconnection between structure, conduct, and performance in this market is self-reinforcing. A concentrated structure enables non-competitive behavior, resulting in poor performance outcomes, such as low farmer shares and high margins for intermediaries. These outcomes, in turn, perpetuate structural imbalances by weakening the capacity of small actors to challenge dominant players. Thus, to establish a fair and sustainable seaweed market, policy interventions must not focus on a single aspect alone. All three elements market structure, conduct, and performance must be addressed simultaneously and in an integrated manner. Efforts to promote healthy competition, information transparency, and farmer empowerment will contribute to a more efficient, inclusive market system that provides long-term benefits for all stakeholders.

CONCLUSION

This study reveals that the seaweed market structure in Rote Barat District is highly concentrated, as evidenced by a CR4 value of 17.49% and an HHI of 10,000, indicating an oligopsonistic market dominated by a few large buyers. Entry barriers are significant, with a Minimum Efficient Scale (MES) of 62%, which limits new participants and further reinforces market concentration. Under this structure, market conduct is characterized by price-setting behavior controlled by dominant traders, with farmers essentially acting as price-takers. The payment system is informal and often delayed, exacerbating farmers' dependency on aggregators. This aligns with the SCP paradigm, which posits that concentrated market structures tend to foster non-competitive behaviors that disadvantage weaker actors in the supply chain. Market performance is assessed through marketing margins and farmer share. The results indicate a clear imbalance in value distribution, with high marketing margins retained by intermediaries, while the farmer's share remains disproportionately low. These conditions adversely affect the welfare of producers and challenge the long-term sustainability of seaweed farming in the region.

Given these findings, strategic interventions are necessary to promote a more equitable and efficient market system. First, the formation and strengthening of farmer cooperatives is essential to improve bargaining power, provide collective access to market information, and stabilize prices through bulk selling mechanisms. Second, enhanced transparency in pricing across the supply chain should be pursued. This includes the establishment of digital market information systems and the promotion of direct market linkages between farmers and end-users.

Third, local governments should introduce fair market regulations to protect producers. These may include margin caps, standardized quality-based pricing, and routine market monitoring. In tandem, capacity-building programs focused on marketing literacy, financial management, and contract negotiation for farmers can help reduce asymmetric power relations. Finally, supporting infrastructure, such as cold storage, transportation access, and post-harvest facilities, must be developed to increase farmers' flexibility in determining selling times and reduce post-harvest losses. Market education initiatives will also empower farmers to better understand and navigate market dynamics. In conclusion, improving the structure, conduct, and performance of the seaweed market in Rote Barat District requires an integrated approach that combines institutional development, regulatory support, and market empowerment. Such reforms are critical not only for enhancing local economic efficiency but also for building long-term resilience and prosperity for coastal communities.

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