

Rice supply-chain management performance and business ecosystem support in Klaten District

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Abstract. The supply chain performance of rice products in Klaten District is still long. This condition affects the distribution efficiency and price formation of rice. The objectives of this study are to (1) analyse the supply chain of rice products from upstream to downstream, (2) analyse the supply chain management performance of rice products, and (3) analyse the process of rice price formation. Data analysis was conducted both quantitatively and qualitatively. The research was conducted in 2018 and data collection was conducted using the interview method with limited farmer respondents and the snowball method for supply chain actors. The research results obtained the following findings: (a) there are 5-7 business actors in the rice product supply chain; (b) supply chain management performance for rice products in Klaten District is at a moderate to high level; and (c) the formation of grain and rice prices is determined more by the supply aspect than the demand aspect. To improve the supply chain management performance of rice products in Klaten District in an integrated manner, it is necessary to improve distribution efficiency and a conducive business ecosystem. Developing an inclusive business program is the latest government-supported idea for creating a conducive business ecosystem.

1 Introduction

Rice is a commodity that has a strategic value in Indonesia in terms of economic, environmental, social, and political aspects. Rice also plays an essential role in the international trade market, especially for Asian staple food consumption and stock of the nation [1]. The strategic issue of rice has always been a government concern, especially regarding policies on production, trade, distribution, and a conducive business ecosystem. Although Indonesia ranks third largest in the world in rice production, the sheer volume of rice in the international market makes Indonesia vulnerable to rice price fluctuations in the world market. Rice is a unique product for Indonesians. Rice in rural areas has become a

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symbol of households' socioeconomic status. Households that consume rice as their staple food are seen as having a higher socioeconomic status than those that consume other staples, such as maize and local tubers.

Marimin et al. [2] defined supply chain management as an integrated marketing system that integrates products and business actors to provide customer satisfaction. There are at least six principles of effective supply chain management [3]: (a) focus on customers and consumers, (b) produce quality products, (c) ensure effective logistics and distribution, (d) efficient information and communication strategies, (e) build effective supply chain cooperation institutions, and (f) create added value and share value fairly.

Several regulations are in place to regulate and maintain the stability of food supply and prices. This is in line with Law No. 18/2012 on Food, in which the government controls and is responsible for the availability of basic and strategic foodstuffs throughout Indonesia. As Indonesia's main staple food commodity, rice has a very important position in terms of economic and socio-political aspects; therefore, fluctuations in rice prices can directly impact the welfare of farmers and the consumer community. The rice supply chain's performance significantly influences the rice price formation process [4–6].

The government is interested in establishing regulations to create an equitable rice trade system through the Minister of Trade Regulation No. 57/2017 on Determining the Highest Retail Price of Rice and the Minister of Agriculture Regulation No. 31/2017 on the Rice Quality Class. The setting of the Highest Retail Price (HRP) for rice commodities in Minister of Trade Regulation No. 57/2017 considers a reasonable cost structure for all supply chain actors' production costs, distribution, and profits. The amount of HRP that has been determined must be a reference for all actors in the rice product supply chain and must regulate sanctions for businesses that sell rice prices exceeding the HRP. The results of this research are expected to provide novelty in building effective rice supply chain management, supported by a conducive business ecosystem.

This study aims to (1) examine the rice product supply chain from upstream to downstream, (2) assess the effectiveness of supply chain management, and (3) examine the trade margins and price formation for rice products.

2 Methodology

2.1 Time, location, and research respondents

The research was conducted in Klaten District, Central Java Province rice production centres. The types of data collected included primary and secondary data. Primary data were collected through direct interviews with respondent farmers, farmer groups, rice milling units (RMUs), traders, wholesalers, and retailers using structured questionnaires. Secondary data were collected from various related agencies, such as the Department of Agriculture, BPS-Statistics Indonesia, and the literature.

2.2 Data and analysis methods

Data analysis was conducted quantitatively and qualitatively. Quantitative analysis was conducted using supply chain analysis, trade margins, and supply chain management performance. Qualitative analysis is needed to build a conducive business ecosystem and to support the description and explanation of the various analyses conducted. In this context, marketing margin analysis is the difference between the price received by farmers and the price paid by consumers [7,8]. To analyse marketing margins in this study, the price data used were prices at the farm and marketing institution levels. A pricing analysis can be

conducted at producer-production centres and consumer centres. Effective supply chain actors and stakeholders involved in rice supply chain management were identified to create a conducive business ecosystem.

3 Results and discussion

3.1 Rice supply chain

A supply chain is a method used by a corporate organisation to distribute the produced goods and services to its clients [9]. The supply chain of rice commodities in Klaten is presented in Figure 1, which reflects several key points: (1) the supply chain system involves 6-7 business actors, namely farmers, rice traders (village level), small-scale rice milling industry (IPK), medium and large-scale rice milling industry (IPM/IPB), interregional traders, large traders in consumption centres, and retail traders; and (2) the government intervention pattern supply chain system involves only four business actors, namely farmers, farmer group associations, small-scale rice milling industry (IPK) owned by farmer group associations, and Indonesian Farmer's Shop (TTI). Suppose the TTI pattern introduced by the Ministry of Agriculture and the "Rumah Pangan Kita" (RPK) introduced by the Logistics Affairs Agency (BULOG) Public Corporation work well. In this case, it is expected to help stabilise the rice prices. The rice supply chain consists of several entities that interact with each other through typical interaction patterns according to the structure formed. These rice supply chain entities interact to achieve the common goal of meeting the needs of end consumers [10]. A supply chain is an integrated system that runs from upstream to downstream. All components of the rice product supply chain system should be viewed as integrated [11].

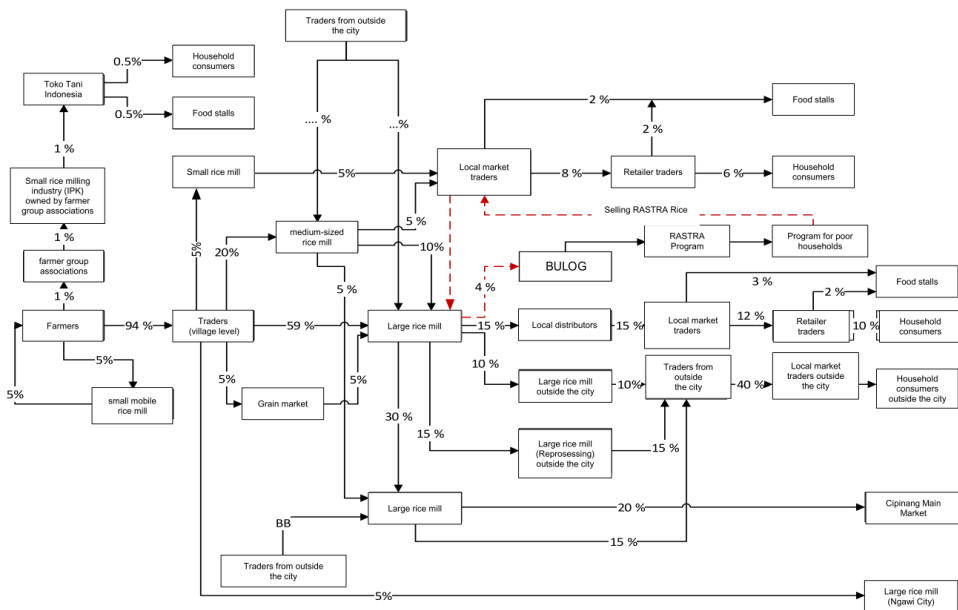


Fig. 1. Rice flow in the rice supply chain in Klaten District, 2018.

Farmers are the main actors as suppliers of grain and rice. Rice is harvested by farmers or rice traders (village level) and sold in the form of dry harvested grain (DG). There is a Community Food Business Development Program (PUPM) by the Farmer Group

Association (Gapoktan) to provide rice to Toko Tani Indonesia (TTI). There are two types of rice traders (village level), namely rice traders (village level), who work for the medium-scale rice milling industry (IPM) and the large-scale rice milling industry (IPB), and independent rice traders (village level). The small-scale rice milling industry (IPK) in the rice production centre area of Klaten, Central Java, experiences a grain shortage, especially during the 2nd and 3rd rice planting seasons. Therefore, some have to buy grain from outside the region.

The medium-scale rice milling industry (IPM) in the economic centre area, which is in a location that is easily accessible to traders, has also experienced growth. It was found that in the rice production centre area of Klaten District, a new IPM was established. The capacity of medium-scale mills is 10-15 tons of rice per day, with the products being produced as glossier rice or rice ingredients (asalan rice). These products are mainly intended for rice mills that process rice to rice. The large-scale rice milling industry (IPB) has grown and developed in several Klaten, Central Java rice centres. IPB, whose equipment is old (>7 years), processes 30% of the grain into rice ingredients and supplies rice to rice processors both in the Klaten area and outside the Klaten District (Sragen, Magelang, Cilacap, Indramayu, and Karawang). The increasing consumer demand for quality rice is an opportunity for the growth of rice mills (not paddies) that specialise in processing raw rice into medium- and super-quality white rice. In addition to the market demand factor, the reason for IPB millers to develop rice-to-rice processing businesses is to speed up the white rice production process.

3.2 Rice product trade margins and price formation

The condition of harvested dry grain prices in 2018 in Klaten, Central Java Province, showed that the spike in grain prices that occurred in January-February 2018, which reached IDR 5,400-5,600/kg, decreased to IDR 4,200-4,500/kg in March 2018. The selling price of medium-quality rice at the rice milling industry level in March 2018 ranged from IDR 9,200-10,000/kg, with a premium class between IDR 11,000-12,000/kg. The net profit received by IPPs was only around IDR 100-200/kg plus the receipt of bran and groats or around IDR 150-300/kg.

At the peak of the harvest season, rice prices stabilised and sales began to normalise. Empirically, there is a gap between the harvest time and the availability of rice in the market. The price of medium rice at the retail level is standard at IDR 10,000/kg, while premium rice is standard at IDR 11,000-11,500/kg. Rice consumers consisted of restaurant consumers (60-70%) and household consumers (30-40%). According to traders in the Klaten Market, the factors that caused the price of rice to spike at the end of January-February were the lack of rice supply in the market because the rice in the mill was running low due to unharvested rice, the weather factor of the rainy season, and the rapid movement of grain between districts.

Table 1. Price of rice by type or quality in Klaten Market (IDR 000/kg), 2018.

Type of rice	January-February 2018		Early March 2018	
	Purchase price	Selling price	Purchase price	Selling price
IR 64	10	11	9	10
C4 Delanggu	11	12	10	11
Tanag rice	13	14	12	13
Cisadane	11	12	10	10
Menthik Wangi	13	14	12	13
Rojo Lele	13,5	14,5	11,5	12,5

Based on interviews with the Klaten Market Office staff, it was found that the number of rice traders in Klaten Market was quite large. There are approximately 5-6 wholesalers, and retailers are around 25-30 people. The average retailer currently sells not only rice but also diversifies its business to sell nine staples. The volume of rice wholesalers sold is 4-5 tons/day, while large retailers are 0.5-1 tons/day and small retailers are 50-100 kg/day. Sources of rice acquisition are Ngawen, Delanggu, Karang Dowo, and Juwiring Sub-districts. The complete and detailed conditions of rice prices at the retail level in the Klaten Market are presented in Table 1.

The price of rice in the Klaten Market was stable at the time of the survey. The perceived standard price of medium rice at the retail level is IDR 10,000-10,500/kg, while the perceived standard price of premium rice is IDR 12,000-13,000/kg. Rice buyers for wholesalers and large retailers in Klaten Market include small retailers (50%), household consumers (35%), caterers (10%), and restaurant consumers (5%). According to traders, the lack of supply brought on by unharvested rice, weather-related issues during the rainy season, and the removal of some rice from the area led to an increase in rice prices at the end of January and beginning of February 2018.

One of the market destinations for rice from Klaten is the Legi Market in Solo City. There are several rice traders, approximately four to five wholesalers and retailers, and 25 small retailers. Generally, traders currently do not only sell rice but diversify their business into nine staples (rice, mung beans, sugar, brown sugar, shallots, and garlic). The sales volume is 5-6 qu/day if the low season is only 3-4 qu/day and if the high season can reach 8-10 qu/day. The amount of capital rotated averaged IDR 10 million/day. If the market is busy, it can reach IDR 15 million. The source of rice is mainly from Klaten, Sragen, Karang Anyar, Klaten, and Sukoharjo. The complete and detailed price conditions by rice type in the Legi Market, Solo City, are presented in Table 2.

Table 2. Rice prices by type or quality in the Legi Market (IDR 000/kg), Solo City, 2018.

Type of rice	January-February 2018		Early March 2018	
	Purchase price	Selling Price	Purchase price	Selling price
C4	11,5	12	10-10,5	11
IR 64	10	10,5	9	9,5
C4 Super	12,5	12,5	11	12
Menthik Wangi	13	14	12,5	13

In addition to Legi Market, Solo, rice from Klaten also flows to the Dargo Market in Semarang City. Although the price of unhusked rice in that period dropped significantly, the price in one of the rice market centres in the Dargo Market decreased slightly but remained high. The complete and detailed conditions and development of rice prices by type in 2018 in Dargo Market, Central Java, are presented in Table 3, which shows that the spike in rice prices occurred in January-February 2018, reaching IDR 10,500-11,500/kg and decreasing back to IDR 10,500/kg in March 2018.

Rice prices in Klaten and Semarang's Gedhe Markets have risen over the last ten days. In August 2023, the price of medium rice in Ghede Klaten will be around IDR 13,000/kg, whereas in Semarang, the price will be IDR 14,000/kg. The price of IR64 rice has risen from IDR 10,000 per kg to IDR 11,000 per kg, C4 rice has risen from IDR 11,000 per kg to IDR 12,000 per kg, C4 super rice is now in the IDR 13,000 per kg range, and fragrant Mentik rice is now IDR 14,000 per kg. The cause is a lack of rice supply as a result of El Niño's dry season, which causes sales volumes to fall, and rice prices to rise.

The formation of grain prices at the rice farmer level in Klaten District is influenced by, among others: (1) the pattern of the harvest or lean season as well as the beginning of the harvest and the end of the harvest; (2) farming costs that continue to increase from time to

time, mainly triggered by increases in input prices, labour wages, and agricultural machinery rent, as well as land rental values; and (3) the quantity and quality of grain that farmers successfully harvest. At the level of the rice milling industry and rice traders, the establishment of rice prices is impacted by (a) the volume of rice absorbed during harvest or famine; (b) marketing objectives and market segments; (c) the share of rice by quality; (d) the influence of BULOG's grain and rice purchase prices and BULOG's sales during market operations; and (e) demand dynamics and changes in consumer preferences for the quality of rice purchased.

Table 3. Rice price by type of rice in Dargo Market (IDR 000/kg), Semarang City, 2018.

Type of rice	January-February 2018		Early March 2018	
	Purchase price	Selling price	Purchase price	Selling price
Super Delanggu	13	14	12,8	13,5
Pandan Wangi	14	15	13	14
Menthik Wangi	13	14	12	13
Premium Sragen	11	12,5	10,5	11,5
Medium Demak	10	11,5	9,5	10,5
C4 super	11	12	10	11
C4/Kawak rice	10	11	9	10
Tanag rice	13,5	14,5	12,5	13,5
Membramo	11,5	12,5	10,5	11,5

3.3 Rice supply-chain management performance

Supply chain management (SCM) implementation performance is measured by the management components of planning, acquiring, delivering to, and receiving from buyers [12]. The results revealed that cooperation and integration between supply chain actors in rice products can facilitate cooperation between institutions to increase competitive advantage [13]. Relationship quality, especially in terms of trust, perceived benefits, supporting policies, and payment terms, plays a key role in maintaining the relationships between parties in the supply chain [14]. For example, in a study conducted by Sujianto in 2022, organic farmers believed that there is a guaranteed market and equal benefits between factors in the supply chain [1]. In the Klaten District, Central Java Province, the degree of involvement in the supply chain management of rice cultivation is categorised as medium to high, despite the very low to medium receipt from buyer activities. The rice supply chain management performance in the Klaten District of Central Java Province is shown in Table 4.

Regarding the planning management component, it was discovered that over 80% of rice farmers in Klaten District had completed planning in the areas of finance, procurement, transportation, and stock; however, only 72% and 70% of farmers, respectively, had completed planning for the indicators of stock and sales. This means that some farmers do not plan for stock and sales indicators because they are tied to loggers and the rice milling industry on a subscription basis or loans. Overall, the management performance of the planning element is 67-84 or classified as medium to high. However, it is necessary to improve its performance in stock and sales indicators.

Table 4. Performance of rice supply chain management according to the perceptions of farmers in Klaten District, 2018.

Elements of management	Indicator	Participation (%)	Average SCM performance
Planning	Finance	87	84
	Procurement	95	72
	Transportation	90	75
	Stock	72	69
	Sale	70	67
Procurement	Supplier selection	80	69
	Pricing	82	71
	Delivery	83	73
	Payment	85	76
Delivery from seller to buyer	Transportation	83	76
	Punctuality	85	72
	Handling	80	70
Receipt from buyer	Rice returns	0	0
	Service	63	60
	Replacement products	0	0

Procurement of grain or rice has four performance indicators: supplier selection, pricing, delivery, and payment. Farmer participation in all indicators was high, ranging from 80 to 85%. Each indicator performed well or extremely well. According to the findings of this study, most rice farmers only obtain grain or rice from their results; however, some rice farmers who are members of farmer groups or joint farmer groups engage in joint marketing to Toko Tani Indonesia. This means that farmers have the flexibility or freedom to determine buyers with prices based on market mechanisms, timely delivery of goods to buyers, and payment in cash or after a 1-2 week deadline. Rice farmers in Klaten District have a fairly good bargaining position in the presence of traders, collectors, wholesalers, or large traders in the market, both during and outside the harvest season, because production volume is still limited and the grain or rice from Klaten is known to be of high quality. The supply chain management aspect of procurement performed moderately to well, with scores of 69-76. However, it must pay attention to buyer selection and pricing indicators.

The management element of delivering grain or rice to buyers includes three indicators: transportation, timeliness, and handling during transportation. Approximately 80-85% of the farmers who responded completed all three indicators with a high level of satisfaction. According to rice farmers, the majority of fellers, collectors, and wholesalers have implemented transportation management, with a high level of participation (80-85%). Farmers believe that grain or rice is collected or delivered to buyers on time and that handling during transportation is satisfactory. According to farmers' perceptions, the performance of grain or rice supply chain management is good, but it needs to be improved, particularly regarding handling and packaging indicators.

The management of receipt from the buyer element, which consists of indicators of grain or rice return, service, and product return, has a low participation rate (0-63%). Meanwhile, the supply chain management performance of grain or rice commodities from receipt from the buyer element is still low (0-60%). This is mainly because most sale and purchase transactions are carried out by breaking up, except for a small number of farmers or farmer groups that supply Toko Tani Indonesia using contract prices.

3.4 Building a rice business ecosystem

A network of businesses, people, and organisations that work together to develop, market, and provide particular goods and services is known as a business ecosystem [15,16]. A business ecosystem is described as a collection of interdependent parties that create, distribute, and deliver products and services to the market. Creating, distributing, and capturing value through new co-created flows. A business ecosystem is a network of interrelated organisations, including suppliers, buyers, producers, distributors, other interested parties, and related institutions that build or use a special combination of each party's capabilities to achieve a common goal [17,18]. According to Porter and Kramer [19], a business ecosystem is a network of interdependencies between suppliers, distributors, stakeholders, and suppliers, and between suppliers, distribution, interested parties, and competitors, which form a value network larger than a single organisation.

The following are the elements of the rice business ecosystem that are present and have an impact on how well rice supply chain management performs: (i) farmers as producers as the main actors producing grain and rice; (ii) related and mutually supportive business partners, both upstream and downstream business partners; (iii) household consumers, hotels restaurants and catering, institutional consumers as rice users; (iv) trusted suppliers to supply modern markets and hotels, restaurants and catering; (v) distributors who deliver rice to various market destinations; (vi) competitors, healthy competition can encourage efficiency and competitiveness of rice products; (vii) financial institution services through the People's Business Credit (KUR), commercial banking and informal financial institutions; (viii) the government as a regulator and facilitator of the rice industry; (ix) media and information communication networks that encourage information to run perfectly; (x) technology, both seed technology, cultivation, and harvest and post-harvest to increase productivity; and (xi) the community both as producers and consumers affect the existence and dynamics of the rice industry.

4 Conclusions and policy recommendations

4.1 Conclusions

The grain and rice supply chain is the integration of raw material procurement activities (GKP, GKG) and services, conversion of goods (GKG) into semi-finished goods (broken rice/PK rice) into final products (medium rice, premium rice), and delivery to customers. There are 6-7 business actors in the rice supply chain in Klaten District, namely farmers, rice cutters/grain collectors, rice millers, interregional wholesalers, wholesalers in market centres, and retailers.

The supply chain of grain and rice in the Klaten District is not yet fully efficient, which is reflected in the high marketing margin, which is the difference between the selling price received by farmers as producers and the purchase price paid by consumers. A high marketing margin is also indicated by the difference in the purchase price and selling price at each trading actor level.

The formation of grain prices at the farm level is influenced by the pattern of the harvest or lean season, farming costs, and harvest volume and quality of grain produced by farmers. Meanwhile, the rice price formation at the rice milling industry and rice traders level is influenced by the volume of rice absorbed, marketing objectives and market segments, the share of rice by quality, the purchase price of grain and rice by BULOG, and demand dynamics and changes in consumer preferences.

The implementation of supply chain management of rice commodities from Klaten, Central Java, has a moderate to very good level of planning performance, moderate to good

level of procurement performance, moderate to good level of delivery of goods, and poor level of receiving goods. Components of the rice industry's business ecosystem that promote rice industry development are required.

4.2 Policy recommendations

Efforts to improve the efficiency of the rice supply chain can be made with the following steps: (1) cutting the relevant supply chain after rice milling; (2) improving the Toko Tani Indonesia (TTI) program, especially related to the purchase price of grain and rice sales with a very high price difference with what happens in the market, so that farmers' institutions have difficulty obtaining grain as targeted by the government; (3) increasing BULOG's grain absorption must be accompanied by an increase in outlets.

Changes in middle- and upper-class consumer preferences have encouraged medium-scale millers to increase the share of premium rice production and reduce medium rice production, as it can create added value. However, the standard premium rice produced and circulated in the market does not fully meet the quality standards for premium rice. Therefore, the government should facilitate the standardisation of rice products according to their quality.

To improve the performance of rice product supply chain management, government policies are needed that can create an *enabling environment* that includes (1) *economic enable* policies, through trade policies that protect farmers and the development of agricultural infrastructure; (2) *important enable* policies through research and development of location-specific technology, microfinance services, standardisation of rice products, and regulations that support the development of the rice industry; and (3) *useful enable* business policies, such as a conducive rice business environment, adequate service facilities, and ease of doing business in the rice industry.

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