

Article

Milling Economics & Concentration of Market Power in Major Rice Milling Zone Polonnaruwa, Sri Lanka

W.A.N. Wijesooriya¹, I.V. Kuruppu^{2,*}

¹ Hector Kobbekaduwa Agrarian Research & Training Institute, Sri Lanka
nalwijesooriya@yahoo.com

² Wayamba University of Sri Lanka, Sri Lanka, virajithkuruppu@gmail.com

* Correspondance: virajithkuruppu@gmail.com

Received: 9 September 2021; Accepted: 25 January 2022; Published: 31 March 2022

Abstract

The processing segment plays and will play a vital role in expanding of the agribusiness sector in developing nations. However, this should strengthen agricultural markets without generating unnecessary pressure and distortions. Paddy processing is one such industry in Sri Lanka, which has enormous potentials for the development. However, inherent complexities and nature of the industry raise serious questions regarding its operational mechanism and the market power. The purpose of this study is to investigate the milling economics and the market power of the rice milling industry in Sri Lanka. Study adopted explorative research methods. Polonnaruwa district was selected as the study location and data was gathered purposively from paddy mills (n=12), paddy collectors/brokers (n=10) and rice wholesalers/retailers (n=10). Concentration Ratio (CR) together with the Porter's five forces were used for the assessment. Present capacity of four largest mills in Polonnaruwa ranged between 150–400 MT of paddy per day and utilized nearly 405,000 MT of paddy annually. Direct and indirect costs for milling rice was Rs. 5.26/ kg and Rs. 5.62/ kg respectively. Additionally Rs. 2.50/ kg and Rs. 2.00/ kg were incurred for packaging and transportation to Colombo. The CR of four largest mills in Polonnaruwa was 50 percent with a concentrated market power. Five forces in the industry were also favoring the millers providing more market power. This strongly implied the oligopolistic/oligopsonic nature of the paddy millers in Polonnaruwa. Medium scale millers should be encouraged to establish modern automatic mills in high surplus producing rural areas with timely updated databases covering all island.

Keywords:

agribusiness, concentration ratio, five forces, market power, paddy milling

Introduction

Rice is the basic grain consumed as a staple food in Sri Lanka which is found in every Sri Lankan kitchen and is the only staple food grain, providing reasonable amount of food nutrients and nearly half of the calories in the Sri Lankans diet. The paddy/rice industry includes nearly 0.9 Million farmers and their families, thousands of input and service providers, millers, retailers, and individuals employed in the production, processing, and marketing of its related products (Senanayake & Premaratne, 2016; Prasanna, 2020; Riswan & Geretharan, 2020). Hence, the rice industry is vital for food security and the economic development of Sri Lanka as its economy relies on agriculture sector.

Accordingly, in 2019 estimated land extent for paddy was 1.11 Million hectares with a production of 4.59 Million MT, contributing 10 percent to country's agricultural GDP (Central Bank of Sri Lanka, 2019). Paddy is cultivated in two main seasons: *Maha* under North East monsoons and *Yala* under South-West monsoons. *Maha* (October to March) usually accounts for about 65 percent of the annual production and the rest 35 percent comes from the *Yala* crop (April to September). However, over the years the patterns of cultivation, marketing and consumption of rice in Sri Lanka has drastically changed.

Major portion of the processing segment of paddy entails milling and thus, millers are considered as one of the pivotal actors in the paddy/rice value chain. Paddy millers mainly engage in the processes of pre-cleaning, soaking, parboiling, drying, milling de-sorting, polishing, grading, colour sorting and packing. Such activities depend on the size and the capacity of the millers and hence, mills are categorized in to three: traditional, semi modern and modern mills. The quality of rice in the market mostly depends on the quality of rice processing. Rice milling industry is the largest agro based industry in the country and in the year 2002, there were over 7,000 mills in the country. Rice milling sector in Sri Lanka is mainly controlled by the private sector (Wijesooriya & Priyadarshana, 2013; Dissanayaka & Wijayarathne, 2020). Interestingly, in the case of paddy a large number of farmers at the base trade goods to a small number of processors, who in turn trade to a very large number of consumers at the top. This implies market power of millers and it appears as an hourglass where a particular or set of actors has the ability to affect price, to reduce competition and to set standards for a sector of economic activities (Murphy, 2006). This generates serious concerns for many stakeholders in the agriculture sector including the policy-makers.

Like most Asian governments, Sri Lanka still views rice as a strategic commodity because of its importance in the diet of the poor, as an occupation and a source of income generation of farmers. Fluctuations in rice prices are considered a threat to political stability, and this may be one reason why governments tend to intervene in their country's rice market (Wijesooriya et al., 2020). Owing to its significant contribution to the country's economic development, the government has initiated programs to increase productivity and improve the competitiveness of the rice sector. The increasing paddy production, stabilization of domestic rice consumption and the increasing dynamism of rice processing and domestic markets call for an overhand in terms of attitudes with regard to rice industry in Sri Lanka. Although, still the natural flow of paddy/rice markets are being manipulated by few actors in the value chain. This is because of the oligopolistic/oligopsonic structure in the market. This exploits both paddy producers and consumers (Senanayake & Premaratne, 2016; Wijesinghe & Weerahewa, 2017; Wijesooriya et al., 2017). Furthermore, Kuruppu (2017) highlighted that, the main reason for sudden price increment occurs as a result of oligopolistic behaviour of few large scale paddy millers located in the major paddy producing areas in the country. This leads to an argument that the rice milling industry is characterized as a non-competitive structure. Therefore, investigating the true nature of the paddy milling sector might shed light to elicit the market power and its mechanism. Therefore, the overall objective of this study was to elicit the paddy milling economics and thereby, understand the market power concentration of the rice milling industry in Sri Lanka. Two specific objectives of the study were to examine the paddy surplus, rice milling, economics and various cost components and to estimate the market power of large scale millers.

Literature review

Wickramasinghe (1999), observed that the rice milling industry had experienced a decline in the number of millers during 1997 as a result of rice-trade liberalization. More than 100 mills had wound

up operations and only about 20 large scale mills had continued operations in the Polonnaruwa area during this period showing the inability of small millers to survive. It also revealed that rice milling industry was characterized by high risk and low return. Studies also argued that rice milling and marketing are competitive. Simultaneously, are characterized by oligopoly buying nature (Ellis, 1993). According to Weerahewa (2004), the impacts of rice trade liberalization on paddy market in Sri Lanka were characterized by some degree of oligopoly power in the industry. The major reason attributed to low farm prices is that buyers do not compete with each other in pricing. Rupasena (2006), has pointed out that seasonal price fluctuation of rice had been reduced during the post-liberalization regime as compared to the pre-liberalization regime. This is due to the expansion of private trade. Private traders, especially, millers purchase paddy at low price at harvest time and hoard to release during the off-season. However, existing literature does not provide conclusive evidence on the market power of the rice milling industry in Sri Lanka.

According to Alvarado (1998), market power refers to the condition where providers of a service can consistently charge a price above those that are established by competitive market. Market power is defined as concentration of resources in the hands of a single producer or an insufficient numbers of producers. It enables a firm to set price above marginal cost. Dessalegn et al., (1998), mentioned that market concentration refers to the number and relative size distribution of buyers or sellers. Moreover, leading firms in such concentrated markets frequently engage in strategic conduct intended to retain, entrench and expand their positions which impose significant economic and social costs on both suppliers and customers. This ultimately leads to the interest of dominance of such firms. Gradual increase in the market power could result distortion of the natural flow of the markets (Murphy, 2006). This has an adverse multiplier effect on the rural economy. It also undermines the benefit of cheaper food and as a result, farm workers and consumers are also affected. Firms with high concentrated markets may be able to exercise market power by raising retail food prices while depressing prices the farmers receive for agricultural commodities (United States Agency for International Development, 2002).

Agricultural marketing encompasses everything that happens between the farm-gate and the consumer, including food processing. Hence, agricultural marketing system plays an important role in determining the prices received by the farmers and those paid by the consumers (Acharya, 2000). Simultaneously, identification of marketing channels and different actors within those is also important to understand the true nature of the industry. It may shed light on different marketing functions (i.e. information, promotion, negotiation, ordering, financing, risk taking, physical possession, payment and ownership) executed by those actors (Kotler et al., 2015). Market power refers to the ability to raise selling prices and depress input prices, to deter entry, to redistribute profit to oneself, from other firms and more importantly to sustain these benefits over time (Griffith, 2002). Market power appears to be present in the stages beyond the farm gate and the market power of retailers and/or processors may also be responsible for the higher retail prices and inefficiencies. Farmers are inherently disadvantaged in the market: they are numerous, while processors are few (Murphy, 2006). However, market power is not the same as monopoly power, where only single firm exists and engage in the selling process. Therefore, careful assessment of the market power of agribusiness industries in the developing countries is vital to understand and set viable policies in order to enhance the welfare of both producers and consumers.

Agricultural markets could be vastly different in many aspects compared with other markets. Furthermore, agricultural markets in the developing economies are complex. Inherent complexities of those markets raise serious issues from time to time. This leads to frequent government interventions which then result mixed outcomes in those economies. Therefore, measuring market power and understanding roles of each actor is utmost important in formulating policies.

There are many indicators to measure the market power. One such approach is Concentration Ratio. Another measure of concentration is the Herfindahl-Hirschman (HH) index, which is the sum of the squares of the market share of each firm in the industry. Murphy (2006), mentioned measuring CR is much convenient and interpretable. Further, five forces: rivalry among competitors, bargaining power of suppliers, bargaining power of buyers, threat of new entrants and threat of substitutes are used to study industries (Porter, 1979). Hence, a combined approach is always encouraged in such cases.

Materials and methods

Explorative research methods were adopted in the study due to the inherent complexity of the paddy/rice industry in Sri Lanka as well as to understand the current context of it. Simultaneously, only confined studies have carried out in the area of paddy/rice milling industry in Sri Lanka. Both qualitative and quantitative approaches were used in the study.

Study area and the sample

Currently, Polonnaruwa is the largest rice processing area in the country with more than 150 commercial paddy mills. In terms of quantity of paddy milling per day, 19 percent of the mills belongs greater than 20MT/ day and 34 percent is 8-20MT/ day (Wijesooriya & Priyadarshana, 2013). The paddy farmers in the district produce 17 percent of the total marketable surplus of paddy. Hence, Polonnaruwa district is selected as the study area. More than 75 percent of the mills are concentrated in Tamankaduwa and Hingurakgoda Divisional Secretariat (DS) divisions in Polonnaruwa district. These mills are either medium or large scale. Small scale mills are barely operated and majority converted their businesses into facilitating functions such as paddy drying and collecting of paddy bran and husk.

Over the years number of small scale rice mills have gradually decreased whereas the large scale mills have increased. Two lists of paddy millers, one from the Divisional Secretariat Office and the other from the United Rice Producers Association in Polonnaruwa were obtained. Accordingly, there were only 105 functioning mills in the district. Purposive sampling was adopted to draw the sample in order to ensure the information richness. Further, this enables to include a variety of settings and situations, including negative cases or extreme cases to obtain rich data (Moser & Korstjens, 2017). Further, the selected sample hold special and expert knowledge about the phenomenon to be studied and were willing to share information and insights.

Accordingly, 12 paddy mills (n=12) were selected for the study. Not only paddy millers but also, extremely upstream (Paddy collectors/brokers; n=10) and downstream (Rice wholesalers and retailers; n=10) actors linked with those millers were interviewed and studied to explore the particular context furthermore.

Data collection and analysis

Both primary and secondary data were gathered and used in the study. Primary data was gathered through key informant interviews using semi structured questionnaires for all respondents in the sample. Information from the site observations along with case studies were also compiled. Secondary data were gathered through the review of literature, documents and records of mills and various other related public and private institutions. Economics has several ways of measuring market power. One common measure is the Concentration Ratio (CR), which measures the share of the market controlled

by the largest firms (typically the top 3, 4 or 5). A CR4 (meaning the share of the top four firms) of 40 percent or less is generally considered to be a competitive market. The weakness of the CR as a measure is that it does not indicate if there is any movement among the top firms measured (number one might slip to fourth place, but the CR could be unchanged). Nor does the CR say whether the top firms are among 100s in total, or just two other firms. The partial snapshot can be misleading. Still, the CR does provide a useful, if rough, measure (Murphy, 2006).

Equation 1 illustrates the sum of market shares of the four largest firms in the industry to the total market share. This has been coined as the CR4 (Kohls & Uhl, 1985).

$$CR4 = \frac{\sum_{i=1}^4 S_i}{\sum_{i=1}^n S_i} \quad \text{-----} \quad 1$$

Where,

CR4 = the sum of market shares of the four largest firms in the industry.

n = number of industries.

S_i = the percentage market share of the i^{th} miller (The market share was calculated based on the quantities of paddy milled by the miller illustrated in the equation 2). A single year (2019 to 2020) was considered for the study.

$$S_i = \frac{V_i}{\sum_{i=1}^n S_i} \quad \text{-----} \quad 2$$

Where,

V_i = quantities of paddy milled by the i^{th} miller per year (2019 to 2020)

Accordingly if CR4 falls in the quartiles of 75-100 percent, the industry is considered as highly concentrated, moderately concentrated if in quartile 50-75 percent, slightly concentrated if 25-50 percent, and atomistic if in the quartile of 0-25 percent (Tengku et al., 2008). Simply, this implies the higher the concentration ratio means the greater the monopoly power or market concentration existing in the industry (Adugna et al., 2019). In addition, Porter's Five Force model was used to determine the relative strengths and weaknesses of major forces in the paddy/rice industry along with other descriptive (Porter, 1979).

Results and discussion

In general, it is clear in an average production year country produces 2.8 Million MT of paddy in *Maha* season and 1.8 Million MT in *Yala* season. According to the authors' calculations using the data of Department of Census and Statistics (2014), 15 districts of the country created surplus of paddy after deducted for human consumption, seed requirement for next season and wastage of those districts. More than 75 percent of the surplus created from the North Central province, Eastern province and Kurunegala district. Table 1 presents paddy production and surplus of Sri Lanka and the Polonnaruwa district in a normal production year.

Polonnaruwa district itself generated 30 percent of the annual marketable surplus of the country with the contribution of nearly 50,000 farmer community in the area. Interestingly, paddy utilization of

millers in Polonnaruwa was well beyond the marketable surplus of the area (nearly twice) and thus created a deficit in the milling process. This encouraged millers to procure paddy even from the outside areas. Table 2 illustrates the annual paddy utilization of millers in Polonnaruwa. Thus, the shortage quantity is mainly obtained from Ampara, Batticaloa and Anuradhapura districts by the large scale millers in Polonnaruwa.

Table 1: Paddy surplus production in Sri Lanka and Polonnaruwa district

No	Item	Units	Quantity
Sri Lanka			
1	Paddy production in <i>Maha</i> season	MT	2,846,276
2	Paddy production in <i>Yala</i> season	MT	1,774,451
3	Annual production in an average production year	MT	4,620,727
4	Marketable surplus in <i>Maha</i> season	MT	1,832,429
5	Marketable surplus in <i>Yala</i> season	MT	930,910
6	Total annual marketable surplus	MT	2,763,339
7	Marketable surplus as a percentage of total paddy production = $(6/3)*100$	Percentage	60
Polonnaruwa district			
8	Paddy production in <i>Maha</i> season	MT	277,045
9	Paddy production in <i>Yala</i> season	MT	261,263
10	Annual production	MT	538,308
11	Total annual marketable surplus in the district	MT	471,868
12	Marketable surplus as a percentage of paddy production in Polonnaruwa	Percentage	88
13	Utilization of paddy by the Polonnaruwa millers	MT/ Year	832,200
14	Deficit quantity of paddy in the district = $(11-13)$	MT	-360,332
15	As a % of the annual marketable surplus of the country = $(13/6)*100$	Percentage	30

Source: Authors' calculations using the data of Department of Census and Statistics

Table 2: Annual paddy utilization of Polonnaruwa millers

Mill category	No. of mills	Per day (MT)	Days operated per month	Months	MT/ Year	As a %
Largest group 1	3	400	25	12	360,000	43.26
Largest group 2	3	150	25	12	135,000	16.22
Largest group 3	4	75	25	12	90,000	10.81
Medium	9	40	25	12	144,000	17.30
Small	86	10	10	12	103,200	12.40
Total	105				832,200	100.00

Source: Authors' survey, 2019/2020

Paddy milling process in Polonnaruwa

Majority of the large scale millers operated in Polonnaruwa mainly produce parboiled rice. Rice producing from short grain paddy is called *Samba* and the long grain paddy is called *Nadu* rice. The milling process involves removal of external impurities (cleaning), removal of the husk (de-husking), removal of bran (polishing) and separation of full head rice and broken rice. Rice bran and husk are by-products of commercial value. The first step in paddy processing is removal of foreign particles such as straw, soil particles, and weed seeds. Raw paddy from field/storage area is manually transferred to the cleaning area where paddy is taken to the shaker (sieving) through elevator, and this shaker separates foreign particles such as stones from paddy. If those are not removed prior to hulling, the efficiency of the huller and the milling recovery is reduced. After removing foreign particles, another elevator picks the paddy to the soaking tanks. Each soaking tank is filled with a quantity of paddy and is soaked for 24 to 48 hours depending upon the type of paddy and then water is drained off. Partial cooking of rice with husk intact is known as parboiling. Parboiling involves increasing the moisture content of the grain to 25-30 percent and then steaming to gelatinize the starch in it. The steps required to achieve this are: soaking or hydration, drying, steaming or heating and drying or dehydration to millable moisture level (13-14 percent wet basis). During the process, rice starch is gelatinized, the protein bodies are disrupted and these two, to some extent, bind each other to give the grain more strength.

Parboiling has many advantages. Besides increasing the out turn of rice by 4–6 percent, it ensures more nutrition in rice, higher protein efficiency ratio, easy digestibility, less susceptibility to insect attack resulting better storage, less washing and cooking losses, remaining well separated even after severe cooling. Parboiled rice bran has more oil content, with better stability, hence, fetches a higher price. Drying is a critical operation in paddy processing. Controlling of moisture in paddy is important for both storage and milling. Since the absorbed moisture is in the free-state on the surface of the kernel, removal of this moisture is relatively easier. Absorbed moisture is in more homogenous form within the kernel; removal of this is to be done carefully so as to avoid development of cracks which lead to broken rice. As the kernel is hard due to gelatinization, drying could be carried out quicker and at higher temperatures. By adopting low moisture parboiling process, drying cost can be reduced substantially. It is observed that in Polonnaruwa nearly 80 percent of millers have mechanical dryers. Only 20 percent of small scale millers used sun drying method. Mechanical drying makes use of hot air which contacts with moist paddy. These are of two types: Direct cyclone type using hot flue gases (filtered) and indirect type using flue gas, steam or thermal fluid. Advantages are drying is independent of climate and time of day/ night, faster rate, requires less area and less manpower, ability to maintain better control over the process of drying and reduction of grain loss. Disadvantages are high cost of investment, requires means of fuel and electric power, higher operational and maintenance cost and need of skilled operators.

The milling process includes pre cleaning, shelling, husk/paddy separation, polishing, sieving and de-stoning. Equipment such as hullers, centrifugal shellers and rubber roll shellers are used for de-husking and equipment such as hullers, emery polishers and cone polishers are used for polishing. The conventional huller is used for paddy de-husking and polishing. The conventional huller for de-husking is used and polishing results in wastage of the grain due to breaking, powdering and non-recovery of rice bran which is a valuable by-product (Table 3).

Normal polishers are used for polishing rice and separate bran from rice in most of the mills. In large scale and some medium scale mills, a mist polisher is used to obtain the value added product. During mist polishing process, mixing a fine mist of water with the dust retained on the whitened rice improves the appearance of the rice (polishes) without significantly reducing the milling yield. A friction

type-whitening machine, which delivers a fine mist of water during the final whitening process, is used for “final” polishing before sale. De-Stoner is used for separating stones and full head rice. After polishing, the polished rice is loaded in shaker through an elevator; here the full head rice plus broken rice are separated. This is a process which similar to sieving rice. After sieving from shaker, the full head rice and broken rice are transferred to grader where full head rice gets separated completely. Then the broken rice is also transferred to shaker for further sieving. This is an important automated process for sorting only the white rice. Black rice is separated by the aid of color sorting cameras attached to the rice flow channels. Finally, the sorted rice is weighed and packed. General paddy mill classification is illustrated in Table 4.

Table 3: Milling outturn of 100kg of long grain white paddy in parboiled processing

Item	Quantity per 100kg of paddy (kg)
Impurities, empty seeds & dry weight	3.10
Head rice	64.50
Broken rice	3.75
Rough bran	5.25
Smooth bran (polish)	1.50
Color sorts	0.75
Dust	0.75
Husk	20.40
Total	100.00

Source: Authors' survey, 2019/2020

Table 4: General classification of paddy mills

Per day milling quantity of paddy (MT)	Scale
Below 20	small
20 - 50	medium
Above 50	large

Source: Authors' survey, 2019/2020

Compared with the situation in 2013, most medium scale millers have upgraded their operations in to large scale level. However, a certain number of small scale millers have left or converted their operations into other intermediary functions within the industry. It can be observed that the four largest mills in 2013, have made their capacity double at the present. This situation is a result of establishing their branding successfully in all major consuming areas using marketing channels and strategies. Further, to cater the increased demand in returns.

Cost of paddy milling & market channels

The average yield of paddy under major irrigation in Polonnaruwa district was often 6-8 percent higher than the normal average yield under major irrigations in the entire country. Especially the average yield of Medirigiriya and Dimbulagala indicated a yield higher than that of polonnaruwa district.

The study found that the average yield ranged between 89-138 bushels/ acre in the above producing areas under the major irrigation schemes. The farm gate price of quality paddy ranged between Rs. 47.00-52.00, which showed an increase of nearly 30 percent compared to the same period of 2018 (Hector Kobbekaduwa Agrarian Research and Training Institute, 2018). This was due to the decision to increase the guaranteed price of paddy up to Rs. 50.00/ kg from the *Maha* season 2019/20. Table 5 illustrates the cost of paddy milling in a modern paddy mill in Polonnaruwa.

Table 5: Cost of paddy milling in a modern automatic paddy mill in Polonnaruwa (average of 50 MT of paddy milled per day, rice variety: Nadu parboiled)

Item	Units	Unit cost (Rs.)	Cost for 100kg of paddy (Rs.)
Cost for paddy bag	Rs./ 64kg Bag	40.00	62.50
Unloading paddy bag & storage	Rs./ 64kg	20.00	31.25
After 3 months, paddy unloading for milling	Rs./ 100kg	15.00	23.44
¹ Impurities, empty seeds & dry weight	2 kg/64kg	103.90	162.34
Put in paddy to processing point	Rs./ 100kg	20.00	20.00
Cleaning	Rs./ 100kg	2.00	2.00
Removing empty seeds and washing	Rs./ 100kg	8.00	8.00
Parboiling	Rs./ 100kg	10.00	10.00
Drying	Rs./ 100kg	2.50	2.50
Operating boiler	Rs./ 100kg	7.50	7.50
Milling	Rs./ 100kg	10.00	10.00
² Processing cost of 64.5kg of rice	64.5kg of rice		339.53
Cost of processing 1kg of rice	Rs./ kg of rice		5.26
Electricity cost	Rs./ kg of rice		1.62
Machinery cost	Rs./ kg of rice		0.40
Depreciation	Rs./ kg of rice		0.18
Insurance	Rs./ kg of rice		0.06
Staff salaries & other	Rs./ kg of rice		0.75
Bank interest	Rs./ kg of rice		2.25
Total processing cost of rice at mill gate	Rs./ kg of rice		10.52
Rice bag (10kg pack)	Rs./ kg of rice		2.00
Packing cost	Rs./ kg of rice		0.50
Total cost of packed rice at mill gate	Rs./ kg of rice		13.02
Transport to Colombo	Rs./ kg of rice		2.00
			15.02

Note: ¹ Nearly 2kg impurities, empty seeds & dry weight included in milling of 64kg of long grain white paddy in parboiled processing.

²Rice outturn from quality 100kg of paddy is 64.5kg of rice.

Source: Authors' survey, 2019/2020

Direct cost for milling of 1kg of rice was Rs. 5.26. Apart from direct costs, another Rs. 5.62/ kg was spent as indirect costs. Hence, total processing cost of rice at mill gate was Rs. 10.52/ kg. Extra Rs. 2.50/ kg was incurred for the packaging. Finally, Rs. 2.00/ kg was incurred for the transportation to Colombo. It is clearly envisaged that, rice millers spent a total cost of Rs. 15.02/ kg of rice for carrying out the processing of stored paddy into milled rice and handling, packing, storing and transporting milled rice to wholesalers or directly to retailers. Millers recovered a considerable portion of the total cost through the income received from byproducts as well.

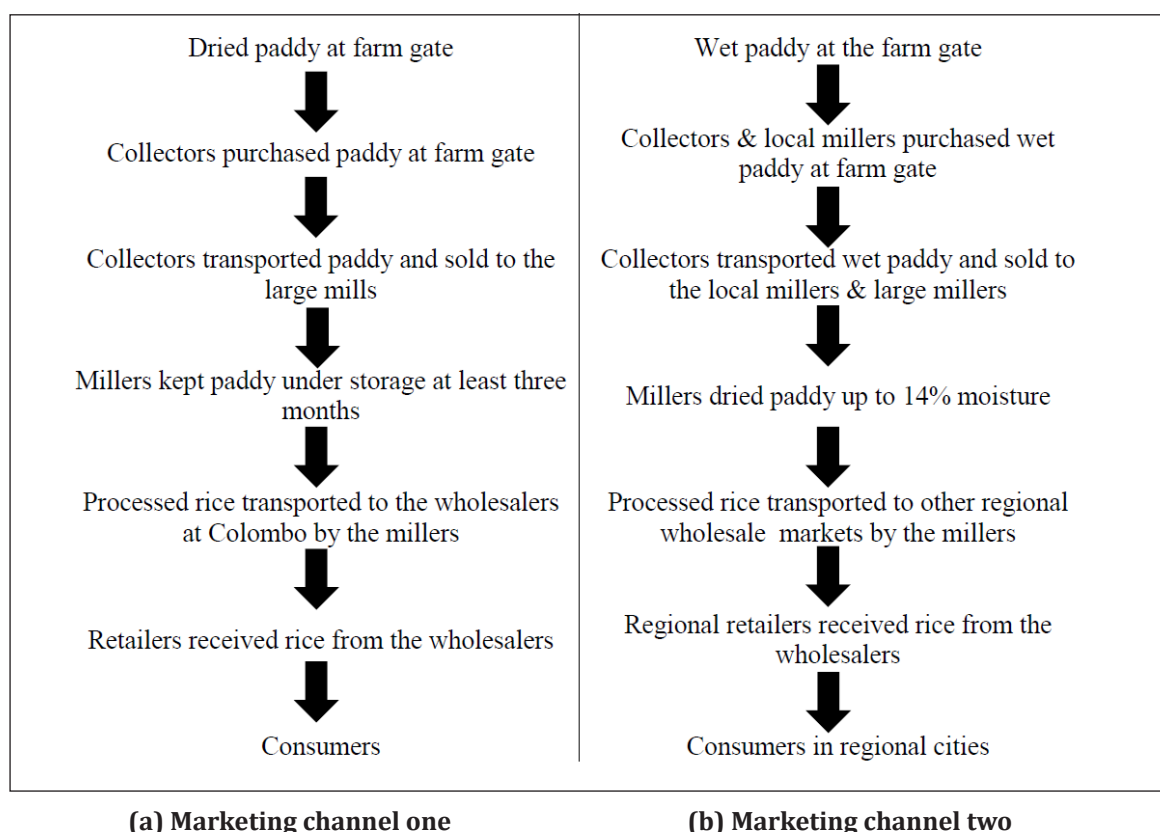


Figure 1: Major marketing channels in the area
Source: Authors' survey, 2019/2020

Study identified two prominent marketing channels in the area (Figure 1). The large millers in the district have major rice selling markets in Colombo and suburbs. The large and some medium scale millers who require a large amount of paddy for their daily processing, purchase paddy through their regular collectors and also from outside areas through brokers. In addition, during the off season small amounts of paddy are being sold by farmers to the local mills. The role of brokers becomes prominent in the time when paddy stocks are scarce.

Market power and five forces

The paddy/rice value chain in Polonnaruwa district mainly consists of a large number of small scale paddy farmers, a few paddy collectors, very few large scale rice millers, a few medium scale rice millers, number of small scale rice millers, number of rice wholesalers in main cities and large number of retailers spread all over the country. The rice miller is the key actor between the paddy producing farmer and the rice consumer of the paddy/rice value chain. Therefore, rice miller plays a dual role;

as the buyer when purchasing paddy and the seller when selling rice to the wholesalers and retailers. Present capacity of four largest mills in Polonnaruwa ranged between 150–400 MT of paddy per day. The four largest rice millers in Polonnaruwa district currently utilized nearly 405,000 MT of paddy annually. Accordingly, Table 6 illustrates CR4 calculations for 2013 and 2019/20.

Table 6: CR4 calculations in 2013 and 2019/2020

Year	CR4 measurement (%)
2013	30.00
2019/20	50.00

Source: Authors' calculations

The CR4 value has increased by 20 percent from 2013 to 2019/20. This means nearly half of the rice production in Polonnaruwa district is governed by the four largest millers and the market power can be explained as concentrated. The rice millers in Polonnaruwa district mainly purchased paddy from large number of small scale farmers scattered in Polonnaruwa, Anuradhapura, Eastern and Northern provinces. Approximately 0.3 million small scale farmers provided paddy from those areas. Among these farmers a few percentage of large scale farmers were located in Batticaloa district whereas the majority who cultivated less than two acres were located from all other areas. As the majority of farmer population who provided paddy were small scale farmers, they have a less bargaining power on determination of farm gate price.

When buyer power is considered the collector who purchased paddy from farmers is identified as the first buyer in the value chain. Rice miller who purchased paddy from the collectors and directly from the farmers is the second buyer in the paddy purchasing of the value chain. The miller produced rice from the purchased paddy and supplied that rice to wholesale and retail traders in major cities. Accordingly, the rice millers play a dual role as a buyer in buying paddy from farmers and a seller in selling rice. This situation especially allows major rice millers to exercise both buyer power and seller power. The marketable surplus of paddy produced in a normal producing year in Polonnaruwa district is approximately sufficient to fulfil the annual paddy requirement of the six largest millers in that district. Simultaneously, major rice millers tend to purchase paddy from other districts. Especially, from the Eastern province where there are only few rice mills available. This provides an upper hand for them to purchase paddy at low prices with low competition. However, higher exit barriers can increase rivalry and competitive pressures. This could be happened when profitability is low for an industry, where firms are unable to exit or exit sooner due to heavy capital investments in specialized assets, high exit/shut-down costs, emotional attachments to the industry, or contractual or other relationships between firms. If the barriers to entry are low, new millers can easily enter the rice milling industry and compete with the established firms. However, due to very high barriers to entry, established mills are protected from new entrants and potential rivals.

Where close substitute products exist in a market, it increases the likelihood of customers switching to alternatives in response to price increases. This reduces both the power of suppliers and the attractiveness of the market. According to the Household Income and Expenditure Surveys, the annual per capita rice consumption was 103.7kg, 107.9kg, 108.8kg, 107.8kg, and 107kg in 1986/87, 2006/07, 2009/10, 2012/13 and 2016 respectively (Department of Census and Statistics, 2018). It is clear that during the recent past, per capita consumption showed a degree of stability. Further, Wijewardana & Rupasena (2016), indicated that consumer response for rice to change either price or income is limited. Inelastic price demand means availability of limited substitutes for rice. Present study also revealed

that bread is not the substitute for rice. As a result of the nature of inelastic price demand, increased rice prices lead to increased rice expenditure and country's inflation. Also, the demand for imported rice varieties was less. Finally, the successful brand establishment of large scale miller and their relative dominance in the market limited the threat of new entrants to the industry.

Extreme upstream & downstream actors

There were number of traders involved in paddy purchasing in Polonnaruwa as the first link of the paddy/rice value chain. They were collectors, local millers, large scale millers and Paddy Marketing Board (PMB). In addition, in some instances Multi-Purpose Cooperative Societies of the respective producing areas also purchased paddy for their retail outlets. However, the most prominent channel in Polonnaruwa was purchasing paddy by the collectors. Therefore, the paddy collectors were identified as the extreme upstream actors in the paddy/rice value chain in Polonnaruwa. In other words, collector was the first link between the farmer and other middleman. Study revealed that village based small scale paddy collectors in the past have now transformed in to one or two large collecting centers covering more than one village. A DS division consisted of 20-25 such type of large collecting centers. These centers trade agro chemicals, fertilizers apart from purchasing paddy. Some instances these collectors provided tractors for land preparation and combined harvesters for harvesting on credit basis. Those collectors possessed a lorry to transport paddy to rice mills. They mostly supplied paddy to large scale millers. They acquired the service of brokers when paddy is purchased from far remote places in the district itself or in districts nearby. The collector traded paddy stocks directly to millers in nearby areas and the outside millers through brokers. Hence, collectors fulfilled an exchanging function in the paddy/rice value chain. In general a collector dealt with about 50-100 paddy farmers in the area. This collector had a farmer base in the village and nearby villages in the DS division. The collector's role was predominant in areas where the mills were less concentrated.

These agents work for a commission on behalf of other participants are generally termed as a broker. In the case of paddy, brokers operated between the paddy collector and the miller. They did not invest in paddy trade and did not take any price risks. They generally have a long standing relationship with millers and make purchases for them. Brokers brought buyers and sellers together and assisted in negotiations on a more ad hoc basis. The study identified a decrease of functioning of brokers within the district due to evolving of large collectors embedded with large scale mills. However, the paddy supplied from other districts such as the producing areas in Eastern and North Central provinces like Ampara and Anuradhapura pursued the assistance of brokers to trade their paddy to large scale mills. Typically, brokers worked for a flat rate around Rs. 1000 per lorry load paid by the miller (Buyer) which was equal to Rs. 10 per 64kg paddy bag. The millers were unable to purchase paddy for daily requirement from their surrounding areas especially during the off season. Therefore, they tend to purchase paddy from outside areas through brokers. Rice wholesalers whose main function was marketing or distributing of rice to retailers. In carrying out this function, they spent the smallest added cost of Rs. 0.50/ kg owing to marketing cost. Retailers, the last actors in the chain, incurred added cost amounting to Rs. 1.00/ kg due to marketing cost.

Wijesooriya et al., (2020), explained that the paddy farmers who do not have safe storage facilities, who have difficulties in finding a suitable place and the required labor to dry the paddy up to 14% moisture level and the farmers who have immediate cash needs are more inclined towards selling paddy to private buyers without drying at the paddy fields. In this study the major problem highlighted by the farmers when selling paddy to private sector is inability to receive a fair price.

Farmers point out that the private sector attempts to purchase paddy at low prices as much as possible especially in the harvesting season. Wijesooriya, et al., (2017), also examined the farm gate price of paddy in major producing districts during the period of 2009-2013. The study revealed that during the peak harvesting month more than 50 percent of the DS division's farm gate price of paddy was below the guaranteed price in many of the districts especially in Ampara and Batticaloa. Farm gate prices of all DS divisions in Ampara district were well below the guaranteed price in 2010 and 2013. The situation was more or less same in all major producing districts. Regular low price DS could be identified in all major producing districts. The large scale millers are regularly purchased paddy during the peak harvesting seasons in all major producing districts. Therefore the farm gate prices are mainly determined by them and on which the farmer's surplus depend on. During the off season (October to January) stocks are available only with them. Therefore they are able to control the rice market through limited supply releasing and such situation effected to the consumers.

Conclusion

Being the staple food of the country, paddy/rice plays a major role in both production and consumption aspects in Sri Lanka. Gradual increment of the dynamism of paddy processing in the country is a great display of the development of the paddy/rice industry in the country. Rice milling industry has undergone a vast structural changes with a concentrated market power. This is mainly because of the high degree of credit affordability, large quantity of paddy storage ability during the harvesting season and established brand loyalty. Simultaneously, five forces in the industry are also favoring the millers providing more market power. Hence, millers could be identified as the major actor in the paddy/rice value chain in Sri Lanka. More importantly, millers exercise dual role as the buyer when purchasing paddy and the seller when selling rice to the wholesalers and retailers. This strongly justified oligopolistic/oligopsonic nature of the paddy millers in Polonnaruwa. In addition, a certain number of small scale rice mills have left the industry. The capacities of major and medium scale rice mills have increased. However, it is important to understand millers still add a higher percentage of value when compared to other actors in the paddy/rice channel by engaging in the activities of cleaning paddy stocks, storing, milling, packing and transportation of rice to the major cities.

As a suggestion, government should encourage medium scale millers to establishment of modern automatic private sector mills in high surplus producing rural areas especially in the Eastern and North Central provinces. Study recommends the need of a detailed rice mill and stakeholder survey covering the whole country including capacity, machineries, storages, rice types etc. Therefore, the need of a detailed census and Information & communication Technology based regular updating database is vital. It can be suggested to collaborative study through Hector Kobbekaduwa Agrarian Research & Training Institute, Institute of Post Harvest Technology, PMB, Department of Census & Statistics and the Ministry of Finance. Further, a detailed study of paddy/rice based by-products and a comprehensive value chain is recommended in order to utilize those in an efficient and effective manner. In addition, rice quality improvement will become even more important in the future in Sri Lanka, like in most other countries, entering into international as well as regional trade agreements and thereby opening its market to the outside world. This would create a situation where the country will have to compete with other rice producing countries in the sale of locally produced rice (Institute of Post Harvest Technology, 2002; Rupasena, 2006). Therefore, updated and dynamic paddy/rice milling industry without market manipulations must be needed.

References

- Acharya, S. (2000). Agricultural Marketing in India: Some Facts and Emerging Issues. *Agricultural Services Bulletin*. Retrieved from www.fao.org/docrep/006/ad639e/ad639e05.htm
- Adugna, M., Ketema, M., Goshu, D. & Kaba, S. (2019). Vegetable Market Performance in Smallholders Production System: The Case of Lake Tana Basin, Ethiopia. *Business, Management and Economics Research*, 5(3), 40-48. doi:10.32861/bmer.53.40.48
- Alvarado, F. L. (1998). Market Power: A Dynamic Definition. *Conference on Bulk Power System Dynamic Control-IV*. Madison: The University of Wisconsin.
- Central Bank of Sri Lanka . (2019). *Annual Report*. Colombo : Central Bank of Sri Lanka . Retrieved from https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/publications/annual_report/2019/en/8_Chapter_04.pdf
- Department of Census and Statistics. (2014). *Estimated Paddy Production and Excess/Scarcity of Paddy by Season and by District*. Retrieved June 10, 2020, from Department of Census and Statistics: <http://www.statistics.gov.lk/Agriculture/StaticInformation/PaddyStatistics/EstimatedMarketableSurplusOfPaddybySeasonandbyDistrict-2010-2015#Top>
- Department of Census and Statistics. (2018). *Household Income and Expenditure Survey 2016*. Colombo : Department of Census and Statistics.
- Dessaiegn, G., Jayne, T. & Shaffer, J. (1998). *Market Structure, Conduct and Performance : Constraints on Performance of Ethiopian Grain Markets*. Retrieved June 12, 2020, from Ministry of Economic Development: [www.eap.gov.et/sites/default/files/Market %20Structure%20](http://www.eap.gov.et/sites/default/files/Market%20Structure%20)
- Dissanayaka, D. & Wijayarathne, L. (2020). Common practices and abundance of insects in rice mills in Polonnaruwa district of Sri Lanka. *Journal of Science*, 1(2), 1-9.
- Ellis, F. (1993, October). Private Trade and Public Role in Staple Food Marketing: The Case of Rice in Indonesia. *Food Policy*, pp. 428-438.
- Griffith, G. (2002). Competition in the Food Marketing Chain. *Australian Journal of Agricultural and Resource Economics*, 44(3), 333-367. doi:10.1111/1467-8489.00115
- Hector Kobbekaduwa Agrarian Research and Training Institute . (2018). *Monthly Food Commodities Bulletin 2015 - 2021*. Retrieved June 10, 2020, from Hector Kobbekaduwa Agrarian Research and Training Institute : <http://www.harti.gov.lk/index.php/en/market-information/monthly-food-commodities-bulletin>
- Institute of Postharvest Technology. (2002). *Technical Report for Paddy Postharvest Losses*. Anuradapura: Institute of Postharvest Technology.
- Kohls, R. & Uhl, J. (1985). *In Marketing of Agricultural Products*. United States of America: Macmillan Publishing Company.
- Kotler, P., Keller, K., Koshy, A. & Jha, M. (2015). *Marketing Management: A South Asian Perspective* (14 ed.). Noida: Pearson India Education Services Private Limited.
- Kuruppu, I. (2017). Consumer Preference and Price Behavior Analysis for Selected Rice Varieties in Sri Lanka. *Applied Economics & Business*, 1, 1-11.
- Moser, A. & Korstjens, I. (2017). Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European Journal of General Practice*, 24(1), 9-18. doi:10.1080/13814788.2017.1375091

- Murphy, S. (2006). *Concentrated Market Power and Agricultural Trade*. Berlin: Heinrich Boell Stiftung.
- Porter, M. (1979, March). The Five Competitive Forces That Shape Strategy. *Harvard Business Review*. Retrieved from <https://hbr.org/1979/03/how-competitive-forces-shape-strategy>
- Prasanna, R. (2020). Does the Nature of Paddy Market Structure Matter for Poor Earnings of Paddy Farming? A Case of Huruluwewa Colonization Scheme in Sri Lanka. *Rajarata University Journal*, 5(1), 93-102.
- Riswan, A. & Geretharan, T. (2020). Determination of Factors Associated with Farmers' Choice of Paddy Marketing Board: Supply Chain in Ampara District. *Sri Lankan Journal of Technology*, 1 & 2, 51-59.
- Rupasena, L. (2006). *Comparative Analysis of Rice Marketing System in Sri Lanka, Pre and Post Liberalized period*. Dharwad: University of Agricultural Science.
- Senanayake, S. & Premaratne, S. (2016). An Analysis of the Paddy/Rice Value Chains in Sri Lanka. *Asia-Pacific Journal of Rural Development*, 26(1), 105-126.
- Tengku, M., Ahamad, T. & Samsudin, M. (2008). *Market Liberalization and its Relationship with Market Structure Conduct and Performance of the Food Processing Industry in Asean Economies*. APEC Agricultural Technical Cooperation Working Group.
- United States Agency for International Development. (2002). *Rice Situation and Outlook Yearbook*. Market and Trade Economic Division. Washington : United States Agency for International Development.
- Weerahewa, J. (2004). *Impacts of Trade Liberalization and Market Reforms on the Paddy/Rice Sector in Sri Lanka*. Washington : International Food Policy Research Institution . Retrieved from <http://ebrary.ifpri.org/utills/getfile/collection/p15738coll2/id/49698/filename/49699.pdf>
- Wickramasinghe, W. (1999, January-March). Government Intervention in Rice Market. *Economic Review*, pp. 12-13.
- Wijesinghe, A. & Weerahewa, J. (2017). Structure, Conduct and Performance of the Rice Milling Industry of Sri Lanka: Evidence from Selected Cases. *Sri Lanka Journal of Economic Research*, 4(2), 71-90.
- Wijesooriya, N., Champika, J., Priyadarshana, D. & Vidanapathirana, R. (2017). *Government Intervention in Paddy Marketing: Issues in Purchasing and Post-stock Management*. Colombo: Hector Kobbekaduwa Agrarian Research and Training Institute.
- Wijesooriya, W. A., Champika, P. A. & Kuruppu, I. V. (2020). The Paddy Farmers' Channel Choice and Links to the Public and Private Marketing Channels in Sri Lanka. *Applied Economics and Business*, 4(1), 60-70.
- Wijesooriya, W., & Priyadarshana, W. (2013). *Structure, Conduct and Performance of Rice Milling Industry in Polonnaruwa and Hambantota Districts of Sri Lanka*. Colombo : Hector Kobbekaduwa Agrarian Research and Training Institute.
- Wijewardana, K. & Rupasena, L. (2016). Price and Income Elasticities of Demand for Rice in Sri Lanka. *Annual Research Symposium* (p. 11). Anuradhapura: Rajarata University of Sri Lanka. Retrieved from http://www.rjt.ac.lk/agri/agri_publications/agricultural_systems/8th%20proceedings-2016.25.pdf