

Structure, Conduct and Performance of Rice Milling Industry in Polonnaruwa and Hambantota Districts of Sri Lanka

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FOREWORD

Achieving food security of people and ensuring uninterrupted access to competitive markets are the priority policy direction areas in the Government Development Policy Framework in Sri Lanka. The main objective of this study is to examine the structure, conduct and performance of the rice milling industry in the Polonnaruwa and Hambantota Districts. The Structure, Conduct and Performance (SCP) approach is adopted to analyze competitive conditions in the rice milling industry by examining how the structure of industry relates to the rice market conduct and performance. The study focuses on the behavior of different participants involved in the industry, industry concentration, paddy to rice process, personnel profile of millers, entry barriers to industry, paddy rice buying and selling practices, pricing, intervention of intermediaries, storage, credit, constraints, product standards, price spreads, product behaviors, processing costs and utilization of by-products under the SCP approach. The study reveals that the rice milling industry in Polonnaruwa is slightly concentrated and in Hambantota in a highly competitive atmosphere. The major entry barriers to industry are lack of capital, lack of experience and knowledge on milling technology, high competition and unstable output market. Despite entry barriers to the industry there are number of mills which commenced milling during the last decade. Nearly one fifth of mills in Polonnaruwa are equipped with all modern machineries which can produce high quality rice. The major paddy purchasing method in Polonnaruwa is through brokers and in Hambantota through purchasing directly by millers from farmers. Lack of consistent uniform electricity supply and high electricity cost, low quality paddy, and lack of modern machineries are the major constraints affecting the industry. The present method of mill classification is relatively old. Majority of the millers sell their rice under their own brand name. The study points out that there is a relationship among the paddy storage ability, credit affordability and the scale of milling. Rice bran in Polonnaruwa and paddy husk in Hambantota are the underutilized by-products.

The report provides an in-depth overview of the rice milling industry in both districts. I congratulate the team of researchers for successfully undertaking this study and hope the findings and recommendations of the study would be useful to policy makers and practitioners in the agrarian sector.

E.M.Abayarathna

Director

Hector Kobbekaduwa Agrarian Research and Training Institute

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EXECUTIVE SUMMARY

Increasing paddy production, stabilization of domestic rice consumption and the increasing dynamism of rice processing and domestic markets call for a rethinking of the general direction of the rice milling industry in Sri Lanka. Achieving food security and ensuring uninterrupted access to competitive markets are the priority policy direction areas in the Government Development Policy Framework in Sri Lanka. In order to understand the competitiveness of rice milling industry, this study is focused on assessing the structure, conduct and performance (SCP) of the rice milling industry in Polonnaruwa and Hambantota Districts which are the major hubs of the country for parboiled and raw rice processing. The SCP approach is widely used to analyze competitive conditions in industries by examining how the structure of industry relates to the market conduct and performance. The research methods adopted are the calculation of the concentration indices such as the four firm Concentration ratios (CR4), Herfindalh- Hirshman Index (HHI), Lawrence curve and Gini co-efficient. Due to the heterogeneous nature of rice milling industry in Polonnaruwa nearly 75 % (N=120) of the total miller population was interviewed. In Hambantota, out of 108 millers 31 (29%) were randomly selected due to the homogenous nature of milling.

Out of the quantity of paddy milling per day, 47 % of rice mills are less than 8Mt/day while 34 % is 8-20 Mt/day and the rest (19%) is greater than 20 Mt/day. In Hambantota, nearly 50% of the mills fall in the range of 8-20 Mt/day. The estimated values of CR4 for the per day rice production of the whole miller population in Polonnaruwa and Hambantota are 30% and 8% respectively. The calculated values of the Herfindalh – Hirshman Index (HHI) equal to 0.04 in Polonnaruwa and 0.01 in Hambantota. The Lawrence curve and the Gini co-officient values in terms of quantity of rice produced by millers indicate moderate and low degree of inequality in Polonnaruwa and Hambantota respectively. The correlation analysis reveals that there is a strong relationship among paddy storage ability, credit affordability and per day rice production. These structure, conduct and performance characteristics indicate that the rice milling industry in Polonnaruwa operates in weak oligopsony and that the industry in Hambantota is highly competitive. The present method of classification of rice mills in Sri Lanka is relatively out dated.

Shortage of capital is a major constraint for the rice millers (74%). Lack of understanding and experience in the milling industry is another major constraint (65%). Lack of knowledge on rice milling technology (50%), unstable output market (44%) and high competition of the industry (30%) are also perceived as important entry barriers. Experiences in milling technology and high quality processing machines are vital instruments to create competitive advantage. Survey results show that a number of mills were started during the period 2000-2010. It implies that there are new entrants to the industry. However, most of those millers belong to the category of less than 8Mt per day production. It was found that large and medium

scale millers had considerable experience in the industry and most of them had started on small scale at the beginning.

Nearly 80% of the millers in Polonnaruwa, which is the major parboiled rice producing area, have mechanical dryers. Therefore, the rice production in rainy seasons is also possible. About 23% have color separators in Polonnaruwa, which are highly expensive machineries and it was 10% in Hambantota. Only 31% have weighing bridges which are also expensive. All large scale millers have Water Jet Polishers and rice graders which indicate that polishing and grading are popular in commercial rice milling.

The major paddy purchasing method of large scale millers in Polonnaruwa is through brokers. In Hambantota major channel is miller purchasing from paddy farmers. Millers in both districts have major rice selling markets in Colombo and suburbs. Receiving low quality paddy and lack of consistent electricity supply are the major constraints faced by millers in both districts. This study has also found that the rice ceiling price is a constraint for the millers to produce quality rice. A huge variation can be observed in the amount of loans obtained for paddy purchasing. In Polonnaruwa Government Banks dominate granting loans for the industry while in Hambantota it is dominated by private banks. It was found during the study that three mills carry out color sorting, polishing and grading rice on contract basis by millers who do not have machineries for such work in Polonnaruwa. This is a method found in Vietnam rice milling industry as well.

Analysis of market margins by using series of secondary data shows that farmers' share in consumer price of rice has a volatile trend. However, a shown slight upward trend is observed during recent years, which is quite apparent in Hambantota. In Hambantota a greater share goes to the farmer. Only four mills in Hambantota have obtained Good Manufacturing Practices (GMP) certification from the Sri Lanka Standards Institution. All those millers are small scale rice exporters. In Polonnaruwa and Hambantota, 94% and 77% of millers sell their rice under their own brand name. Nearly 6% of small scale millers in both districts sell their brown rice to large and medium scale millers. Analysis of rice retail prices of all rice consuming countries shows that the Sri Lankan rice prices are competitive. A huge amount (nearly 3000mt) of rice bran is monthly exported to India from major rice processing areas for extracting rice oil.

Rapid development of the rice milling industry has taken place during the last decade. Demanding new methods of classification. The study suggests the necessity of a new classification based on the literature in certain other rice producing countries. According to the per day rice production(Mt), it is suggested to classify less than 8 Mt, 8-20 mt as medium and more than 20 Mt as large scale.

Scale up of medium capacity millers (8-20mt/day) is needed to reduce milling industry concentration in Polonnaruwa. The industry further needs a proper rice

grading system which is present in most of other rice producing countries. Millers who process improved rice using proper grading and Sri Lanka Standards Certification should be given an opportunity to sell their products exempting them from ceiling price to a certain extent. Defining mandatory grading and standards for Sri Lankan rice and collaborating with the private sector to enforce them as a vital step. Technical capacity to achieve the required standards needs to be built. Hence, introducing ceiling prices based on graded rice according to the standards is recommended. This may be helpful to increase the quality of rice reaching international standards.

Color sorters, water jet polishers and modern graders are expensive heavy machineries in the industry. Three mills found during the study, do color sorting, polishing and grading rice on contract basis with millers who do not have those machineries. This is a method found in Vietnam rice milling industry. This mechanism can be promoted to increase the capacity of small scale millers.

In order to improve the milling industry there is an urgent need to upgrade the competency of personnel in new milling technologies as per the needs of changed environment. Some of the large scale millers have gained knowledge on new technology from other countries- mainly from India at their expense.

When new mills are established they must be established in the major rural producing areas. That will minimize environmental problems caused by the mills concentrated in urban areas. It will also reduce the interference of brokers and enhance the rural economy. Measures should be taken to find out the ways and means of utilizing paddy husk that is wasted in large scale in the Hambantota district. Encouraging investment for establishing rice bran oil manufacturing plant in Polonnaruwa area is highly recommended.

The present taxation procedure needs to be restructured in order to ensure the sustainability of the industry. It is further recommended that a detailed study be conducted to evaluate the merits and demerits of different taxation systems with a view to design an appropriate taxation system.

CONTENTS

	Page No.
FOREWORD	i
ACKNOWLEDGEMENTS	ii
EXECUTIVE SUMMARY	iii
CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	vii
LIST OF APPENDICES	xiii
LIST OF MAPS	xiii
ABBREVIATIONS	xiv
CHAPTER ONE	
Introduction	01
1.1 Rice Economy of Sri Lanka	01
1.2 Rice Milling Industry in Sri Lanka	04
1.3 Research Problem	06
1.3.1 Significance of the Study	07
1.4 Objectives of the study	07
1.4.1 The Broad Objectives	07
1.4.2 The Specific Objectives	07
1.5 Limitations of the Study	07
1.6 Outline of the Report	07
CHAPTER TWO	
Review of Literature	09
2.1 Historical Review	09
2.2 Review of Theory	11
2.2.1 The Market	11
2.2.2 Marketing and Agricultural Marketing	11
2.2.3 Marketing Channels	13
2.2.4 Marketing Intermediaries	14
2.2.5 Marketing Functions	14
2.3 Industrial Organization	15
2.3.1 Markets and Industry	15
2.3.2 Perfect Competition	16
2.3.3 Monopoly	16
2.3.4 Monopsony	16
2.3.5 Oligopsony	16
2.3.6 Oligopoly	16
2.4 Market Power	17

2.4.1	Dimensions of Market Power	19
2.4.2	Measures of Concentration	19
2.4.3	Standards	20
2.4.4	Horizontal and Vertical Concentration	20
2.4.5	Competition	21
2.5	Conceptual Framework of Structure, Conduct, Performance Paradigm	23
2.5.1	Market Structure	23
2.5.2	Market Conduct	23
2.5.3	Market Performance	24
2.6	Empirical Review	24
2.7	Behavior of rice milling industry in some other major Rice producing countries	27
2.7.1	Rice Milling industry in Vietnam	27
2.7.2	Rice Milling Industry Behavior in Indonesia	28
2.7.3	Rice Milling Industry in Thailand	29
2.7.4	Rice Industry in Sri Lanka	30
CHAPTER THREE		
Research Methodology		33
3.1	Conceptual Framework	33
3.2	Herfindahl-Hirschman Index (HHI)	34
3.3	Lorenze curve and Gini Coefficient	34
CHAPTER FOUR		
Results and Discussion: Structure, Conduct and Performance of Rice Milling Industry		37
4.1	Structure of the Rice Milling Industry	37
4.2	Different Participants involved in Rice Milling Industry in the Study Areas	37
4.2.1	Paddy Collectors (Assembly Traders)	37
4.2.2	Millers	39
4.2.3	Brokers in the Paddy Buying System	39
4.2.4	By-product Collectors	40
4.2.5	Facilitators	40
4.2.6	Paddy Marketing Board (PMB)	41
4.2.7	Institute of Post Harvest Technology (IPHT)	42
4.2.8	Banks	43
4.3	Steps in the Paddy to Rice Process	43
4.3.1	Paddy Processing	44
4.3.2	Cleaning and Soaking	44
4.3.3	Par Boiling	44
4.3.4	Drying of Paddy	45
4.3.5	Methods Adopted	46
4.3.6	Milling	46
4.3.7	Polishing	46

4.3.8	Grading	46
4.3.9	Color Sorting	46
4.4	Key Personal Profiles of Rice Millers	46
4.5	Industry Experience	48
4.6	Milled Rice Production in the Study Areas	48
4.7	Barriers of Entry in to the Rice Milling Industry	51
4.8	Degree of Millers Concentration	51
4.8.1	Dryers	55
4.8.2	Water Jet Polisher	56
4.8.3	Rice Color Sorting Machines	56
4.8.4	Weighing Bridges	56
CHAPTER FIVE		
The Conduct of Rice Millers in the Market		57
5.1	Introduction	57
5.2	Quality of Paddy	60
5.2.1	Paddy Quality According to the Producing Areas	61
5.2.2	Major Millers Purchase at Higher Prices	61
5.2.3	Shortage of Capital, High Fluctuation of Paddy Prices and Difficulty in Obtaining Pledge Loans in Time	62
5.3	Storage, Credit Affordability and Market Power	62
5.3.1	Farm Storage	63
5.3.2	Credit Availability	64
5.4	Labor Use in Rice Processing	67
5.4.1	Lack of Consistent Electricity Supply	69
5.4.2	Lack of Modern Milling Equipments	69
5.4.3	Receiving Low Quality Paddy	70
5.4.4	Labor Problems	70
5.4.5	Financial Constraints	70
5.4.6	Other Constraints	70
5.5	Price Selling Process in the Study Areas	70
CHAPTER SIX		
Analysis of Rice Milling Industry in Performance		77
6.1	Introduction	77
6.1.1	Conversion of Paddy to Rice (from 100kg of Nadu paddy)	77
6.2	Farmer's Share on Consumer Price of Rice in Colombo Market	78
6.3	Sri Lanka Standards (Specifications) for Rice	81
6.4	Good Manufacturing Practices (GMP) in Rice Milling Industry	84
6.4.1	Utilization of By-products	85
6.5	Rice Processing Cost	88
CHAPTER SEVEN		
Findings Conclusions and Policy Recommendations		91
7.1	Major Findings	91

7.1.1	Structure of the Rice Milling Industry	91
7.1.2	Rice Miller Conduct in the Market	91
7.1.3	Rice Market Performance Analysis	92
7.2	Conclusions	92
7.3	Policy Recommendations	94
REFERENCES		96

LIST OF TABLES

		Page No.
Table 1.1	Trends of Annual Paddy Production, Average Yield, Rice Imports and Population Growth Over the Past Six Decades	03
Table 2.1	Discussing Marketing Functions, Kotler (1997) Delineates Nine Functions	14
Table 2.2	Paddy, Wholesale, and Retail Prices for White Rice 5% and Corresponding Margins, in Milled Rice Equivalent, in \$/ton, 1997–2010 in Thailand	30
Table 2.3	Subsidies and Incentives in Paddy Production and Rice Industry in Year 2009	32
Table 2.4	Conversion Rate Sri Lankan Rupee	32
Table 3.1	Distribution of Sample Rice Millers	33
Table 3.2	Elements of Structure Conduct and Performance (SCP)	35
Table 4.1	Distribution of the Age of Millers by District	47
Table 4.2	Percentage Distribution of Experience of Millers by Quantity of Paddy Milling per in Both Districts	48
Table 4.3	Major Rice Types Produced by the Different Types of Mills	49
Table 4.4	Distribution of Mills by Quantity of Paddy Milling per Day (Mt.)	49
Table 4.5	Classification of Rice Mills	50
Table 4.6	Barriers of Entry into the Rice Milling Industry (% of responses)	51
Table 4.7	Four-Firm Concentration Ratio (CR4) of Rice Millers in the Sample	52
Table 4.8	The Values of Concentration Indices on Milled Rice Production	52
Table 4.9	Availability of Modern Machinery and Equipment of the Millers	54
Table 5.1	Main Method of Paddy Purchasing by Quantity (Per day Milling Quantity) of Millers in the Polonnaruwa District	57
Table 5.2	Main Method of Paddy Purchasing of Millers in Polonnaruwa and Hambantota Districts (%)	57
Table 5.3	Factors Influencing Paddy Purchasing Price According to the Millers in Polonnaruwa	58
Table 5.4	Need of Brokers in Purchasing Paddy	59
Table 5.5	Constraints Faced by Millers in Paddy Purchasing	60
Table 5.6	Millers' Paddy Storage Ability	63
Table 5.7	Details of Pledge Loans Obtained by Millers for Paddy Purchasing	64
Table 5.8	Correlation Matrixes: Correlation between Storage, Credit Affordability and the Scale of Milling (Paddy Milled per Day)	65
Table 5.9	Type of Labour Use (%)	67
Table 5.10	Labor Force under Different Categories of Mills	68
Table 5.11	Transport Facilities of Millers (%)	68

Table 5.12	Constraints Faced by Millers in Rice Processing	69
Table 5.13	Main Rice Selling Markets of Polonnaruwa Millers (N=115)	71
Table 5.14	Rice Selling Markets of Hambantota Millers	71
Table 5.15	Millers Who Sell Their Rice through Other Millers	71
Table 5.16	Response of Millers to the Rice Ceiling Price (Polonnaruwa)	72
Table 5.17	Response of Millers to the Rice Ceiling Price (Hambantota)	73
Table 5.18	Determination of Rice Selling Price (% of responses)	73
Table 5.19	Millers' Response to the Competitiveness of the Industry	74
Table 5.20	Problems Faced by Millers when Selling Rice	74
Table 5.21	Millers Suggestions for Improvement of the Industry	75
Table 6.1	Millers with Their Own Brand Names	81
Table 6.2	Requirements for Raw Milled Rice	81
Table 6.3	Requirements for Parboiled Milled Rice	82
Table 6.4	Comparison of Sri Lankan Rice Specifications with Those of Other Countries	83
Table 6.5	Definition of Technical Terms Used in Rice Grading in Sri Lanka	84
Table 6.6	Sri Lanka Standards for Paddy	84
Table 6.7	Participation in Formal Trainings on the Industry	85
Table 6.8	Methods Adopted for Minimizing Environmental Problems in Polonnaruwa District (%)	85
Table 6.9	Rice Mill Residue Usage Options in Other Countries	86
Table 6.10	Comparison of Rice Retail Prices with Other Countries	87
Table 6.11	Per Day Milling Quantity of Paddy Equal to 16,000 of Paddy, Medium Scale Rice Mill. Outturn 65 kg of Parboiled Nadu Rice	89

LIST OF FIGURES

		Page No.
Figure 2.1	Empirical Evidence on S-C-P Paradigm	24
Figure 4.1	Different Participants Involved in Rice Milling Industry in the Study Areas	38
Figure 4.2	The Process of Paddy/Rice Processing in the Study Area of Polonnaruwa	43
Figure 4.3	Loranze Curve of per Day Rice Production of Millers in Polonnaruwa District	53
Figure 4.4	Loranze Curve of per Day Rice Production of Millers in Hambantota District	53
Figure 4.5	Availability of Modern Machinery in the Mills (%) in Polonnaruwa (N = 120)	55
Figure 5.1	Identified Major Paddy Marketing Channels in the Polonnaruwa District	58
Figure 5.2	Identified Major Paddy Marketing Channels in the Hambantota District	58
Figure 5.3	Seasonal Price Index of Farm Gate Prices of Paddy (Short grain white) in Polonnaruwa, 2007 – 2011 = 100,	66
Figure 5.4	Seasonal Price Index of Farm Gate Prices of Paddy (Long grain white) in Polonnaruwa, 2007 – 2011 =100	66
Figure 5.5	Seasonal Price Index of Farm Gate Prices of Paddy (Long grain red) in Hambantota, 2007 – 2011 =100	67
Figure 6.1	Conversion of Paddy to Long Grain White Paddy (Nadu) in Polonnaruwa	78
Figure 6.2	Conversion of Paddy to Rice (Long Grain Red Paddy) in Hambantota	78
Figure 6.3	Farmers' Share of Consumer Price of Samba Rice	79
Figure 6.4	Farmers' Share of Consumer Price of Nadu Rice	79
Figure 6.5	Farmers' Share of Consumer Price of Raw Red Rice	80
Figure 6.6	Rice Producing Cost Breakdown in Polonnaruwa	89

LIST OF APPENDICES

		Page No.
Annex Table 1.1	Minimum Purchasing Price of Paddy by the Government during the Period of 2000-2011	101
Annex Table 2.1	Monthly Producer Prices of Short Grain (Samba) Paddy	102
Annex Table 2.2	Monthly Farm Gate Prices of Long Grain White (Nadu) Paddy	103
Annex Table 2.3	Producer Prices of Paddy (Red Nadu) in Hambantota - Rs/Kg	104
Annex Table 2.4	Farmers Share on Consumer Price (Colombo) of Samba Grade II Rice	105
Annex Table 2.5	Farmers Share on Consumer Price (Colombo) of Nadu Grade I Rice	106
Annex Table 2.6	Farmers Share on Consumer Price (Colombo) of Raw Red Rice	107
Annex Table 3	Rice Specification in India, Pakistan, and Bangladesh	108
Annex Table 4	Details of Rice Mill Expenses	109

LIST OF MAPS

		Page No.
Map 3.1	Geography of Study Area	36

ABBREVIATIONS

BERNAS	Malaysian Paddy Rice Marketing Authority
CR4	Four Firm Concentration Ratios
CWE	Cooperative Wholesale Establishment
FAO	Food and Agricultural Organization
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GMP	Good Manufacturing Practices
HARTI	Hector Kobbekaduwa Agrarian Research and Training Institute
HHI	Herfindahl-Hirschman Index
IPHT	Institute of Post Harvest Technology
IRRI	International Rice Research Institute
MPCS	Multi Purpose Cooperative Society
NRI	Natural Resources Institute
PMB	Paddy Marketing Board
RMI	Rice Milling Industry
SCP	Structure Conduct Performance
SLS	Sri Lanka Standards
USAID	United States Aids for International Development
UNDP	United Nations Development Programme

CHAPTER ONE

Introduction

1.1 Rice Economy

Rice is the staple food of more than half of the world's population. About one billion households depend on rice cultivation for employment and their main source of income (IRRI, 2004). Rice has played a key role in the historical development of the state in many Asian countries. Rice is mentioned in the scriptures of the ancient civilizations of Asia. Most Asian governments still view rice as a strategic commodity due to its importance in the diet of the poor in employment and income generation of farmers. Asian cultures are partly cultures of rice, and many Asian societies depend on rice for satisfaction of basic needs.

Given this importance, 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. Historically, governments in the main rice-producing and consuming countries had favored policies that maintained stable prices for consumers in urban centers and provide subsidies to farmers (Hossain and Narciso, 2004).

Today, patterns of cultivation, marketing, and consumption of rice are changing faster than ever before. Yet there are also strong forces working to stabilize and conserve rice systems. Key factors that affect the demand for rice are income, prices, population growth, and urbanization in different ways. As income rises, consumers tend to shift from standard-quality rice to high-quality rice. The political economy of rice is changing, and that shapes rice production and consumption. Even though there has been a long history of State engagement in rice stockholding and trading the State's role is coming to an end. However, rice remains a strategic food security crop for policymakers and voters.

There are tremendous variations in taste and preference for rice across the world. European consumers are increasingly interested in special rice varieties such as organic rice, waxy rice, jasmine rice, wild rice, and colored pericarp (Ferrero and Nguyen, 2004). The demand for rice is shifting from lower-quality rice to higher-quality rice.

Agriculture has been the backbone of the Sri Lankan economy with one-third of the rural population dependent on it. It contributes to about 11.2% of the country's GDP and 32.9 % of the total employment (Central Bank of Sri Lanka, 2011). Historically the dominant sector of the Sri Lankan economy has been paddy (*Oryza sativa*) cultivation.

Our ancestors made the country the Granary of the East. Its importance in ancient times is demonstrated by the extensive irrigation works constructed in *Rajarata* and *Ruhuna* up to the thirteenth century. Our civilization is shaped and grown from paddy cultivation. Rice is cultivated in almost all parts of the country, except at very high altitudes. It is the main contributor to the rural economy, as the majority of rural households are engaged in rice production as their main or supplementary source of livelihood. The rice sector occupies a prominent position in the Sri Lankan economy. The relationship between Sri Lankan life and rice cultivation is so intimate, that it permeates all aspects of Sri Lankan culture and history. Paddy sector plays a vital role in the economy of Sri Lanka with a contribution of 2.9% to the total Gross Domestic Product (GDP) and by providing livelihood to nearly 0.9million farm families islandwide (Central Bank of Sri Lanka, 2006). While 32 per cent of the labor force in the country is engaged in agriculture related activities, about half of it is involved in the paddy industry (Department of Census and Statistics, 2006). In the year 2010, paddy production of the country reached the highest; 4.3 million metric tons.

The milled paddy is called rice. Paddy is an important sector in terms of food security in the nation as rice is the staple food of the Sri Lankans. The nutritional characteristics of rice vary according to a number of factors such as the production location and post-harvest activities. Among them particularly influential are the degrees of milling and the storage, and cooking practices. Although rice can be consumed after different degree of transformation, it also depends on consumer taste. Nearly 44 per cent of total calorie intake comes from this food item (Rupasena, 2006.). Rice is also a major source of protein and it contains substantial amounts of zinc and niacin. A majority of consumers spend a considerable portion of their income on rice. Rice accounts for approximately 25% of the consumer goods basket and about 75% of total grain consumption.

The Consumer Finance and Socio-economic survey, conducted by the Central Bank of Sri Lanka revealed that the expenditure on rice as a percentage of total food expenditure in 1981/82, 1996/97 and 2003/04 was 28.3%, 20.4% and 21% respectively. For low income groups the percentage expenditure on rice was even higher. According to the Household Income and Expenditure Surveys, the annual per capita rice consumption was 103.7Kgs, 107.9 Kgs and 108.8 Kgs in 1986/87, 2006/07 and 2009/10 respectively. During the recent past, per capita consumption shows a degree of stability.

Paddy is cultivated in main seasons: *Maha* under North east monsoons and *Yala* under South-west monsoons. *Maha* (October to March) usually accounts for about 65 per cent of the annual production and the rest 35 per cent comes from the *Yala* crop (April to September). The annual cultivated extent of paddy exceeded one million hectares in the year 2008 for the first time in history due to the commencement of cultivations in war cleared areas. Average cultivated extent during the period of 2007-2011 was 1.026 million hectares and the *Maha* season

contributed 61%. Two thirds of the paddy extent is grown under irrigated conditions and paddy crop is heavily dependent on rainfall. Some performance indices of the paddy sector is shown in Table 1.1. It clearly shows that both production (ton in million) and productivity (t/ha) have increased during the last 70 years.

Table 1.1: Trends of Annual Paddy Production, Average Yield, Rice Imports and Population Growth over the Past Six Decades

Decade	Population (Millions)	Production (mn.tons)	Yield (t/ha)	Rice Imports as a % requirement
1940	6.0	0.26	0.65	60
1950	7.5	0.60	1.56	50
1960	9.9	0.90	1.86	40
1970	12.5	1.62	2.63	25
1980	14.7	2.13	2.94	10
1990	16.3	2.50	3.18	05
2000	18.5	2.86	3.86	<1
2010	20.65	3.12	4.45	<1
Increase Over 1940	3.45	12.0 fold	6.85 fold	

Source: Annual Symposium of Department of Agriculture, 2010

Nirangan S K D F F (2004) has examined the investment in paddy/ rice sector in Sri Lanka and has shown a statistically significant positive impact on rice production. He has found that the rice research impact was realized after the 8th year of the investment. Production of rice has increased gradually after the 8th year up to the 12th year and then declined gradually. The study has also found that one percent increase in the rice research investment has increased the rice production by 0.37 percent. It is also noted that the technical changes arising from rice research has increased the producer's surplus over time.

Rupasena (2006) has studied the rice marketing system in pre and post liberalization periods of Sri Lanka. His study has revealed that all the rice wholesale markets were well integrated and the rice prices were more stabilized during the post liberalization period. However, he has noted that the variation of marketing margins was higher in the post liberalization period. Producer, wholesale and retail prices of rice within a year has clearly indicated that retail market was more stable than other markets during the post liberalization period. His study also has found that the institutional mechanism for rice marketing is weak both at national and divisional level. He has suggested that the supply driven government policy needs to be changed into demand driven in order to transform rice sector into a self sustaining, profit making , viable business activity in the new economic environment.

1.2 Rice Milling Industry in Sri Lanka

As paddy production increases, increasing milling is a vital step in post harvest production of rice. The major objective of rice milling system is to remove the husk and the bran layers, and produce white rice kernel that is well milled and free of impurities. Depending on consumer requirements, rice should have a minimum of broken kernels. A rice milling system can be a simple one or a two step process, or a multi stage process. Single step milling process, husk and bran removal are done in one pass and milled or white rice is produced directly out of paddy. In a two step process, removing husk and removing bran are done separately, and brown rice is produced as an intermediate product. The multi-stage milling process is mostly done in commercial milling. In multi-stage milling, paddy is subjected to a number of different processing stages.

Good quality paddy with proper moisture content and free of impurities is a major requirement for good quality milled rice. Well maintained milling process and skilled operators are the other determinants. Absence of these requirements for milling will result in poor quality rice. Good agronomic practices during the crop management result in good quality paddy.

Post harvest management practices like timely harvesting, proper threshing, proper drying, and good storage are the key determinants of good quality paddy. Another important factor of good quality paddy is proper milling equipment and sound milling processes. Skilled mill operators and mill maintenance are the other important factors.

Rice milling industry is the largest agro based industry in the country and in the year 2002, There were over 7000 mills in the country. Rice milling sector is mainly controlled by the private sector and can be categorized into three types: modern, semi modern and traditional. Traditional mills are those at village level, which milled small quantities of rice on a fee basis for household consumption. Others are large mills doing commercial scale milling. A survey conducted by the Institute of Post Harvest Technology in 2002 has revealed that all the traditional mills and 95 per cent of the commercial mills are owned by the private sector. The rest of the commercial mills belong to cooperatives. The commercial rice mills can be categorized into three main types depending on the machinery used for milling: traditional, semi- modern and modern. Among the commercial rice mills, 25 per cent are of the traditional type, 35 per cent are of the semi-modern type and 40 per cent are of the modern type (Rupasena, 2006). In the year 2002 the total milling capacity of the country was nearly 2700 Mt per hour, of which 60 % was in custom mills and the rest in commercial mills. The above mentioned survey conducted by the Institute of Post Harvest Technology (IPHT) emphasizes that the 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. In this context, reducing production costs for sale of rice at competitive prices and improvement of rice quality to international standards are vital. This survey has further revealed that quality of locally produced rice available in the open market is below the international standards. Low productivity of the existing rice mills has significantly contributed to high production costs. For instance, even though the achievable rice milling recovery is 69%, in most rice mills the rice outturn is around 62 to 65%. The main factors contributing to reduction in rice quality are the presence of high amounts of broken grains, paddy seeds, type admixture, impurities, damaged and discolored grains and non-uniformity in bran removal.

In order to cater to the needs faced by the industry, IPHT has embarked on a programme to improve the processing techniques of existing 100 rice mills covering the entire island.

The study identified main barriers of the production process in parboiled rice mills: lack of modern machineries like pre cleaners, de-stoners, graders, colour sorters and dryers. The main obstacles in the production process of the selected raw rice mills are lack of efficient paddy separators, polishers, graders, bran removers and de-stoners. Another observation was the absence of abrasive type polisher for primary polishing and water shining polisher for final polishing. Requirements for modernization of a rice mill vary, depending on the machinery/equipment available.

The major barrier to modernization of mills is shortage of sufficient capital by the rice millers to acquire the necessary machinery and equipment for mill improvement. Hence, it is important that concessionary credit facilities are provided to upgrade their mills by introducing improved machinery and equipment. The loan requirements vary from mill to mill, depending on the machinery and equipment already available in the process line. Therefore, modernization programme was initiated by the IPHT in January, 2011. It recommended that the millers obtain a report from the IPHT, identifying the requirement of components for mill modernization, before any loan is granted. Under this programme the credit limits was Rs. 500,000/- per mill at an annual interest rate of 12% through the Govijana Bank. Credit should not be issued for construction of buildings and will be limited to machinery recommended by IPHT. The IPHT monitors and ensures the proper utilization of loans obtained by rice millers for rice mill modernization. It is observed that a limited number of rice mills from major producing areas were upgraded under the project.

A report on the task force on the rehabilitation on paddy purchasing, processing and marketing in Sri Lanka (2003) reveals that the rice produced in traditional and semi modern rice mills, which constitute 60% of the commercial mills and 100% of the custom mills, is of poor quality with a high degree of grain breakage, discoloration

and impurities. This is also partly due to the mode and the structure of the production.

Further, rice recovery in these mills is as low as 50-60 % as compared to modern mills where the outturn is between 69-70%. The report further reveals that at the beginning of the last decade there was a big demand for cost effective improved rice milling machinery such as cleaners, de-stoners, sellers, separators, polishers and graders in the milling sector. Most mills are equipped with machinery imported from China and India. Nearly 70% of the rice milling industry in the country is subjected to the process of parboiling. Therefore, majority of the rice mills are equipped with parboiling facilities. Parboiling at present is a labor intensive process. As a result, the cost of parboiled rice is approximately 25% higher than raw rice. Hence, there is a big demand for cost effective, efficient parboiling equipment such as boilers and dryers. According to the report, packing of rice in utility bags of 5kgs and 10 kgs was started at the beginning of the last decade.

The major milling regions in the country are Polonnaruwa, Anuradhapura, Kurunegala, Ampara , Hambantota and Maradagahamula. After the end of the war Batticaloa district also has started milling activities. Out of them Hambantota produces raw red rice and Batticaloa produces both raw red and white rice varieties. Maradagahamula in the Gampaha District consists of a number of small scale mills and they produce low and medium quality rice.

The rice prices start to rise in the month of September each year and reach the maximum in January and then register a declining trend. The declining trend continues at a rapid rate till March and at a lower rate till May. The second phase of rice price decline occurs in the months of July and August with the *Yala* harvest. During December and January rice prices increase at unaffordable levels and it badly affects urban consumers, particularly low income groups. In February and March paddy prices decline sharply and it badly affects the marginalized farmers. At present both paddy purchasing and rice processing are dominated by the private millers. According to the market economic theory, an efficient price is achieved at the point where demand and supply is in a competitive market situation. Furthermore, in a competitive market environment, any buyer and seller should have freedom to enter the industry and leave it. Therefore, a healthy competition of paddy and rice market is vital to protect the consumer as well as the producer.

1.3 Research Problem

Rice industry has now become very important. Sometimes it creates political problems as well. It is argued that the rice milling industry is characterized as a non-competitive structure and few millers control the entire market. Some argue that, during the harvesting season, paddy prices are controlled by a few millers in major producing areas and even during off season rice prices are governed by the same group. This has become a major issue discussed by media and the general public.

Furthermore, it is an important topic discussed even in the Parliament from time to time. Therefore, a detailed study is needed to examine the competitiveness of the rice milling industry.

1.3.1 Significance of the Study

The importance of the study can be highlighted in relation to the needs of the country. "Achieving food security of people and ensuring uninterrupted access to competitive markets are the priority policy direction areas in the Government Development Policy Framework". (The Emerging Wonder of Asia, page No. 13)

1.4 Objectives of the Study

1.4.1 The Broad Objective

As there had been no comprehensive study undertaken in order to understand the competitiveness of rice milling industry, this study is devoted to assess the structure, conduct and performance of the rice milling industry in the Polonnaruwa and Hambantota Districts.

1.4.2 The Specific Objectives

1. To assess the number and relative distribution of rice millers and collectors (assembly traders) in Polonnaruwa and Hambantota districts.
2. To identify the entry barriers that affect the performance of the rice milling industry.
3. To examine the approaches followed by millers in buying, selling and pricing of paddy and rice.
4. To analyze the price margins.
5. To identify the key policy initiatives, needs regarding the promotion of the rice industry and to make recommendations for developing feasible marketing strategies/trade policies to improve the economic efficiency of the rice processing and marketing system.

1.5 Limitations of the Study

Study limits to the major parboiled rice processing area Polonnaruwa and major raw rice processing area Hambantota in the country.

Despite attempts to convince the study objectives, some millers were reluctant to provide actual rice production data due to income related matters.

1.6 Outline of the Report

Chapter I:

Deals with the importance and scope of the research problem, objectives of the study and the background information on the study aspects.

Chapter II:

Provides precise review of literature on Historical, Theoretical and Empirical views.

Chapter III:

Describes in detail Research Methodology employed in the study.

Chapter IV:

Describes the structure of the rice milling industry including the relevant results obtained from the analysis of data using analytical techniques and logical reasoning for results of the study.

Chapter V:

Deals with the rice miller's conduct in the market including the relevant results obtained from the analysis of data using analytical techniques and logical reasoning for results of the study.

Chapter VI

Discusses the performance of the rice milling industry including the relevant results obtained from the analysis of data using analytical techniques and logical reasoning for results of the study.

Chapter VII

Summarizes the findings, and indicates policy implications and recommendations.

References Acknowledges the references made from reports, journals, books and other sources.

CHAPTER TWO

Review of Literature

This chapter provides a precise review of structure conduct performance approach and rice milling industry under three important sections: Historical Review, Theoretical Review and Empirical Review. It also attempts to define some basic concepts like the market, agricultural marketing, intermediaries, marketing functions, oligopsony, oligopoly monopsony, monopoly, market power, concentration, and competition. In addition, the theory of industrial organization and structure conduct performance is discussed.

2.1 Historical Review

Existing literature does not provide conclusive evidence on the competitiveness of the rice milling industry in Sri Lanka. Wicramasinghe and Ubaldulah (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 stopped 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.

Some argue that rice milling and marketing are competitive (Ellis *et al.*, 1996; Harrison, 1995). Others conclude that they are characterized by oligopony buyers (Dharmaratne and Hathurusinghe, 1999). According to Weeraheva (2004), the impacts of rice trade liberalization on paddy market in Sri Lanka are characterized by some degree of oligopsony power in the industry. The study suggests that further research is necessary to reveal the degree of oligopsony power. The major reason attributed to low farm prices is that buyers do not compete with each other in pricing and they offer low prices.

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.

According to Alvorado (1988), market power refers to the condition where providers of a service can consistently charge a price above those that are established by competitive market. The author has also defined the market power 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 (1998), mentioned that market concentration refers to the number and relative size

distribution of buyers or sellers. He also indicated the existence of some degree of positive relationship between market concentration and gross marketing margin.

Carstensen (2000) has reviewed market concentration in agriculture livestock and grain market in America. Economic theory and actual experience in the marketplace demonstrate that concentrated markets can and usually do impose serious economic harms on both producers selling in such markets and consumers buying from them. Limiting the number of firms in any sector reduces the incentive to engage in dramatic innovations in technology or marketing. 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. Such conduct does not promote economic efficiency or positive dynamic change in the market. It serves only to bend or distort the market to advance the interests of the dominant firms. This is not only economically harmful but it also can weaken or destroy important social and politically valuable elements of our society. Those robust, competitive markets have been and should remain the center of our economy. The failure to preserve and protect them will result in serious economic and social costs. This is true in general but in particular in agriculture.

Merphy (2006), argued that concentration of market power is an important reason for the erosion of farm income and that it undermines the viability of local economy. To the extent that farmers and ranchers are squeezed by market power abuses, income is siphoned out of rural agricultural areas and moved to corporate financial centers. 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.

Over the past 25 years, farmers had received a decreasing share of the consumer food dollar. Some analysts and farm interest groups are concerned that this decline can be attributed, in part, to increasing concentration in agriculture. They believe that firms in highly 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 government accountability office, 2009).

Olivier, (2010) has described that the excessive buyer concentration in food supply chains tends to depress prices that food producers at the bottom of those chains receive especially in developing countries. This in turn means lower incomes for the producers. As a result, the least competitive of these producers may be forced out of business, or may be relegated to subsistence agriculture, and may increase inequalities in rural areas in which poverty is concentrated in developing countries.

Market power may reduce or eliminate entirely the net welfare benefits from removing price support mechanisms. Ignoring imperfect competition in the

agricultural marketing sector may lead to erroneous policy conclusions and recommendations (Carlo R et.al, 2011)

2.2 Review of Theory

Basic Concepts

2.2.1 The Market

Markets can be viewed as social arrangements that allow buyers and sellers to discover information and carry out voluntary exchange of goods or services. Markets are normally physical locations, but not always. Transactions can occur on the phone, over the internet or through intermediaries. Commodities (e.g., crops and food), livestock and labor can be exchanged through markets. The focus is primarily on markets where physical goods are traded (Fewsnet-USAID, 2008). The concept “market” has many connotations. For geographers it usually refers to a physical area and denotes the place where commercial exchange takes place. Kotler (1997) defines a market as a set of actual and potential buyers of a special product. A market can grow around a product, a service or anything else of value. According to a marketers’ point of view, a good organized market will offer a favorable product that reflects consumer preferences. In this study, we examine and analyze the market behavior of rice milling industry in Sri Lanka. Therefore, the rice market is defined as an economic market and it denotes a system which encompasses whole of the physical market infrastructure, actors, product characteristics and different regulations, which all play a role in the realization of the exchange. This market consists of a set of marketing channels through which the commodity is transferred from producers to consumers. Furthermore, the national market obviously includes many market places.

Each market place may be defined as “an authorized public gathering of buyers and sellers of commodities meeting at an appointed place at regular intervals (Hodder, 1969). One of their main characteristics is a large number of simultaneous person-to-person transactions of relatively small quantities. Market places perform three basic functions: (1) the import of goods to the local region and their retail distribution; (2) the bulking and export of goods from the local region; (3) the exchange of goods within the local region.

2.2.2 Marketing and Agricultural Marketing

Agricultural marketing encompasses everything that happens between the farm-gate and the consumer, including food processing. The size of the marketing sector is sometimes defined in terms of the difference between farm-gate receipts and consumer expenditure on food (Wollen and Turner, 1970).

According to Wills G. (1974) and Kotler and Zaltman (1971), in an economic context, the government could be regarded as having two main functions. One is to supply some goods and services (health, education, agricultural research and extension, etc.) of public interest and the other is to act as a regulator of the efficiency with which private businesses supply goods and services. In both roles, the government, just as much as business is faced with the problem of finding out what the consumer wants and ensuring that proper consideration is given to product planning, promotion, physical distribution and pricing.

Bateman (1976), in his review of marketing theory showed that the study of agricultural marketing in Britain derived much of its impetus between the two world wars from the problem of low farm prices. The low prices were believed to be associated with inefficiencies in the distribution of agricultural produce from farmer to consumer, with farmers' inadequate bargaining power and the lack of grading of agricultural produce. The solution was considered to lie in the hands of the government rather than of the farmers themselves and institutions such as Marketing Boards were seen as the appropriate lines of intervention.

Meulenberg (1986), criticizes this point of view and according to him, marketing of agricultural products needs a marketing management approach that focuses on an analysis of decisions related to the marketing mix (product, price, place of selling, and promotion). The issues of marketing of agricultural commodities resemble the issues at stake in the marketing of industrial commodities. However, in the case of a limited marketing firm, when many small enterprises supply homogenous products, the capacity to develop a marketing policy will be limited.

According to Acharya (2000), the agricultural marketing system plays an important role in determining the prices received by the farmers and those paid by the consumers. The performance of the marketing system depends on the structure of the market and on the conduct of the market functionaries. Agricultural marketing includes: (a) the performance of physical and institutional infrastructure to transfer farm products from the farmers to consumers; (b) the discovery of prices at different stages of marketing; and (c) the transmission of price signals in the marketing chain specifically from consumers to farmers. Agricultural marketing adds value in terms of time, place, form and possession of utilities to the agricultural products originating at the farm level. Physical infrastructure include like storage structures, roads and transportation facilities, marketing centers, grading equipment, packaging facilities, processing plants, and retail outlets. The institutional infrastructure includes organizations (public, private or cooperatives) and rules of the game, prescribed by either government or market functionaries - individuals or their groups - for performing various marketing functions.

While direct government intervention in the marketing of food and other agricultural commodities should be phased out, governments should play a more active role in: (a) encouraging grading, standardizing, and monitoring quality standards at all the stages in the marketing chain; (b) promoting farmers or

consumer groups to undertake various functions of marketing; (c) promoting value-addition and processing facilities for agricultural products; (d) collecting, compiling and disseminating market and outlook information; (e) training farmers in post-harvest handling of farm products; and (f) undertaking or promoting research and studies relating to changes in farm incomes, real prices of food, terms of trade for the agricultural sector, physical losses in the marketing chain, gross marketing margins and malpractices in the marketing system.

2.2.3 Marketing Channels

To consider the link between actors involved in moving the product from producer to consumer, we discuss the concept of marketing channels or channels of distribution. The marketing channel links producers and final consumers. According to Stern *et al.* (1996, pp 1) "Marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use". The complexity of these channels depends upon the distance between the producers and the consumers, the availability of marketing facilities, the size of farms, and the time available for the farmer for marketing.

Kohls and Uhl (1990) define marketing channels as alternative routes of product flows from producers to consumers. They focus on the marketing of agricultural products, as this study does. Their marketing channel starts at the farm's gate and ends at the consumer's front door. The marketing channel approach focuses on firm's selling strategies to satisfy consumer preferences.

The performance of a marketing channel is related to its structure and the strategies (conduct) of the actors operating in these channels. A major distinction with respect to its structure is that I consider whether the organization functions in conventional or vertical marketing channels. According to Stern *et al.* (1996, pp 315), "A conventional marketing channel can frequently be described as a piecemeal coalition of independently owned and managed institutions, each of which is prompted by the profit motive with little concern about what goes on before or after it in the sequence". In conventional marketing channels, actors tend to be pre-occupied with cost, volume and investment relationships at a single stage of the marketing process. It is relatively easy to enter the channel, and coordination among channel members is primarily achieved through bargaining and negotiation (Lutz, 1994).

As opposed to conventional marketing channels, vertical marketing systems can be described as: professionally managed and centrally programmed networks pre-engineered to achieve operating economies and maximum market impact. Vertical marketing systems are rationalized and capital intensive networks designed to achieve technological, managerial, and promotional economies through the integration, coordination, and synchronization of marketing flows from points of production to points of ultimate use (McCammom, 1970).

Theoretically, three types of vertical marketing system are classified: administered systems, contractual systems, and corporate systems. Vertical marketing systems attempt to capitalize on programmed organization, economies of scale, and economies of standardization. Implicit within the concept of a vertical marketing system is the notion that competition takes place between marketing channels.

In Vietnam, the conventional marketing channel is widespread, because the system relies mainly on formal markets where paddy and rice are traded on markets without major exits or entry barriers. However, there is some room for vertical marketing systems based on informal collaboration concerning exchange of information and financial arrangements between the rice traders (Hai, 2002).

2.2.4 Marketing Intermediaries

The analysis of marketing channels is intended to provide a systematic knowledge of the flow of goods and services from their origin to their final destination. This knowledge is acquired by studying the “participants” or marketing intermediaries in the process, i.e., those who perform physical marketing functions in order to obtain economic benefits. In general, three groups of marketing intermediaries can be distinguished: merchants, agents/brokers and facilitating intermediaries. The merchants take title of the merchandise, the brokers and agents carry out marketing functions on commission, and the facilitating intermediaries assist the merchants in their marketing activities. Figure 4.1 in Chapter Four shows a distinction between intermediaries and other actors in the industry.

Some traditionally accepted definitions help to identify and classify participants in the marketing process. In the real world, these classifications are by no means mutually exclusive.

2.2.5 Marketing Functions

Discussing Marketing Functions, Kotler (1997) delineates nine functions:

Table 2.1: Marketing Functions in Detail

Function	Details
1.Information	Collection and dissemination of market information
2.Promotion	Development & dissemination about offers
3.Negotiation	Attempts to reach final agreement on price and items of offers
4. Ordering	Backward communication of intentions to buy
5.Financing	Allocation of funds required to finance
6.Risk taking	Assumption of risks in connection with carrying out channel work
7.Physical Possession	Successive storage, processing and movement of physical products
8.Payment	Payment of bills
9. Ownership	Actual transfer of title

Rice has to be transferred to many market places within the country during the year, particularly from producing areas (surplus regions) to other regions (deficit regions). Providing rice products in time and to different places in the market is essential. Therefore, transportation and storage are important functions in the channels of distribution. Financing and risk cause many difficulties to rice traders. Shortage of investment capital and price volatility are important barriers to entry. (Duc-Hai and Hiep, 1998). According to Goletti and Minot (1997) credit constraints are common to all types of rice marketing agents in both private and public sectors.

Ordering is subordinate to negotiation. Both functions are performed by the same market intermediaries. However, negotiation is the more important of the two, because a successful negotiation process will almost inevitably lead to the immediate placement of an order. Processing and market information should be considered carefully in this study. The rice processing procedure will directly affect the quality of milled rice in the market. Market information is very important to rice millers, as it will help them to perform the arbitrage function. Market information helps them choose relevant places, time and prices to buy and sell rice efficiently. The banking system in Sri Lanka provides a significant support for the rice milling industry. Most of the millers are familiar with payment by money transfers through the banks. Payment by cheques is very common. Finally, rice is considered a simple and homogenous product. It is a staple food where low prices are the major driving force for consumers.

2.3 Industrial Organization

2.3.1 Markets and Industry

The marketing channel approach is related to the theory of Industrial Organization; however, the latter study object is broader and encompasses production and marketing activities.

According to Ferguson (1992), an industry is defined as comprising firms which have the ability to produce, relatively rapidly, the products of any of the firms in the group. Following Ferguson, a distinction between a market and an industry can be made. Markets group firms that trade commodities together, which are close substitutes from the buyers' viewpoint, while an industry groups together commodities which are close substitutes from the suppliers' viewpoint. These are usually broader groups than markets. Despite this distinction, the theory of industrial organization is helpful in channel analysis, especially when performance standards have to be developed. The theory of industrial organization was developed to understand the conduct of firms in markets for manufactured products, but can also be applied to markets for services as well as agricultural products.

2.3.2 Perfect Competition

Perfect competition is a market situation in which it is assumed that there are many sellers and buyers and the market determines the price of food commodities. Both buyers and sellers become price takers and not price makers (Fewsnet, 2008).

2.3.3 Monopoly

Monopoly is created when a market has only one seller or is controlled by one seller. (Fewsnet, 2008).

2.3.4 Monopsony

Monopsony – a market with only one buyer or controlled by one buyer (FEWSNET-USAID. 2008). "Monopsony power," like "monopoly power," is referred by economists to buyers who face an upward sloping supply curve. The term does not apply to only one buyer as its syllables imply; oligopsony or monopsonistic competition is better, but more complex terms.

A monopsonist may be a monopolist at the same time. A monopsonist has market power, because he can affect the price of purchased goods by varying the quantity that is purchased.

Monopsonists have logical, natural compulsion to wield their power against powerless vendors selling raw goods to the market controlled by monopsonists. (Domina and Taylor, 2009).

2.3.5 Oligopsony

Oligopsony is a market with only a few buyers or controlled by only a few buyers (Fewsnet - USAID 2008). A market is characterized by a small number of large buyers who control all purchases and therefore control the market price of a good or service. A market is a place in which there is only a few but large scale buyers. Sellers in an oligopsony may have difficulty remaining in business as the buyers have a great deal of power to dictate prices. This may affect both the profit margin and other factors, such as labor conditions or wages. It is the opposite of an oligopoly (Farlex, 2009). It is a market in which a limited number of buyers follow the leadership of a single large firm. For example, in a town or region, a large bank may set rates on certificates of deposit that are then adopted by smaller banks and savings and loan associations on their own certificates of deposit (Scott, 2003).

2.3.6 Oligopoly

This refers to a market with only a few sellers or is controlled by only a few sellers (Fewsnet, 2008). A market is characterized by a small number of producers who

often act together to control the supply of a particular commodity and its market price (Harvey, 2004). Oligopoly exists in a market in which a limited number of sellers follow the lead of a single major firm. For example, the domestic automobile market in America was long characterized as an oligopoly, with American motors Chryslers and Ford following the pricing lead of industry giant general motors (Scott, 2003). Petroleum gas, electricity, tobacco products and railway are some of the examples in Sri Lanka. Oligopoly is a situation where a small number of companies split all or nearly all the market share of a good or service. There are two major models for oligopoly: the Cournot model and the Bertrand model. In the Cournot model, each company assumes the output of the others, resulting in greater output than in a monopoly but less than in a state of perfect competition. This pushes prices lower but not as low as they would be in perfect competition. In the Bertrand model, the companies compete for the lowest possible price, resulting in perfect competition. Both models are applicable in different situations and times and neither does express oligopoly perfectly. Less commonly, a third option is possible: if the companies in the oligopoly openly collude with each other, they can form a cartel (Farlex, 2009).

2.4 Market Power

Market power is like the wind. You can feel it but you cannot see it (Kohls and Uhl, 2002). 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, 2000). Market power therefore worries economists because it interferes with the distribution of benefits from economic exchanges, usually in the interests of a few at the expense of the majority (Murphy, 2006). 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. Consequently, market power in agriculture creates a series of challenges for policy-makers in agriculture because it undermines competition as a firm with market power can increase its profits at the expense of its suppliers or customers or both and retards initiative for development (Murphy, 2006).

Market power exists when one buyer or seller in a market has the ability to exert significant influence over the quantity of goods and services traded or the price at which they are sold. Market power does not exist when effective competition is present, but it does when there is a monopoly, monopsony or oligopoly (Domina and Taylor, 2009).

Market power is the ability to affect price (setting buyer prices above and/or supplier prices below open market levels), to reduce competition (for example, by keeping out new entrants) and to set standards for a sector of economic activity.

Market power is the ability to set customer prices above competitive levels (seller power) and/or the ability to set supplier prices below competitive levels (buyer power). Market power is not the same as monopoly power. A monopoly exists when only one firm sells a particular good or service in a market. Monopolies (and monopolistic, when only one firm buys the good or service on offer) are easily identified; market power is more complex and not always so obvious. Market power is not the same as just size; there are big firms that do not have much market power. Murphy further describes that the farmers are inherently disadvantaged in the market: they are numerous, while processors are few (one mill can grind the rice of many farmers); individual farmers' production decisions have no effect on price (they are too small individually to make prices rise by reducing acreage or head of livestock); they must find capital up-front for an uncertain harvest several months hence (in the case of fruit trees or livestock, even several years); and, it is expensive to store harvested production, leaving most producers trying to sell their crops at the same time. The larger the market, the more difficult these circumstances become. A bigger market means more growers competing with each other. Although there should also be more buyers potentially, the vast majority of farmers lack the storage and capital needed to get their goods to distant markets, so they are left selling locally, to middle-men who now have more suppliers to choose from (Murphy, 2006).

Market power in agricultural production, processing and distribution shapes global trade and investment rules and is shaped by those rules. The steady downward pressure on tariffs, for example, has opened up markets in ways that favor companies in a position to do business on a global scale. The strong policy push away from government interference in markets, whether in the form of commodity boards, quantitative restrictions on imports, export taxes, price stabilization policies, production incentives (or restrictions), production subsidies, or capital controls, has changed markets for farmers the world over.

In many poor countries, the private sector lacks the capital and know-how to provide the services that commodity boards once offered such as low-interest credit, subsidized inputs, a guaranteed buyer at a stable price, or access to markets that individual producers could not reach on their own. Transnational agribusiness might enter these newly opened markets, but have no interest in serving the needs of the whole country. Areas that are close to airports and ports or big urban centers might see new investment, but much of the country is left out of the change. Market power is also shaping agriculture independently of trade and investment rules.

Especially the governments of developing countries urgently need to review their national competition strategies to ensure that both producer and consumer interests are addressed and that more than just efficiency outcomes are considered. Recent decisions related to competition have focused on consumer interests, which is a vital dimension of the issue. Yet, more attention is on final price and efficiency rather than on other important concerns, including the impact of market power on

equity (how costs and benefits are shared) and price stability (especially for producers, price stability is an important factor in determining capacity to invest and innovate rather than pursue low-return, risk-averse behavior). Governments also need to consider the impact of market structures on employment: if maximizing efficiency in an agriculture sector means widespread rural unemployment. Then governments have to consider whether alternative employment is available in other economic sectors, or whether they can afford the dislocation and poverty that the loss of agricultural jobs leading to. (Murphy, 2006).

2.4.1 Dimensions of Market Power

In agriculture, market power is often concentrated at the point a firm turns a commodity into a comestible good. Eg: Millers have more market power than rice farmers. Market power in agriculture takes the shape of an hourglass: a large number of farmers at the base sell goods to a small number of processors and distributors and supermarkets in the middle, who in turn sell to a very large number of consumers at the top. In this pattern, agri-business firms often have dependent suppliers (suppliers with nowhere else to sell their production) and dependent buyers (if you need corn, soybeans or wheat, four firms sell the overwhelming majority of production globally). That hourglass creates a series of challenges for policy-makers in agriculture; it has to be worked with and understood (not ignored, as it is in so much free market rhetoric) for policy outcomes to be successful (Murphy, 2006).

2.4.2 Measures of Concentration of Market Power

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.

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. A sector composed of 100 equal-sized firms will generate an index of 100. If there are only four equal-sized firms, the HH index will be 2,500. With only one firm in the market, a straightforward monopoly, the HH index is 10,000. The higher the index, the more concentrated is market power in the sector. The slaughter of steers and heifers in the U.S. has reached an HH index of 1800, high enough for the Department of Justice to consider the sector "highly concentrated" (O'Brien 2005).

The HH index is apparently simple but relies on some difficult judgment calls, including the need to define the parameters of the industry. For example, should the soy industry be considered as a whole (seeds, trade in soybeans, soy processing, sales of soy cake and oil) or should one product—soy oil—be considered in relation to other vegetable oils, with which it competes? Even when the scope of the market is clear, a high index is not always proof of market power because the few firms in the market can face competition from outside: they have the market today, but it is possible that if they over-charge or make a bad investment, other firms will be in a position to move in and challenge the firm's market dominance. If the barriers to market entry are low, a competitive market can be maintained with relatively few firms. Despite the complications, it is important to be able to measure concentration to determine trends and change in the sector, and to give the problem a tangible form (Murphy, 2006).

2.4.3 Standards

Market power gives the transnational agribusinesses the ability to determine who has access to markets and, increasingly, to determine standards on a private basis, without the aegis of governments. For instance, hygiene standards are essential, because consumers must be protected from spoiled merchandise. However, once a company established its market dominance through acquisition of local firms and cooperatives, firms insisted that farmers wishing to sell them milk install their own refrigeration units on farm, a prohibitive capital cost for many farmers, and a cost that was not justified by their output as small-scale producers.

Few market dominant firms show much interest in setting standards together with farmers. Farmers will often need government support, perhaps in the form of legislation, to ensure they are fairly dealt with. Among the standards including some requirements such as local content is one way to address farmers' concerns. FAO and others are working on different versions of GAP (good agricultural practices)-based standards to explore their potential to improve sustainable and equitable practices that would empower farmers. For now, most of the standards are set by retailers or processors, and are made with an eye on consumers and food safety concerns, rather than on farmers' preoccupations or sustainable resource use (Murphy, 2006).

2.4.4 Horizontal and Vertical Concentration

Agricultural markets today are characterized by both horizontal and vertical concentration. Both are elements of market power. Horizontal concentration means that only a few firms dominate a given point in a production chain. The commercial seed market, heavy farm machinery, and most commodity processing are examples of horizontally concentrated markets. The CR numbers reflect horizontal concentration. Vertical concentration means that the same firm or few firms dominate more than one point on a production chain. For example, a company has

power at many stages of the food production chain, which magnifies its power at every point along that chain. Concentration at a given point in the food system can fuel concentration up and downstream from that point. Many factors come together to create profound structural change when a new market power, such as a well-capitalized multinational like Nestlé, enters a market. The new entrant is likely to buy up small local firms and farmer-owned cooperatives if exist, which can increase efficiency but at the expense of competition. A more centralized, consolidated supplier or processor will generally prefer to deal with more centralized retailers—supermarkets—than the varied marketing outlets of a traditional market. Similarly, as buyers, a larger firm is unlikely to deal with hundreds of suppliers, so the channels available to producers to sell their products generally constrict. While economic efficiency goals are met in this process, other important economic objectives—job creation, wealth distribution and balanced regional growth—all suffer (Murphy, 2006).

2.4.5 Competition

Open competition is the bedrock of capitalist economics. In an open market, prices provide signals to buyers (and sellers) about the price that they should charge (or pay). In a perfect market, open competition among firms ensures that consumers are provided a good product that is worth the price they pay. In return, firms are assured that if they can do the best job on price and quality, they will have customers; they will not be kept out of the market by the vested interests of established firms. Neo-classical economics recognizes a number of threats to competition. On the supply side, the archetypal threat to competition is monopoly, the condition in which a single supplier of a product sets the price by controlling its supply. Oligopoly, the situation of a few suppliers sharing the market to the exclusion of newcomers, similarly prevents demand and supply from reaching proper equilibrium. Oligopoly power is not as effective as monopoly power at setting prices independently of demand, but it is harder to monitor and can prove more harmful to a well-functioning market than monopoly power. On the demand side, monopsony and oligopsony describe an industry with a single or a few buyers, respectively. These situations, too, result in less than optimal results for others in the market (Murphy, 2006).

There are situations when a monopoly or monopsony can serve the public interest. They sometimes offer a so-called “second-best solution”, where an open market is not possible, hence so a monopoly has to be tolerated. For example, a publicly or privately-owned and operated company is likely to have a monopoly on providing water because the cost of laying water and sewage pipes does not warrant more than one company having the contract. Governments have developed specific laws to regulate these situations to ensure that the firm in the monopoly position does not abuse its market power, for example by over-charging. There is no competition in such a case, but some of the benefits of competition can be stimulated through other means.

Where it works, competition protects economic efficiency, optimizes the use of resources, and encourages innovation. Competition also promotes socially desirable goals, by redistributing wealth and stopping the emergence of monopolies. However, it is difficult to determine an ideal level of competition. Fragmented markets are often inefficient, and most goods are more expensive to produce if they are made by a large number of different firms rather than by a few, because economies of scale favor large-scale production. Competition issues grow more complicated when borders are opened. Most countries, even if they enforce relatively strict competition laws at home, are lax about enforcing competition rules on their companies operating in foreign markets. Competition would be reduced, and the remaining firms would all be focused on short-term profits with no mandate (or obligation) to consider broader public policy interests (Murphy, 2006).

Much of the discussion of competition policy reflects a preoccupation with protecting consumers against the power of organized production. Indeed, much of the argument in support of deregulation and opening markets is premised on the welfare gains to be had by lowering prices for consumers. However, for agriculture, both in history and with the emerging dominance of retailers as a major power in agricultural markets, the effects of market power upstream, on farmers in particular, should also be of central concern.

It is essential for states to legislate and implement proper competition laws. When circumstances seem to justify monopolies or oligopolies, particular attention must be paid to ensuring sound regulation. There is no point hoping that laws based on the assumption of perfect competition will work in oligopolistic markets. It is clear that in the name of efficiency gains from economies of scale, transnational agribusinesses have already grown to an alarming size, enabling them to undermine proper market functioning. One of the complications of liberalizing trade is that it can create stronger conditions for competition in a local market as new entrants arrive, but it can also consolidate market power as some firms become global players (MacLaren/Josling 1999). According to the UN International Fund for Agriculture and Development (IFAD), without government intervention private sector development occurs but is likely to be “unbalanced in geographical terms, inequitable in socio-economic terms, and could even further exacerbate poverty for some rural people” (IFAD 2001). The responsibilities of governments include creating and enforcing the conditions that markets depend upon to work efficiently and fairly, such as providing open and universal access to information and prohibiting collusion among firms. National competition laws are vital (and often absent, especially in developing countries) but no longer sufficient to manage global competition challenges— some thought has now to be given to protecting competition in global food and agriculture markets (Murphy, 2006).

2.5 Conceptual Framework of Structure, Conduct, Performance Paradigm

Structure, Conduct, Performance (S C P) is an analytical approach or framework used to study how the structure of the market and the behavior of sellers of different commodities and services affect the performance of markets, and consequently the welfare of the country as a whole. Specifically, market structure consists of the relatively stable features of the market that influences the rivalry among the buyers and sellers operating in a market. Some examples of market structure include the number of buyers and sellers of food commodities in the market, the number of sellers of agricultural inputs such as fertilizer and veterinary drugs, barriers to entry into the market and the nature of trading relations (vertical coordination mechanism) among market participants.

Market conduct refers to the patterns of behavior that traders and other market participants adopt to affect or adjust to the markets in which they sell or buy. These include price setting behavior, and buying and selling practices.

Market performance refers to the extent to which markets result in outcomes that are deemed good or preferred by society. Market performance refers to how well the market fulfills certain social and private objectives. These include price levels and price stability in the long and short term, profit levels, costs, efficiency and quantities and quality of food commodities sold (Fewsnet Markets Guidance, 2008).

2.5.1 Market Structure

Market structure consists of relatively stable features of the environment that influence the behavior and rivalry among the buyers and sellers operating in a market. For example, if the market structure is characterized by high barriers to entry, (e.g., license fees and kinship ties), it may result in only a few firms or traders profitably maintaining business activities in, or even entering, certain markets. These few traders may engage in non-competitive behavior such as collusion and exclusionary or predatory price setting behavior. Such non-competitive behavior can result in higher profits and high marketing margins for traders. Concentration can also result in low producer shares for farming households. This can have a significant impact on the income and food security of producer households and on the purchasing power of households that depend on the market as the source of food (Fewsnet Markets Guidance, 2008).

2.5.2 Market Conduct

Market conduct refers to the patterns of behavior that traders follow and how they adjust to changing market conditions. Examples of market conduct include price setting behavior and buying and selling practices. For example, in an environment where there are many buyers and sellers, the market tends to determine the price. If one trader tries to increase his or her price, he or she sells nothing. This means

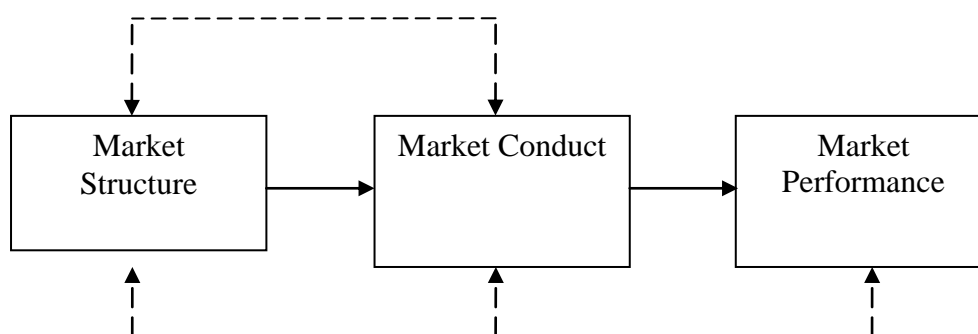
households buy food commodities and agricultural inputs at prices that equal to the costs of producing the last unit of the commodities (marginal cost). In contrast, if there are only a few sellers of food commodities in a market, these few traders can conspire and charge consumers higher prices, up to the level where consumers can afford to buy from nearby market at a lower cost (Fewsnet Markets Guidance, 2008).

2.5.3 Market Performance

Market performance refers to the extent to which markets result in outcomes that are deemed good or preferred by society. For example, regular and predictable availability of basic food commodities at affordable prices is generally considered a desirable outcome. Other desirable outcomes would be that traders do not obtain excessive profits, and that commodities meet certain sanitary and phytosanitary standards. In addition, prices paid by consumers should not be excessively above the cost of marketing, processing and transaction costs for a given commodity, and the prices received by farmers should cover their costs of production (Fewsnet Markets Guidance, 2008).

2.6 Empirical Review

Figure 2.1: Empirical Evidence on S-C-P Paradigm



A widely accepted conceptual framework (figure 2.1) in industrial organization studies holds that structural conditions determine the behavior (conduct) and subsequent performance of a firm (Bain, 1959). The concentration–profits relationship plays a central role in the S-C-P paradigm. The existence of a small number of firms in an industry is said to facilitate collusion, with in turn results in higher profits. The pioneer of S-C-P paradigm, Bain (1951) stated that the average profit rate of firms in oligopolistic industries of higher concentration tends to be significantly larger than that of firms in less concentrated oligopolies or in industries of atomistic nature. In another study, Bain (1956) examined the influence of barriers to entry on profit rates of the leading firms in a sample of oligopolistic industries for the periods 1936-1940 and 1947-1957. He observed that seller concentration is necessary but not a sufficient condition for higher profit rates. He also stated that seller concentration alone is not an adequate indicator of the probable incidence of

extremes of excess profits and monopolistic output restriction. The concurrent influence of the condition of entry should clearly be taken into account.

Dorfman and Steiner (1954) developed a model of the relationship between market structure and advertising. The authors suggested a positive link between market power and advertising where, as the Lerner index of market power increases, the advertising sales ratio also increases. They also stated that the advertising to sales ratio is directly related to the price-cost margin, inversely related to the price elasticity of demand and directly related to the advertising elasticity of demand.

Mann (1966) analyzed the performance rates of 30 industries for linkages to seller concentration and barrier to entry. He found that seller concentration and barrier to entry have independent influence on profit rates of industries. The industries with concentration values of 70 percent and above have higher profit rates. However, the study by Chandrasakaran (1982), has found that difference in profit rates between the substantial and moderate to low barrier classes is less than one half of the difference between the very high and the substantial barrier categories. Besides, the combined effect of seller concentration and barriers to entry reveals that monopoly advantages exist in those industries which are highly concentrated and have high barriers to entry.

In another research, Kilpatrick (1967) empirically studied the correlation between the top four, top eight and top twenty firm concentration ratio plus some variants and industry profit rates. In the similarity of correlation coefficients found, he concluded that the result provides much evidence that the particular choice is not crucial and that an economist can use an ordinary concentration ratio in a cross-sectional study without being concerned about a different choice which would have altered his conclusion appreciably. Later in another study, McFetridge (1973) analyzed the relationship between the market structure and performance and he found the positive significant effect of concentration with the square of Herfindal-Hirschman index (HHI) to be the preferred measure of concentration on profitability.

Rao and Ramakrishnan (1972) used Gini ratio as their measurement as it has the intrinsic merit of considering all possible differences. However the trapezoidal area under the Lorenz curve has its limitation as the trapezoidal area overestimated the area under the Lorenz curve, which means it underestimates the Gini ratio.

Rhodes and Cleaver (1973) had conducted an extensive research on the concentration and performance relationship using 405 census industries. Four firm concentration values were computed and used as a dummy variable dichotomized at several values while the aggregate price-cost margins were used as performance figure. They used additional explanatory variables such as industry growth, and profit ratios. One of the major findings was the statistical significance of the concentration dummy variable at the 1 percent level regardless of the breakpoint being used. They had concluded that since the significant CR4 dummy variable is

interpreted in such a way that the intercept or average margins in industries above that level are greater than in industries below that level and since this relationship was found throughout a wide range of potential critical values, it would seem to suggest the existence of a basic linear relationship. Their study was strictly an analysis of the concentration-performance relationship at the industry level.

In the presence of structural imperfections however, inter-industry variations in profitability abound because entry barriers prevent new competitions and expanded output. In similar vein, industry structure theory in the strategy literature maintains that competitive advantages and inter-firm differences in efficiency cannot persist over a long period unless structural imperfections are present (Porter, 1980; Teece et al. 1997). Porter (1986) also noted these strong industry effects on a selection of business level strategies. A large body of research in corporate business portfolio studies concurred to point out the importance of industry structure variables in explaining performance.

The S-C-P paradigm extends the structure - conduct - performance relationship to oligopoly. Figure 2.1 depicts the structure - conduct- performance paradigm. According to that, basic market conditions determine market structure; market structure determines conduct; and conduct determines performances. In addition, government policies have direct impact on structure, conduct and performance. The S-C-P paradigm advocates active government involvement in industry to ensure that competition prevails. Meanwhile, the thin arrows on the diagram shows the feedback effects of performance on conduct and market structure.

To assess market structure, conduct and performance, and to properly understand the roles of the each element, Waldman and Jensen (2001), linked those elements and attributes which have direct relationships. In perfectly competitive markets, an atomistic market structure results in efficient economic performance with price equaling to marginal cost, inefficient firms driven from the market, and long run economic profits equal to zero. With a monopolistic market structure, economic performance is poor where price exceeds marginal cost, inefficient firms can survive in the long run, and economic profits are greater than zero.

Another older conceptual framework developed by Scherer also contains basic condition, market structure, conduct and performance as the main components. The only difference is he did not include government policies in his model. The author had mentioned that performance in particular industries or markets is said to depend upon conduct of sellers and buyers while, conduct depends upon the structure of the relevant markets. Market structure and conduct are also deemed to be influenced by various basic conditions. Primarily, the author was concerned with relationships or tendencies involving a casual flow from market structure and basic condition to conduct and performance. There are also feedback effects from conduct to basic condition and market structure; market structure to basic

condition. However, he did not mention about feedback effects from performance (Ahmad and Shamsudin, 2008).

Based from the literature reviewed, it can be observed that many studies have been conducted towards determining the relationship among market structure, conduct and performance. Most of the previous studies had used popular absolute CR and HHI to examine the market structure. Advertising, capital intensity as well as research and development (R & D) expenditure are used as market variables in determining market conduct. Meanwhile, profitability ratios, market margins and price spreads are used to represent the market performance. Econometric modeling and regression analysis are often used to assess the linkages and relationships of market structure, conduct and performance (S-C-P). Thus, the method is appropriate to be applied in the study.

2.7 Behavior of Rice Milling Industry in Some other Major Rice Producing Countries

2.7.1 Rice Milling Industry in Vietnam

Rice millers/polishers fulfill the processing function in Vietnam. Normally, depending on the availability of rice milling or polishing machines, millers are classified into three groups: pure millers, polishers, and miller-polishers. Pure millers are millers without any polishing machines. Polishers are rice processors engaged only in polishing activities and do not mill paddy into white rice. They buy brown rice from other mills and process it further to polished rice usually for export. Small millers collect paddy from rice farmers and after processing, brown rice is sold to large millers. Moreover, polishers may receive brown rice from traders, they only process it into polished rice and collect the service cost for their activities. The polishers have an important function in the market because of the following reasons:

- (1) During the wet season (¹Mua crop or Summer-Autumn crop), most paddy is processed to brown rice. This crop is suitable for storage and, therefore, part of it can be converted to polished rice later.
- (2) From brown rice, a polisher can produce polished rice mainly for the export market. The third group of miller-polishers consists of millers having polishing machines at their disposal. These are the most technologically complete mills, able to process paddy into a polished rice of high quality suitable for export.

Depending on their daily processing capacity rice millers are further classified into two groups: small and large millers. Small mills have a daily processing rate of less than 20 tons. Large mills have a daily processing rate of over 20 tons. Large mills and polishers involved in milling and polishing are older and have also older management staff with good experience on rice trading and processing. Polishers

¹ A cropping season

and small-scale millers entered the market more recently. Large-scale millers use more family labor to manage the business.

Compared to the milling process, the polishing process is easier. Most of the polishers use brown rice as raw material. They have to check the moisture degree of brown rice before polishing. During the polishing process, they can also control and adjust the machine in order to produce a certain type of broken rice and a degree of whiteness. The final product is a high quality polished rice, suitable for export.

The “²conversion ratio” or “rate of return” from paddy to white rice is about 66-68 percent. In the case of polishing, the average “conversion ratio” is 89 percent. It means that from 100 kg of brown rice, after polishing they can obtain around 89 kg of polished rice, the rest 11 kg is in terms of smooth bran that can be used for feeding animals. In more detail, the “conversion ratio” highly depends on the quality of paddy or brown rice. It includes the moisture degree and type of paddy (long or short grain). A higher degree of moisture and/or short grain paddy/rice will reduce the “conversion ratio” after milling or polishing. Moreover, the different processing techniques also influence the “conversion ratio”. The modern rice mills with new processing machines and experienced millers usually get a higher “conversion ratio”.

2.7.2 Rice Milling Industry Behavior in Indonesia

Indonesia is one of the world’s leading rice producers and it produced more than 57 million tons of paddy in 2007 which was about 9% of the world total. According to official statistics, paddy rice production was expected to reach close to 60 million tons in 2008. The provinces in the main island of Java, particularly West Java, Central Java, and East Java, accounted for 54% of paddy production in 2008. It was followed by Sumatra (23%) and Sulawesi (11%). Most of the rice milled in Indonesia today is milled in small rice mills scattered all over the country for the country’s own consumption. The husk is sometimes used as poultry feed together with broken rice. Sometimes the husk is collected and burned, with the ash used for cleaning utensils. Broken rice is used as animal fodder. Recently the Indonesian rice milling industry is focused on implementing a number of measures for the sustainability of the industry.

- Separation of milling areas from all other areas of operation. For parboiling mills, locating the steam-generating units away from storage and immediate work areas
- Good and adequately maintained drainage to facilitate run-off and minimize the likelihood of flooding
- Regular inspection of bulk storage tanks to minimize the risk of surface water pollution
- Installation of interceptor traps for solids, oil and fuel to reduce or control the release of contaminated water via the surface drains.

² Conversion ratio – Milling outturn

- Designing of chimney and vents of sufficient height and appropriate technology to avoid difficulties caused by dust and smoke emissions
- Locating the soaking tanks close to the drying area
- Locating the steaming tanks close to the soaking tanks and using non-corrosive metal and insulating the steam conduit pipes and making sure they are free from leaks
- Treatment of effluents and waste water.
- Re-using of rice husk as fuel for paddy drying, steam generator, or gasifier and sale of rice husk or high crystalline silica produced from controlled burning of rice husk and use of more efficient variable-speed drive motors for controlling combustion of rice husk

Through a government agency called BULOG, Indonesia operated a buffer-stock scheme that procured rice locally in order to defend a floor producer price, and sold rice in the open market to defend a ceiling retail price. BULOG procured on average 6% of the domestic rice harvest. Indonesia's policy of stabilizing rice prices during the 1970s, 1980s, and 1990s is a classic and well-documented example of the stabilization approach. Over these decades, BULOG was remarkably successful in fostering intra-year and inter-year rice price stability. Four key elements of BULOG's success in stabilizing prices were (1) intervening in terms of purchases only at the margin of fluctuations in peak season volumes; (2) close monitoring of price trends and harvest predictions in areas where problems are likely; (3) relatively quick responses to changing local conditions; and (4) reliability and credibility of its purchase operations in defending a floor price (Ellis, 1993). A floor price was announced every year before the main crop was planted, thus providing clear incentives to farmers to adopt new technologies. The level of the floor price that was announced took current inflation rates into account and was adjusted up or down slightly depending on world price fluctuations, fertilizer prices and other factors (Timmer, 1996).

2.7.3 Rice Milling Industry in Thailand

The world's largest rice exporter is Thailand. Therefore examining the behavior of the industry in Thailand is very important. In the beginning of the twenty first century the Thai government introduced a new rice price policy that has been in operation on and off since the introduction. The policy functions as a mortgage programme in favor of the producers. In 2008 government reintroduced the policy and pledged highest ever prices. Traditionally RMI has had an important role in the Thai economy and rice still constitutes a rather large share of the GDP. In 2004, rice exports were valued around US \$ 1900 million (Vanichanont, 2004). Thailand put its total number of rice smallholdings at 3.8 million. Around 20 million tons of rice is produced annually by Thailand's farmers, two-thirds of which is consumed by them and their families, and used as seeds or sold onto the local market. The remaining one third is exported.

Table 2.2: Paddy, Wholesale, and Retail Prices for White Rice 5% and Corresponding Margins, in Milled Rice Equivalent, in \$/ton, 1997–2010 in Thailand

Year	Paddy price	Wholesale Price	Retail Price	Wholesaler Margin	Retailer Margin	Paddy Price as a % of Retail Price
2000	171	251	333	47	33	51
2001	147	209	288	42	38	51
2002	165	219	285	32	31	58
2003	179	240	309	34	29	58
2004	205	258	353	26	37	58
2005	250	301	358	21	19	70
2006	266	332	380	25	14	70
2007	287	365	433	27	19	66
2008	485	626	795	29	27	61
2009	426	504	749	18	49	57
2010	394	448	805	14	80	49
Avg2001-2005	198	255	323	31	28	61
Avg2006-2010	372	455	633	23	38	59

Note: Ratio of conversion from paddy to milled rice is 0.66.

Source: OAE for farm price; Ministry of Commerce for wholesale and retail price. The rice situation of Thailand/ Asian Development Bank,2011

More than half the rice traded from farms goes through traders and middleman and only 6% through cooperatives. Nearly 20% farmers directly sell to the millers. All rice has to go through a mill. Two thirds of trade carried out by the mills is via brokers and direct or indirect sales to wholesalers and exporters. There are small, medium and large millers. The small millers mill for local, regional and sometimes also export markets. In the past years, small and medium scale millers faced difficulties staying competitive and the number of mills has been decreasing. In 2007, there were many thousands of mills scattered around the country but only around 900 were large. Larger millers have upgraded their technology and many of them have reached standards set by the Good Manufacturing Practices (GMP), International Organization for Standardization (ISO) and Hazard Analysis and Critical Control Points (HACCP) during the past decade (Vanichanont, 2004). Due to the low interest loans programmes in Thailand, there is opportunity for upgrading existing mills and entrance for new ones, which is competitive. (Forssel, 2009).

2.7.4 Rice Industry in Malaysia

Rice in Malaysia is protected through price controls, subsidies, tariffs and buffer stocks. Rice is considered as a "strategic" sector in Malaysia, and the Government aims to maintain self-sufficiency level for rice. Buffer stocks are used to stabilize the domestic price from fluctuations in the world market. The government intervenes in

³ Calculated by author

the rice market by providing subsidies to farmers and consumers as well as by imposing high import duties. Malaysians consume about 2.2 million tonnes of rice annually and is approximately equal to the Sri Lankans annual rice requirement which is 2.3 million tones. Under the Ninth Malaysia Plan, a target was set to raise Malaysia's rice self-sufficiency level to 90% by 2010 from about current 70% (2008).

The rice trade is controlled through a sole importer called BERNAS. BERNAS has regulated the paddy and rice sector in Malaysia since its privatization in January 1996 and is involved in paddy procurement and rice processing, importation and exportation, distribution and marketing activities. It is involved in state trading and it performs certain social obligations on behalf of the Government on rice. BERNAS operates 31 of the 400 commercial rice mills in the country. BERNAS manages the Bhumiputra Rice Millers scheme and the distribution of paddy price subsidies to farmers on behalf of the government. Bernas controls about 24% of the paddy market and 45% of the local rice demand.

BERNAS is obliged to purchase paddy from farmers at the GMP if the market price is below the GMP. BERNAS also maintains the national rice stockpile on behalf of the Government. In addition, BERNAS had the exclusive right to import rice until 2011 with an option for a further five-year extension. When importing rice, according to the authorities, BERNAS implements a transparent purchasing system with open tender procedure. BERNAS does not regulate the retail prices for rice; and these are regulated by the Control of Paddy & Rice Section under the Ministry of Agriculture and Agro-based Industry. However, as the only authorized importer of rice (a monopony buyer), BERNAS tends to have the market power to negotiate lower prices with its suppliers.

Roshiyana (2006) points out that in Malaysia, the milling quality of any paddy variety is influenced by the quality of paddy due to genetic and environmental factors, the post harvest treatment, type of milling system used and the processing conditions. Physical factors of grain such as white belly, white core, immature grain, damaged grain and grain size affect the milling quality of paddy. The market value of rice is based solely on the physical characteristics of the grain. Long grains fetch better price than medium or shorter grains.

In the year 2006, rice grades were categorized only as Super, Premium and Standard as compared to the nine categories in the previous grades (A1, A2, A3, A4, B1, B2, B3, B4 and broken rice grain). The main distinguishing feature between Premium and Standard grades is the grain size. The top grades, namely, Super are high quality rice, with high milling quality and low broken content (15%) have the specialty 46 Malaysian milled rice characteristics such as aromatic smell and superior quality (long grain). The Premium grade consists of ordinary white rice, which contains more than 60% long grains with good milling quality and broken rice content with lower than 45%. Those ordinary rice-containing medium grains attained through normal milling standards consist of not more than 45% broken rice. In this study local milled rice from all the states in Peninsular Malaysia were considered. Details of the subsidies and incentives given to the rice industry are shown in table. 2.3

Table 2.3: Subsidies and Incentives in Paddy Production and Rice Industry in Year 2009

Type of Subsidy	Description
Subsidy for the paddy price	Farmers receive RM 248.10 for each MT of paddy sold.
Federal Government paddy fertilizer subsidy scheme	240kg/hectare mixed fertilizer (12 bag@ 20kg/bag) and 80kg/hectare for organic fertilizer (4 bag @ 20kg/bag)
Yield increase incentive	RM 650 for each 1 MT of increase in yield at the farm level compared to the previous year (base year).
Paddy production incentive 1.	Ploughing expenses at a maximum of RM 100 per hectare and additional fertilizer of RM 140 per hectare per season (maximum)
Additional fertilizer NPK	3 bag @ 50kg each bag/hectare
Subsidy for Pesticide Control	RM200/hectare/season
<i>Rice Millers Subsidy 2</i>	<i>Peninsular Malaysia: RM750/Mt</i>
Sabah & Sarawak: RM600/Mt	
Subsidy Rice in Sabah and Sarawak	Difference between wholesale price and purchasing cost of rice import

1 Figure estimates based on area harvested and total expenses in year 2009.

2 This subsidy started in 2008 during the rice crisis to encourage millers to produce ST15% broken rice. However, this scheme will be replaced by consumer subsidy program called "Rice for the People Subsidy Programme"(SUBUR).

Rice is subject to a guaranteed minimum price (GMP) and a paddy price subsidy, to encourage paddy cultivation. Under the GMP scheme, BERNAS undertakes to buy paddy from farmers at not less than the GMP if the market price is lower than the GMP. Under the paddy price subsidy programme, the Government makes fixed payments (currently RM 24.81 per 100 kg) to farmers for the paddy they sell to any commercial rice mill. This subsidy is in addition to the price received for paddy. The Government also adopts a price control for certain types of rice consumed by the lower income population: i.e. lower grade rice has price ceilings. For ST15 (lower grade), the price is fixed at RM 1.65/kg for Peninsular Malaysia and RM 1.80/kg for Sabah and Sarawak; for SST5 (lower grade) and SST10 (lower grade), the price ceilings are RM 2.60/kg and RM 2.40/kg, respectively.

Farmer received price for 1 kg of paddy = 0.75RM (GMP) +0.248 (Subsidy for sold paddy) = 0.998RM

In the year, 2009 Exchange rate 1RM = Sri Lankan Rs 33.02

1 kg of paddy price of 0.998RM = Sri Lankan Rs 32.95

Table 2.4: Conversion Rate Sri Lankan Rupee

Rice standard	Ceiling Price (RM)	Ceiling Price (Sri Lankan Rs.)
15% Standard rice	1.60	52.83
10% Standard rice	2.40	79.25
05% Standard rice	2.60	85.85

Source: compiled by author

CHAPTER THREE

Research Methodology

There are many different definitions and concepts of structure-conduct-performance (S-C-P). The S-C-P paradigm in industrial organization studies is empirical in its orientation. The S-C-P paradigm has been developed by Mason (1939, 1949) and Bain (1956). The approach is widely used to analyze competitive conditions in industries by examining how the structure of industry relates to the market conduct and performance. In a later version of the S-C-P model, the complexity of two-way relationships between structure conduct and performance are elaborated, where the structure affects conduct, conduct affects performance and performance in turn affects conduct which jointly affects the structure of the market (Scherer, 1980; Clarke. 1985).

In line with the study objectives, the method of data collection consists of two major components including questionnaire survey for rice millers and analysis of secondary data. In addition, a comprehensive literature review has been made. A well structured pre-tested questionnaire was used to obtain primary data. The study covered more than 75 percent of functioning commercial rice mills including all major scale mills in Polonnaruwa district. In the Hambantota district, 31 mills were selected randomly out of the total population of 108 mills.

Table 3.1: Distribution of Sample Rice Millers

District	DS Division	No. of Mills Selected
Polonnaruwa	Tamankaduwa	51
	Hinurakgoda	32
	Medirigiriya	16
	Dimbulagala	10
	Lankapura	06
	Elahera	05
	Sub total	120
Hambantota	Tissamaharama	19
	Ambalantota	08
	Sooriyawewa	04
	Sub total	31
Total		151

3.1 Conceptual Framework

The concepts of inequality and market power concentration among millers were used as key measures to analyze the degree of competition.

Measure of Inequality

Lorenz co-efficient technique

Market Power Concentration,

(a) Four firm concentration ratio (CR4), Kohls and Uhl (1985)

CR4 is the sum of market shares of the four largest firms in the industry to the total market share.

$$CR_n = S_1 + S_2 + S_3 + S_4 + \dots + S_n$$

Where, S₁ – market share of the industry

n – number of industries

CR4 < 33% – competitive market structure

33 % < CR4 < 50% – weak market structure

CR4 > 50% – oligopsonic market structure

CR4 fall 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. Tegku *et al*, (2008)

3.2 Herfindahl-Hirschman Index (HHI)

HHI is defined as

$$HHI = \sum_{i=1}^k (X_i / T)^2$$

Where, k=number of firms, X_i =Sales volume of firms I

T = total market share

HHI less than 0.01 – highly competitive

HHI below 0.1 – unconcentrated

0.1 < HHI < 0.18 – moderate concentration

HHI above 0.18 – high concentration

3.3 Lorenze curve and Gini Coefficient

Lorenz curve is the graphic technique for summarizing information in a concentration table. It shows as a continuous function, the percentage of total industry sales accounted for by any given fraction of the total firm population, with the firms ranked in order of market share or size (cumulated from smallest to largest).

Lorenze curve is also characterized numerically by means of the Gini coefficient (GC), which measures the departure between the Lorenze curve actually observed and the curve that would appear if all firms had equal market shares or sales. For a perfectly

equal distribution of market shares, there would be no area between the 45-degree line and the Lorenze curve, which means a Gini coefficient of zero. For complete inequality, with the leading firm producing the whole output Gini coefficient's value equals to one. So the Gini coefficients for real economic systems vary between zero and one. The lower the Gini coefficient, the firm's equality in an industry is more evenly spread.

Formulated by Gini (1912), the coefficient is the ratio of the area between a Lorenze curve and the 45-degree line to the area triangle below 45-degree line. Its formula is,

$$\text{Gini Coefficient (G)} = \sum_{i=1}^n (2i - N - 1)X_i/N^{2a}$$

Where,

- X_i = the market share of firm i marked in ascending order;
- N = the number of firms in the industry;
- a = mean size

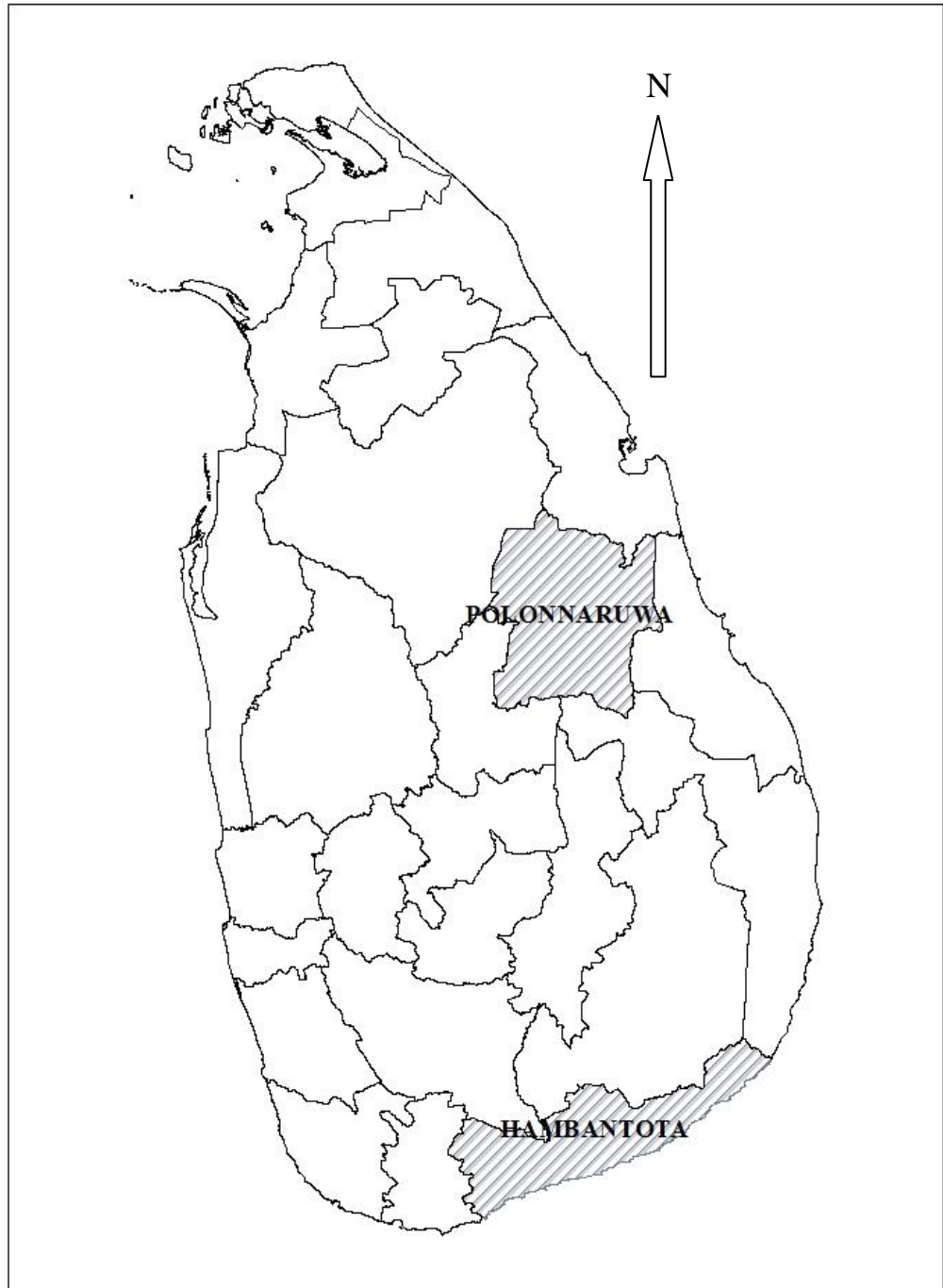
Table 3.2 presents the principal aspects developed to deal with under the structure conduct performance (SCP) in this study.

Table 3.2: Elements of Structure Conduct and Performance (SCP)

Structure	Conduct	Performance
1. Different Participants involved in Rice Milling Industry 2. Steps in the paddy to rice process 3. Key personal profile of rice millers 4. Barriers to entry in to the rice milling industry 5. Degree of Millers Concentration. 6. Availability of modern machineries	1. Main Method of Paddy purchasing 2. Identified Major Paddy Marketing Channels 3. Factors influencing paddy buying price 4. Intervention of brokers 5. Constraints faced by paddy purchasing , processing and rice selling 6. Storage and Credit 7. Labor usage 8. Transport facilities 9. Response of Millers to the Rice Ceiling Price 10. Determination of Rice Selling Price 11. Millers' suggestions for improvement of the industry	1. Farmers Share on Consumer Price of Rice 2. Standards (Specifications) for Rice 3. Trainings on the Industry. 4. Rice brand loyalty. 5. Utilization of by products 6. Methods adopted to minimize environmental problems 7. Price comparison with other countries. 8. Rice Processing cost

Source : Compiled by Author

Map 3.1: Geography of Study Areas



CHAPTER FOUR

Results and Discussion: Structure, Conduct and Performance of Rice Milling Industry

4.1 Structure of the Rice Milling Industry

This chapter presents different elements of market structure of the rice milling industry. First of all we provide a description about the different participants involved in rice milling industry in the study areas and try to describe the functions of different types of intermediaries. Secondly, brief details about the process of paddy/rice processing is provided. Thirdly, we discuss about the personnel profile of the rice millers and classification of mills. Then, we focus on analyzing the competitive process in the market structure of rice milling industry by measuring the industry concentration, barriers to entry, and the inequality of scale of milling. We conclude by describing the availability of modern machineries and equipment of the millers in the study areas.

4.2 Different Participants involved in Rice Milling Industry in the Study Areas

Studying the behavior of different actors or marketing intermediaries in the rice milling process is a very important aspect. Those different actors perform different physical marketing functions in order to obtain economic benefits. In general, three groups of marketing intermediaries can be distinguished: merchants, brokers, and facilitating intermediaries. The merchants take title of the trading, the brokers carry out marketing functions on commission, and the facilitating intermediaries assist the merchants in their marketing activities, Figure 4.1 shows a distinction between intermediaries and other actors on the industry.

Different actors involved in rice milling industry can be identified as Traders, Brokers and Facilitators. They fulfill various functions in the paddy rice supply chain. The traders take title of the merchandise; the brokers carry out marketing function on commission and the facilitators assist the traders in their marketing activities. Polonnaruwa district can be considered the hub of the rice milling industry as the majority of large scale millers are concentrated in that district.

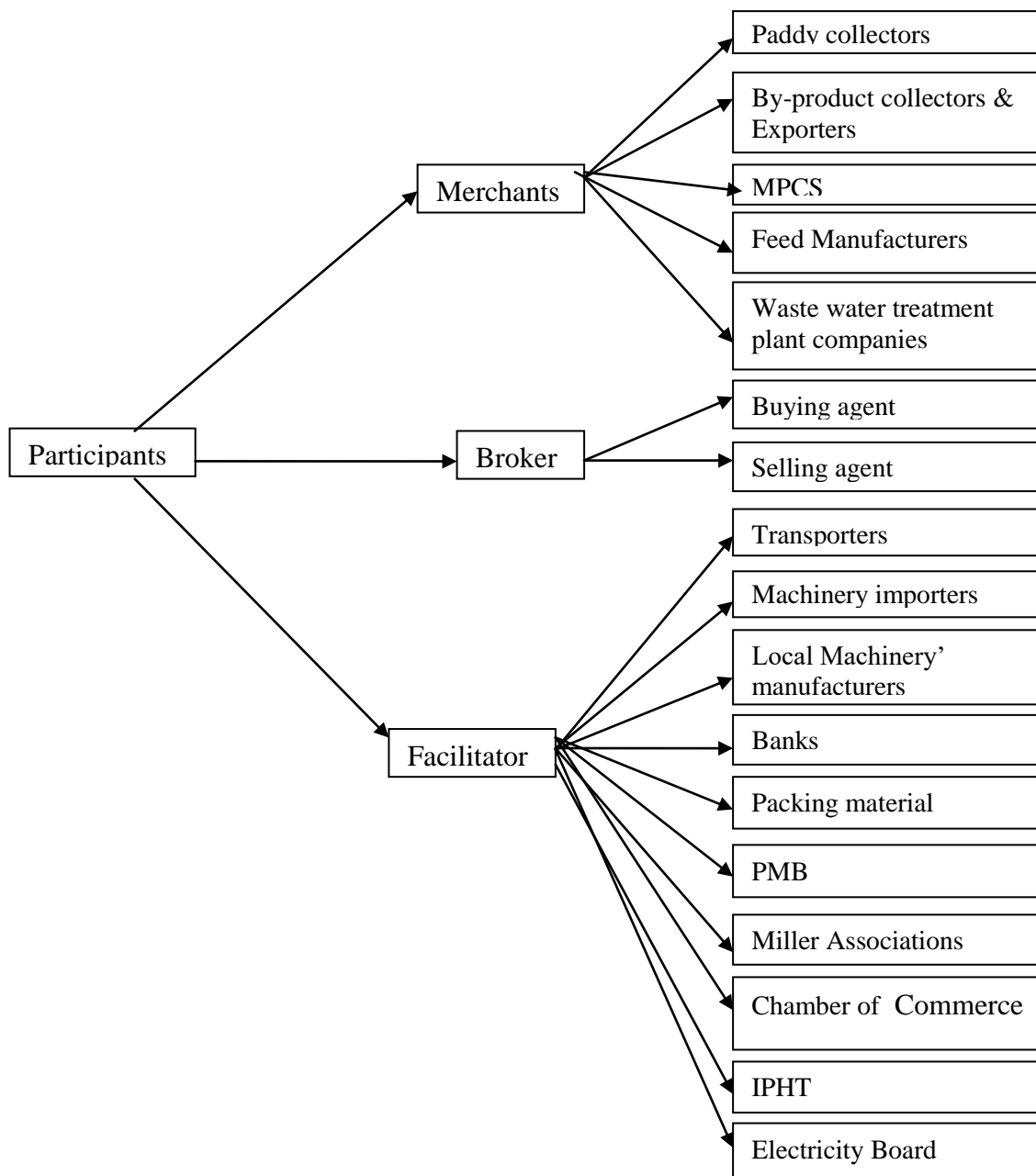
4.2.1 Paddy Collectors (Assembly Traders)

Collector who are sometimes known as ⁴assemblers operate at village level. He is the first link between the farmer and other middleman. Millers' information reveals that normally there are about three collectors in a village and each has a collecting center to which he collects several smaller lots of the village paddy production spending his money and combines them into a single load. In Hambantota no collectors are found at village level and each miller has a permanent farmer base to obtain paddy.

⁴ Village level Paddy Collection Centers

The collector sells his paddy stocks directly to the millers in nearby areas and the outside millers through brokers. Hence, he fulfills an exchanging function. A collector has a farmer base in the village and nearby villages. The collector's role is predominant in areas where the mills are less concentrated. The collectors carry on their business keeping about Rs 100 profit per 64 kg sack of paddy. However, in Hambantota, which is the major raw red rice processing area, the role of collectors is minimum. The common practice in Hambantota is either millers purchasing paddy from farmers at the farm gate or farmers bringing their paddy to the mill.

Figure 4.1: Different Participants involved in Rice Milling Industry in Study Areas



Source: Compiled by Author, 2011

4.2.2 Millers

In the paddy rice marketing channel, the millers fulfill the processing function which is one of the most important stages. They change the form of the product: paddy in to brown/polished rice. The quality of rice in the market mostly depends on the quality of rice processing. Out of the 200 commercial mills in the Polonnaruwa district, nearly 160 mills are functioning at present. The information reveals that there are nearly 108 mills in Hambantota, which mainly produce raw rice especially raw red variety. The majority of the large scale millers who mainly produce parboiled rice operate in Polonnaruwa. When the distribution of mills in Polonnaruwa is concerned, more than 75% is concentrated in Tamankaduwa and Hingurakgoda divisional secretariat areas. Despite being the major regional paddy producing district, areas like Elahera, Dimbulagala, Manampitiya, Medirigiriya and Welikanda have only a few mills. All the major scale and most of the medium, scale mills are concentrated in Tamankaduwa and Hingurakgoda divisional secretariat divisions.

The majority of the commercial mills in the Hambantota district are concentrated in Tissamaharama and Ambalantota areas. Aggregate number of mills approximately equal to 115 consisting 55 and 48 in Tissamaharama and Ambalantota areas respectively. The rest is operated in the Sooriyawewa area. Almost all the mills process only raw rice. Mills in Hambantota can mainly be categorized as small and medium scale depending on the scale of operation. The large scale mills that exist specially in Polonnaruwa do not exist in Hambantota. Only one large scale mill which produces both parboiled and raw rice is found in Tissamaharama.

4.2.3 Brokers in the Paddy Buying System

These agents work for a commission on behalf of other participants. They operate between the paddy collector and the miller. They do not invest in paddy trade and do not take any price risks. They generally have a longstanding relationship with millers and make purchases for them. Brokers bring buyers and sellers together and assist in negotiations on a more ad hoc basis. Typically they work for a flat rate around Rs.1000/= per lorry load paid by the miller (Buyer). It is equal to Rs 10 per 64 kgs paddy bag. This broker charge is added to the milling cost.

The most popular way of purchasing paddy in the Polonnaruwa district is through Brokers. This has been mentioned under purchasing behavior of paddy. A major problem the millers face is low quality paddy reaching the market. The millers are unable to purchase paddy for their daily requirement from their surrounding areas especially during the off season. Therefore, they tend to buy paddy from outside areas especially from the producing areas in the Eastern province. This is when the brokers interfere with the purchasing, giving assurance of the quality of paddy to the miller. Another important facility given by the brokers is that they arrange a ten-day credit facility to the miller. The millers get the service of a broker as they can purchase quality

paddy at the door step of their mill while saving time. Therefore, many of the medium and large scale millers get the service of a broker. Though the services of the brokers are not very prominent in Hambantota, some of the millers in that district also emphasized the need of service of a broker, especially during the off season. However, in Hambantota brokers are found as selling agents.

According to the survey, there are 25 brokers in Kaduruwela, 15 in Minneriya and 3 each in other regional areas like Medirigiriya, Elahera, Dimbulagala and Manampitiya. The brokers operating in Kaduruwela mostly deal with the supplies coming through outside collectors in the Eastern province, especially from the Ampara district. Some brokers in Minneriya deal with the Millers from Maradagahamula, and Kurunegala areas.

The brokers normally enter the channel when collectors try to sell paddy to millers. Some collectors have direct contact with millers. Then they have the ability to sell directly but others have to seek the help of brokers.

4.2.4 By-Product Collectors

There is a group of traders who organize purchasing of rice bran and broken rice from mills. There are nearly 25 such traders operating in the Polonnaruwa district. All these rice bran are transported to Colombo from where they are exported to India. In India, the parboiled rice bran is used to manufacture rice oil. There are five main exporters, the majority of them are of Indian origin. A tax of Rs1/Kg is imposed when exporting the rice bran. Therefore, this is a potential area that can be used to promote investment in the country itself.

The rice bran is produced mainly from raw rice in Hambantota which is used for manufacturing animal feed. Therefore, the major feed manufacturing companies and the domestic feed manufacturers in Kuliypitiya area purchase them through collectors. During the study period the price of rice bran in Polonnaruwa was Rs 12/Kg and in Hambantota it was Rs 24/Kg. It is observed that the price of red rice bran was higher than parboiled rice bran due to its superiority in term of nutrition.

4.2.5 Facilitators

Traders not only use brokers but also facilitating intermediaries. Kotler (1997) refers to three types of facilitators: first, physical distribution firms, including warehousing firms and transportation firms; second, marketing service companies, including marketing research firms, advertising agencies, media firms, and marketing consultancy firms and third, other firms that help finance and/or insure risks associated with the buying and selling of goods.

With regard to the rice milling industry in Sri Lanka, the government and private banks, Paddy Marketing Board, Machinery importers, Local Machinery

manufacturers, Electricity Board, IPHT and transportation firms are considered as important facilitators. Other government institutions or private agencies, involved in the marketing chain are: porters, bag-sewers, money-changers, agents for market regulation like quality control, tax agents and market authority. In sum, the above classification of marketing agents is useful for this study. They will be applied for analyzing all types of actors/agents that perform different marketing functions in the rice marketing channels in Sri Lanka in more detail.

4.2.6 Paddy Marketing Board (PMB)

Government intervention in Paddy/Rice marketing system in order to stabilize the market is common in most of the rice producing countries in Asia. The type of intervention varies in the form of support prices for farmers and issue prices for the distribution of food grains to consumers. The implementation of policy requires purchases or procurement from farmers at pre-announced prices, stocking these food grains and distributing them either directly or through traders to the consumers. BULOG in Indonesia was a famous government institution intervening in paddy/rice marketing. Due to the successful intervention of BULOG, the average inter seasonal retail price increases in Java in Indonesia were only 11% of the lowest monthly figure (Ellis *et al*, 1992). Food Cooperation in India (FCI), National Agricultural Cooperative Marketing Federation (NAFED), Nepal Food Corporation, Malaysian Federal Agricultural Marketing Authority, and Philippines National Food Authority are some of them. In Myanmar, a government organization named Myanmar Agricultural Produce Trading (MAPT) implements government policies relating to agricultural marketing, Agricultural and Fisheries Marketing Corporation in the Republic of Korea, the Pakistan Agricultural Storage and Services Corporation (PASSCO) in Pakistan and the Public Warehouse Organization (PWO) in Thailand are examples of other formal government sponsored organizations working in the field of agricultural marketing. One important feature of Thailand's agricultural marketing system is that the private traders are provided adequate credit by the Central Bank.

Government may keep different types of storage reserve, depending on they wish to intervene in the paddy/rice market. As a government institution, the Paddy Marketing Board (PMB) in Sri Lanka is involved in storage for the purpose of stabilising prices and revenues to farmers and protecting consumers during the off season. Related to this is Government's overriding concern for national food security, which is fundamental to political stability. Government, therefore, usesw storage to balance national supply and demand over time, and to minimise the risk of politically embarrassing shortages. They are thus attempting to supplement, and in some cases to replace, market mechanisms, on the assumption that the market can only achieve a balance with an unacceptable degree of supply and price fluctuation.

The Paddy Marketing Board in Sri Lanka which was established in 1971 lost its market power in paddy purchasing in 1977 due to the liberalization of the economy.

Then, gradually the private sector was involved in purchasing, processing and distributing of rice as the role of PMB decreased. However, the intervention of the government was done through the CWE and Cooperatives at harvest time only on an ad-hoc basis until 2005. The Paddy Marketing Authority was established in 2005 in order to fulfill the activities of PMB. However, the PMB was reestablished in 2010 to achieve the objectives of purchasing agro production and their supply and distribution, encouraging producer to increase quality of their produce and processing and distribution of agro-productions and maintaining security stock to ensure food security. Initiatives of the PMB have been helpful for consumers to obtain their food requirement at reasonable prices while the farmer community is given the opportunity to enhance their living conditions through government's guaranteed price scheme for paddy, introduced through the Paddy Marketing Board. The Annex 1 shows the guaranteed prices fixed by the PMB and the minimum purchasing price of paddy by the other establishments during various regimes.

The paddy production in the war affected areas like Batticaloa, Trincomalie, Ampara and Mannar increased significantly after 2009 when the war ended. The market equation of paddy started to change as a result of huge surplus reaching the market from those areas. The role of the PMB became quite prominent in order to stabilize the market even than before. The PMB continued purchasing paddy, increasing the amount gradually every season and reached the ever highest in 2011/12 *Maha* season.

Maintenance of good quality paddy during long term storage has become one of the major considerations in food security and safety planning and marketing in most rice producing countries. Failure to comply with good storage management practices can jeopardize food supply to the needy population. The lesson learned from the rice shortage in 2008 coupled with rising population, domestic prices and escalating cost of paddy production have made us wiser on how to handle this valuable commodity.

4.2.7 Institute of Post Harvest Technology (IPHT)

The major function of the Institute of Post Harvest Technology (IPHT), is the development of post harvest technology of rice, grains, and other agricultural commodities like fruits, vegetables and spices. The institute is engaged in research, training & extension, consultancy, advisory and other development activities in order to improve the post harvest technology. The Institute has taken over the functions of the Rice Processing Research & Development Center (RPRDC) of the Paddy Marketing Board, which was set up with FAO/UNDP assistance in 1976. In order to improve the rice quality in local rice mills IPHT implemented a project in 2001, called Modernization of Rice Mills, to increase rice output and improve rice quality to international standards. During this project, on the recommendation of the IPHT, the Treasury introduced a loan scheme with concessionary interest rates through the Bank of Ceylon to rice processors for modernization of their rice mills. According to the institute's information, a number of rice mills in major producing

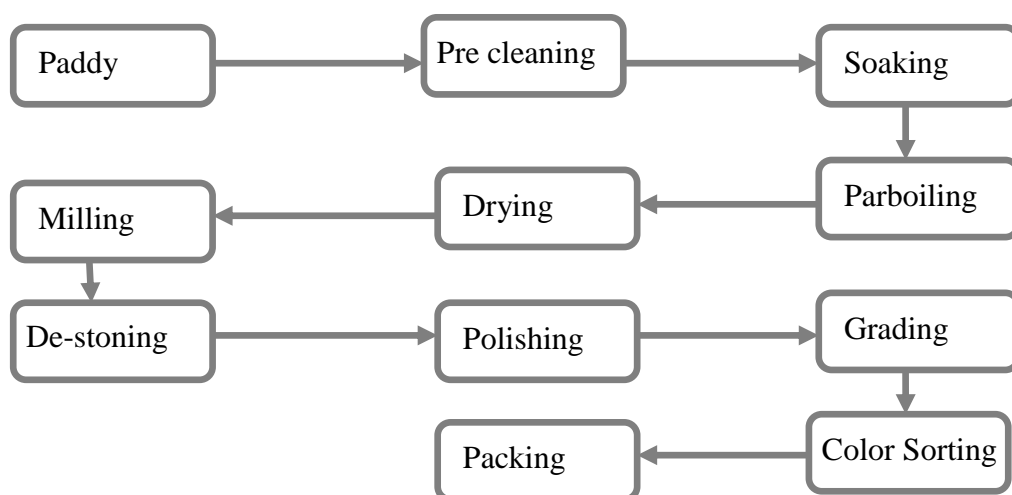
areas of Anuradhapura, Polonnaruwa, Hambantota, Ampara and Mahaweli system C undertook modernizing their rice mills under the direction and guidance of the IPHT. As a result of this exercise, a significant improvement in the quality of locally produced rice was achieved. Millers, brokers, PMB, wholesalers, retailers and cooperatives are the main intermediaries involved in paddy marketing in Hambantota district. The most vital role is played by the millers, because a large number of mills are located in the area. Collectors, who play a dominant role in other paddy surplus areas, are not seen in Hambantota and the first marketing channel is very distinct compared to other marketing channels.

4.2.8 Banks

The role of state and private banks is vital as facilitator in the rice milling industry. The banks fulfill the financial needs such as arranging pledge loans for paddy purchasing and credit facilities for obtaining modern machinery. Besides, the service of these banks is essential in transactions of selling rice. They also arrange cultivation loan facilities for farmers to produce paddy. Hence, the function of banks is a must in each step of paddy/rice value chain. The study has found that the state banks lead in Polonnaruwa while private banks dominate in Hambantota. The banks prefer to arrange ⁵pledge loan schemes as they are more profitable which help to obtain a considerable income within a short period. The state banks provide loans with an annual interest rate of 9% to be paid within 9 months while the private banks offer 12% interest rate within the same recovery period. The details of loans provided by the banks in the study areas will be discussed under the credit availability.

4.3 Steps in the Paddy to Rice Process

Figure 4.2: The Process of Paddy/Rice Processing in the Study Area of Polonnaruwa



⁵ Paddy pledging scheme for millers

4.3.1 Paddy Processing

The milling process in Polonnaruwa includes pre cleaning, soaking, parboiling, drying and other milling activities and the district mainly produces parboiled rice. Rice producing from short grain paddy is called ⁶*Samba* and the long grain paddy is called ⁷*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. All the activities carried out on paddy from time of harvest till the production of rice, come under paddy processing, viz., parboiling, drying and milling.

Paddy processing includes parboiling, drying and milling activities. Modernization of paddy processing activity will result in increased yield of rice, reduction in broken rice, improved quality of bran etc.

4.3.2 Cleaning and Soaking

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 these are not removed prior to hulling, the efficiency of the huller and the milling recovery are 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. Soaking is accomplished in hot or normal water for different durations depending on the type of the rice desired. Soaked paddy is gelatinized either by heating directly by placing the vessel over fire or by steaming.

4.3.3 Parboiling

Partial cooking of rice with husk intact is known as parboiling. Parboiling involves increasing the moisture content of the grain to 25- 30% 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 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 paddy is then dried in yards under sun or mechanical dryers using heated air. Parboiling processes can broadly be classified as household and commercial.

⁶ Name of short grain rice

⁷ Name of long grain rice

Because of variations in the two steps involved in parboiling, numerous methods exist in soaking (cold/warm/hot water); heating (open, pressure steaming, closed heating); as also in the sequence of soaking and heating. At rice mills, paddy is soaked for 6 to 48 hours depending on the time required for a particular type of rice. Afterwards water is drained off and then steamed by placing paddy in a rectangular steaming tank or in a separate vessel using steam. Depending on the need of consumers, the processing steps are changed now and then. Existence of non-standard equipment, devices and techniques results in wide variations in the quality of rice produced. Various methods of parboiling are used in major rice producing countries. Single (soaking in water, steaming and drying) and double boiling. Raw paddy is first loaded into the steaming tank and then steamed. Then it is unloaded into the soaking tank and soaked for nearly 24 hours. One of the other methods is low temperature parboiling. In Sri Lanka, most of the mills use single parboiling technique.

Parboiling has many advantages. Besides increasing the out turn of rice by 4-6%, 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.

The manner of soaking, steaming and drying determines the final quality of the parboiled rice, apart from besides the nature of paddy grains, type of milling and extent of milling.

4.3.4 Drying of Paddy

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 slowly and carefully so as to avoid development of cracks which lead to broken rice. By adopting low moisture parboiling process, drying cost can be reduced substantially. It is observed that in Polonnaruwa nearly 80% of millers have mechanical dryers. Only 20% of small scale millers use ⁸ the sun drying method.

Raw paddy contains more than 20% moisture. For safe storage the moisture level of raw paddy should be brought down to 14% -16%. The process of drying has to be very slow and at relatively low temperature. Parboiled paddy, having been soaked in water, would contain a moisture level of 28% -40%. This paddy has to be dried to about 14%, which is the recommended level of moisture for best milling results. As the kernel is hard due to gelatinization, drying could be carried out quicker and at higher temperatures.

⁸ Drying paddy in large concrete floors using sunlight

4.3.5 Methods Adopted

Sun Drying: Sun drying is yard drying in which paddy is dried in the form of a thin layer, spread on the ground using the heat of sun and the wind. Efforts are made to expose the paddy to sunlight uniformly through spreading, combing, turning over etc., by employing unskilled labour. The wind blowing over carries away the moisture. Drying is effected by use of natural sunlight. Therefore, no energy cost is incurred.

Mechanical Drying: Mechanical drying makes use of hot air coming to contact 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, loss of grains reduced and less handling. Disadvantages are high cost of investment, requires means of fuel and electric power, higher operational and maintenance cost and need of experienced operators.

4.3.6 Milling

Milling is a process in which paddy husk is removed and the brown rice is polished for removing rice bran to obtain white rice. 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.

Rice bran is an important non-conventional source of oil. Solvent extraction of rice bran yields rice bran oil as well as de-oiled bran. In India, rice bran oil is used as a cooking medium and as a base stock for manufacturing Vanaspathi and soap, depending upon the grade (edible/industrial). De-oiled bran (DOB) is used as cattle feed and poultry feed. While production of rice bran oil helps to reduce the imports of oil, the de-oiled bran has a ready export market. Husk is an important by-product of rice milling. It is used as a fuel (Calorific value 3000 Kcal/Kg) in brick making, particleboard manufacturing etc. Other derivatives of husk such as high carbon ash and low carbon ash also have commercial potential.

4.3.7 Polishing

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 this 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.

4.3.8 Grading

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 is similar to sieving the 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.

4.3.9 Color Sorting

This is an important automated process for sorting only the white rice. Black rice is separated by the help of color sorting cameras attached in the rice flow channels. Finally, the sorted rice is weighed and packed.

4.4 Key Personal Profile of Rice Millers

Table 4.1: Distribution of the Age of Millers by District

Age Category	Polonnaruwa		Hambantota		Total	
	No.	%	No.	%	No.	%
Less than 30	10	8	2	6	12	8
30 – 40	24	20	4	13	28	19
40 – 50	38	32	15	48	53	35
50 – 60	38	32	9	29	47	31
60 – 70	10	8	-	-	10	7
Greater than 70	-	0	1	3	1	1
Total sample	120	100	31	100	151	100

Source: Authors’ survey data, 2011

Results in Table 4.2 reveal that more than 70% of millers in both districts are over 40 years. Accordingly, it can be hypothesized that young persons are unable to become mill owners as this industry is based on practical experience. It was observed in the study that the majority of the millers have experience in milling and have become owners later.

4.5 Industry Experience

Experience in rice milling is an integral part of the industry as rice processing involves a complex process, from raw material to the final product. Purchasing of paddy, quality related matters, processing techniques, finding output markets, and facing the competition are some of the areas in which experience is necessary.

Table 4.2: Percentage Distribution of Experience of Millers by Quantity of Paddy Milling per Day in Both Districts

Experience Yrs	Quantity of Paddy Milling per day(Mt)					
	(%Polonnaruwa(N=120))			(%Hambantota(N=31))		
	<8	8-20	>20	<8	8-20	>20
<5	42	7	4	25	0	0
5-10	18	5	4	42	7	0
10-15	9	22	26	8	13	25
15-20	15	24	30	8	33	25
>20	16	41	35	17	47	50

Source: Authors' survey data, 2011

Almost all the millers in Polonnaruwa have started the industry either in 1980s or in the beginning of 1990s. The mills which produced rice of popular brand names have been started either in 1970s or 1980s on a small scale and they have developed gradually up to their present level.

Over 65% of medium and large scale millers in both districts have more than fifteen years of experience in the industry (Table 4.3). It indicates that those large and medium scale millers have considerable experience in the industry. It was observed during the study that most of those millers had begun from small scale processing. Results in Table 4.3 also reveal that more than 50 percent of the small scale millers (less than 8 Mt/Day) in both districts have less experience in the industry. In Hambantota, the majority of the mills belong to the medium scale and milling process is homogeneous. It is observed that out of the mills started in Polonnaruwa during the last decade, 80 percent has been centralized in Kaduruwela and Minneriya areas.

4.6 Milled Rice Production in the Study Areas

All mills studied in the Polonnaruwa district produce parboiled rice and all the studied mills in Hambantota produce raw rice, especially raw red rice. The production of rice in the two districts varies according to the types of processing, varieties of rice produced and quality of the varieties. The small and medium scale millers in Polonnaruwa mostly produce the lowest grades of samba and nadu in

addition to “*bada bath*⁹” variety. All those varieties are unpolished. According to the millers *bada bath* rice has a taste between parboiled and raw rice. The major scale millers in Polonnaruwa mainly produce color sorted, polished samba and nadu varieties and *keeri samba*¹⁰. In addition to that, all the millers in Polonnaruwa produce raw white and *bada bath*. The details of the major rice types produced by different types of mills shown in Table 4.4.

Table 4.3: Major Rice Types Produced by Different Types of Mills

Scale	Major Rice Types	
	Polonnaruwa	Hambantota
Small	Normal parboiled samba and nadu, <i>badabath</i>	Normal raw red rice
Medium	Polished rice (samba and nadu)	Single and double polished raw red rice
Large	Color sorted samba and nadu, Keeri samba	Single and double polished raw red rice

Source: Authors’ survey , 2011

Except *badabath* rice all rice, varieties were subjected to polishing. Hence, a wide variety of rice is produced in large and medium scale rice mills in Polonnaruwa. This situation was not observed in Hambantota where the millers mainly produce two types of raw red rice; raw red single polished and raw red double polished. Most of the medium and large scale millers produce only these two rice varieties. The processing technology in all the rice mills is similar and there are no differences in machineries as in Polonnaruwa. Therefore, in Polonnaruwa quality and grades of the rice produced in mills of various categories differ whereas in Hambantota there is uniformity in the quality and grading of rice produced in the mills of different scales.

Table 4.4: Distribution of Mills by Quantity of Paddy Milling per Day (Mt.)

Mill Size (Mt/Day)	Polonnaruwa N=120	Hambantota N=31	Total N=151
Less than 8	56 (47)	12 (39)	68 (45)
8 -20	41 (34)	15 (48)	56 (37)
Greater than 20	23 (19)	04 (13)	27 (18)
Total	120	31	151

Percentages given in parenthesis

Source: Authors’ survey data, 2011

According to the results in Table 4.4, quantity of paddy milling per day, 47 % is less than 8Mt/Day while 34 % is 8-20 Mt/day and the rest (19%) is greater than 20 Mt/day

⁹ *Bada bath* is produced soaking paddy half the time of the normal parboiled procedure .

¹⁰ A special samba variety produced from BG 360 paddy variety.

(table 4.5). It was observed that, more than 50% of rice mills in Polonnaruwa were concentrated in Tamankaduwa DS division which is the major urban area in the district. Majority of the mills in the Hambantota district are located in Tissamaharama and Ambalantota DS divisions.

The method of classification of rice mills in Sri Lanka is largely conventional. Accordingly, the mills with a milling quantity of paddy more than 8Mt per day are classified as large scale mills. The rice mill survey done in 2006 (Hathurusinghe, 2006) classified mills that produce more than 8 Mt of paddy milling per day as major scale mills. This study revealed that out of 157 mills, only 14% had the milling capacity of more than 8 mt /Day and in Hambantota out of 48 mills, 15% were in this category. According to this study, few mills had expensive modern machineries such as color sorters and dryers. According to the Institute of Post Harvest Technology (former Rice Processing research and development centre), at the beginning of the last the decade, modern expensive machineries like color sorters, dryers and water jet polishers were not popular in the rice milling industry.

However, it is observed that the situation has changed during the last decade. Our study revealed that 23% of the millers had color sorters in Polonnaruwa and 10% in Hambantota, 79% millers had mechanical dryers in Polonnaruwa with different capacities. Miller’s information reveals that at the beginning of the last decade, only a few large scale mills operated in Polonnaruwa which milled over 20Mt/Day. Our study found that in Polonnaruwa, out of 120 mills 19% belongs to the category of per day paddy milling quantity over 20Mt/day. It implies that rapid development of the rice milling industry has occurred during the last decade. Therefore, a new method of classification is needed. When the literature in major rice producing countries like India, Vietnam, Myanmar and Thailand is taken in to consideration it is clear that the mills which have either an hourly processing capacity of more than 3Mt paddy or a daily processing capacity of over 20 Mt are classified as large scale mills. It is also revealed that the mills with an hourly processing capacity of less than 1Mt and daily capacity of less than 8Mt belong to the category of small scale mills.

The following table shows unit of analysis of per day milling quantity of paddy found in the study (table 4.6).

Table 4.5: Classification of Rice Mills

Per Day Milling Quantity of Paddy(Mt)	Scale
Less than 8	Small
8 -20	Medium
More than 20	Large

Source: Authors’ survey data, 2011

4.7 Barriers of Entry into the Rice Milling Industry

The barriers of entry into the industry reflect competitive relationships between existing millers and potential entrants. 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 firms are protected from potential rivals. Prior to the survey, information of barriers of entry on milling industry was obtained from millers with the use of some open ended questions. Then, a questionnaire was prepared according to the received information from the millers.

Table 4.6: Barriers of Entry into the Rice Milling Industry (% of responses)

Type of Barrier	Polonnaruwa	Hambantota	Total
	N= 120	N=31	N=151
Shortage of investment capital	73	81	74
No understanding of milling industry	65	65	65
No understanding of rice milling technology	53	39	50
Unstable output market	43	48	44
Severe competition	33	23	30
Lack of credit facilities	27	6	23
High taxes	15	13	15
Difficulty in selling rice at a rate covering the milling cost	14	10	13
Other	4	10	5

Source: Authors' survey data, 2011

Table 4.7 reveals that the lack of investment capital is a major constraint for millers. According to the information of millers, at least twenty five million rupees is required to commence a medium scale mill. The millers emphasized that, experience about the sector and the technical know-how in the milling industry is vital factors aspects to enter the industry. When taken together, these two factors are more important than the other factors. This is reflected by the observation that most of the large major scale millers with over twenty five years experience have started at small scale level.

4.8 Degree of Miller Concentration

The most important issue is whether some millers are able to dominate the industry. In order to have a clear view on this, it is useful to compute the 'four firm "Concentration Ratio (CR4). Concentration ratio (CR) is the cumulative share of the largest firms in the industry. The CR4 is the sum of market shares of the four largest firms in the industry to the total market share.

Table 4.7: Four-Firm Concentration Ratio (CR4) of Rice Millers in the Sample

Level	Cumulative Percentage	
	Polonnaruwa	Hambantota
(N)	(120)	(31)
Largest 4	37	25
Largest 8	45	44
Largest 12	50	61
Estimate to the Population	30	08

Source: Authors' survey data, 2011

The degree of miller concentration refers to the number of millers in the industry. This CR can be interpreted as an indicator of the degree of competitiveness among rice millers in the Polonnaruwa and Hambantota districts.

The value of CR4 indicate 37% (table 4.8) which means the slightly concentrated milling industry in Polonnaruwa. In Hambantota CR4 value of 25% reflects a highly competitive market structure. Estimation for the CR4 for the whole population has declined up to 30% in Polonnaruwa and 8% in Hambantota. The calculated value of the Herfindalh- Hirshman Index (HHI) was equal to 0.04 in Polonnaruwa and is 0.01 in Hambantota (Table 4.9) which means that the industry is unconcentrated in Polonnaruwa and is highly competitive in Hambantota.

Table 4.8: The Values of Concentration Indices on Milled Rice Production

Measure	Polonnaruwa	Hambantota
CR4	30	08
HHI	.04	.01
Gini-Coofpcient	.58	.28

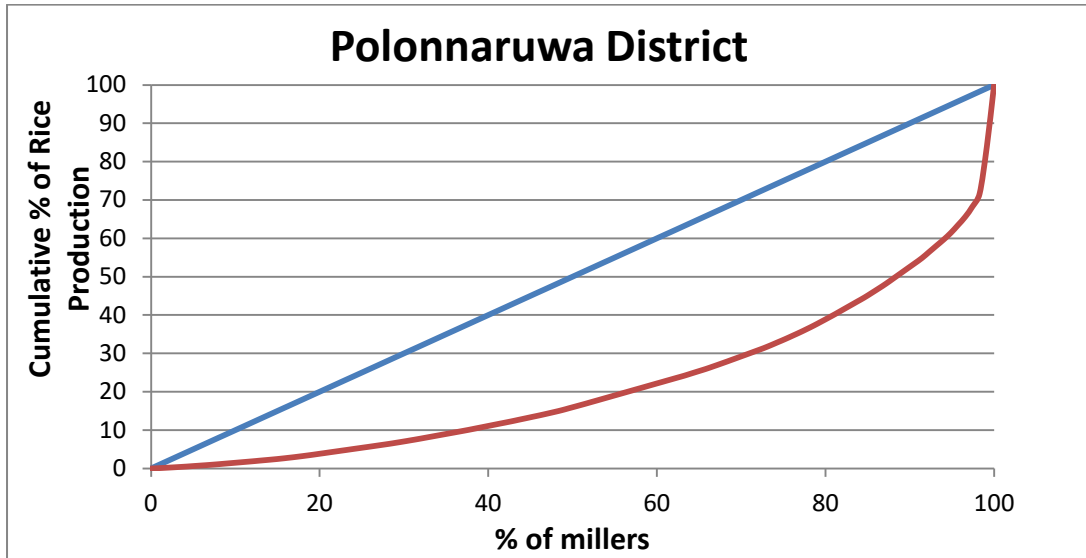
Source: Authors' survey data, 2011

As discussed in Chapter 2 the Lorenz curve and the GINI ratio were used to measure the degree of miller concentration. In order to calculate the GINI ratio, the volume of actual per day milled rice production by millers is ranked from highest to lowest, while their respective market shares are calculated by obtaining the percentage of the total per day production handled by each miller. The Gini co-efficient for the 120 millers in Polonnaruwa and 31 millers in Hambantota for per day of rice production was 0.58 and 0.28. This indicates moderate degree of inequality in terms of quantity of rice produced by millers in Polonnaruwa. However it indicates that in general rice milling industry in Polonnaruwa operates in a slightly concentrated situation which means a weak oligopsony behavior. The industry in Hambantota can be considered highly competitive.

Large scale millers exercise their market power mainly during the off season in numerous ways. During the season, they store a large volume of paddy bought at

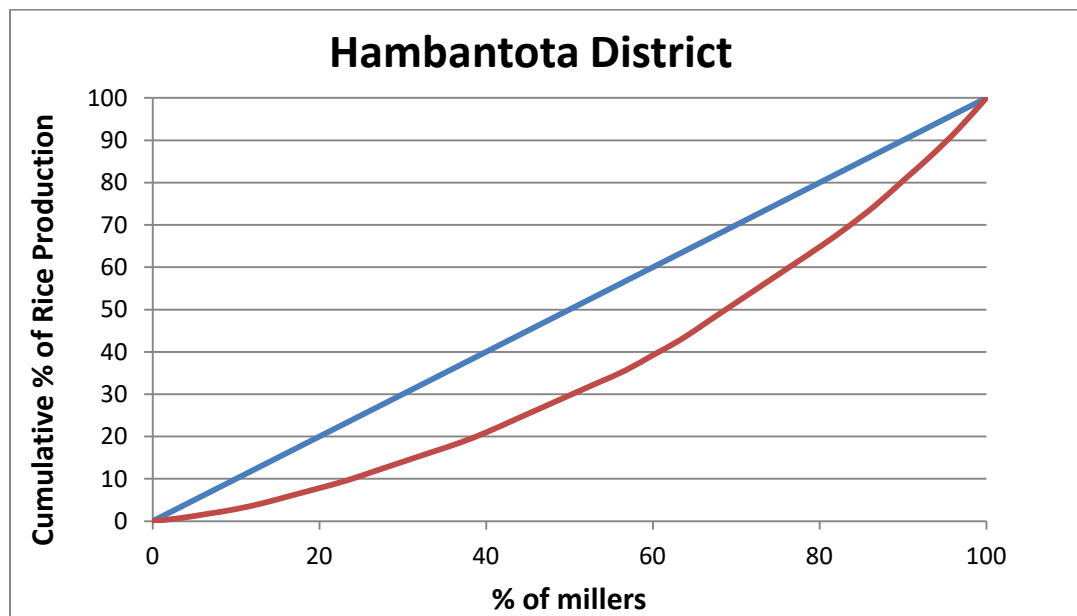
the lowest rates and during the off season, release rice to the markets. A large quantity of paddy storage ability during the harvesting season enabled through high pledge loans and granting credit period to their buyers when releasing rice to the market scale of operation, their established brand loyalty, provide impetus to major rice millers to exercise market power.

Figure 4.3: Lorenz’s Curve of per Day Rice Production of Millers in Polonnaruwa



Source: Authors’ survey data, 2011

Figure 4.4: Lorenz’s Curve of per Day Rice Production of Millers in Hambantota



Source: Authors’ survey data, 2011

Table 4.9: Availability of Modern Machinery and Equipment of the Millers

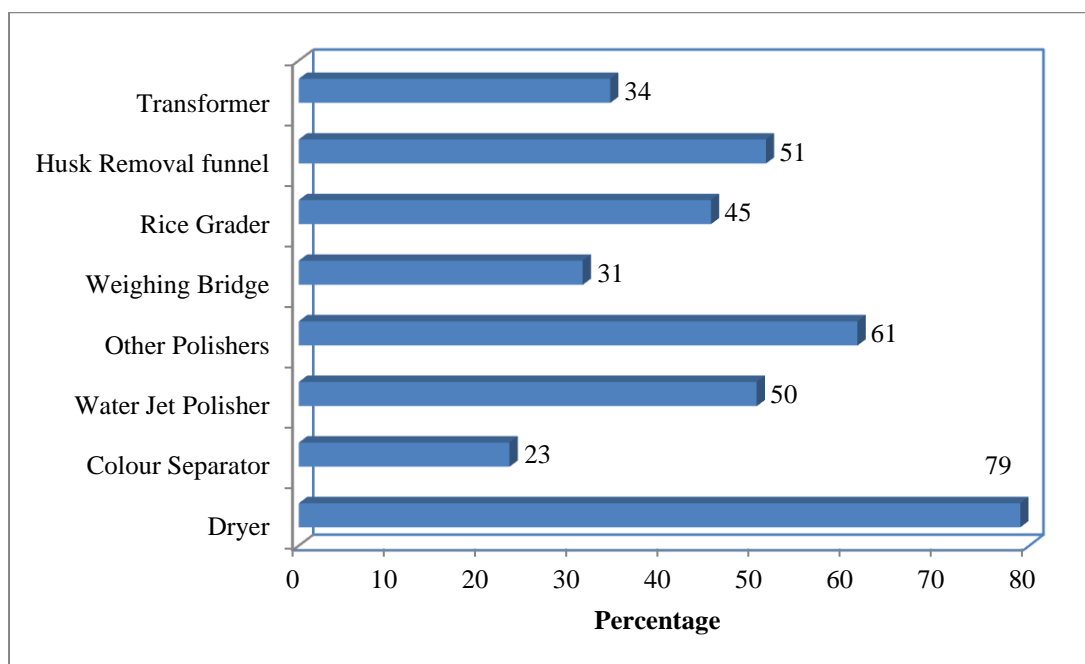
Machinery/Equipment	Polonnaruwa(N=120)		Hambantota(N=31)	
	No.	%	No.	%
Dryer	95	79	1	3
Color Separator	27	23	3	10
Water Jet Polisher (Glass Polisher)	60	50	13	42
Other Polishers	72	60	20	65
Weighing Bridge	37	31	6	19
Rice Grader	54	45	19	61
Husk Removal funnel	61	51	11	35
Transformer	41	34	2	6

Source: Authors' survey data, 2011

There has been a rapid development in the use of modern machinery in the rice milling industry in the last decade. Using new technology is vital for improving the quality of rice to reach the international standards. The millers who use high electricity consuming machinery like color sorters, polishers and graders need separate transformers and in interrupted electricity supply. Therefore, a miller who owns a transformer always belongs to the major or medium scale. The study reveals that 34% and 6% of millers in Polonnaruwa and Hambantota own transformers. In addition, the milling process of most of the large scale and some medium scale mills is automated through elevators. It was observed that, in the Polonnaruwa district, 19 % of millers belong to the large scale category. All those millers are equipped with modern improved machinery in rice processing. Meanwhile, some of the medium scale millers also make use of those machinery to a certain extent.

The availability of low cost Chinese milling equipment has reduced the start-up costs of many millers, although this equipment is reported to have a far shorter lifetime than higher-end. It was found that in certain large scale mills more costly milling equipment was imported from Japan (Sataki) and Switzerland (Buhler). Overall investment for machinery in commercial rice mills alone, capable of processing at least 16 Mt/day of paddy, was at least Rs 25 Million. Commercial mills' profitability, taking investment costs into account, is largely a function of capacity utilization. In many cases, larger mills benefit from better liquidity and access to bank loans, so they can afford to keep their mills functioning at higher rates of capacity utilization.

Figure 4.5: Availability of Modern Machinery in the Mills (%) in Polonnaruwa (N = 120)



Source: Authors' survey data, 2011

4.8.1 Dryers

About 79% of the millers (figure 4.4) in Polonnaruwa have mechanical dryers. Some large scale millers have more than one dryer according to their daily rice production. The dryers are used for drying the parboiled paddy. Previously the millers used sun drying of parboiled paddy on concrete floors. This method results in a higher amount of broken rice due to uneven drying. Using mechanical dryers is a very effective alternative to overcome this. The most favorable effect of this is the ability to dry the parboiled paddy in rainy seasons. Dryers have different capacities such as 8000kgs, 12000 kg, 16000 kg, 23000 kg and 33000 kg. These dryers were previously manufactured by dryer builders in India. However, now it is carried out by some local manufactures. In India and other rice producing countries, research and development constantly take place to uplift the efficiency of these dryers. Advantages are drying is independent of climate and time of day/night, faster rate of drying, requires less area and less manpower, better control and less handling. However, the high cost of investment and the requirement of experienced operators are some disadvantages. A study conducted in 2006 (Hathurusinge C.P) found that out of 157 mills in Polonnaruwa only 10% have dryers.

4.8.2 Water Jet Polisher

This machine which is also called ¹¹mist polisher utilizes the highest amount of electric power during the rice processing. This polishing process improves the storage life of rice due to complete removal of rice bran. In water jet polishers, a controlled amount of water mist is injected, resulting in highly polished glossy grain. It was observed that 50% and 42% of millers in Polonnaruwa and Hambantota respectively, possess these polishers. Majority of the users of these polishers are either large scale or medium scale millers who produce polished rice. The study has found that 4 polishing mills operate on hired basis in Kaduruwela area in Polonnaruwa. These mills fulfill the polishing function of the small scale millers who do not own these types of polishers. In addition to polishing, these mills also do color sorting on hired basis. These millers charge Rs1.50/Kg for polishing. Literature shows that these types of millers who fulfill only polishing are found in the rice milling industry in Vietnam too.

4.8.3 Rice Color Sorting Machines

This expensive machine is used in the last stage of processing before packing of processed rice. The study has found that 23 % of millers in Polonnaruwa have color sorters and most of them are large scale and medium scale millers. Color sorting machine removes discolored and black tipped grains through a scanning process and camera instructs to create compressed air stream for separated discolored grains. Finally, it produces rice with uniform color. The use of these machines, which was rare at the beginning of the last decade is spreading not only among large scale millers but also among the millers of medium scale due to the rapid improvement of the rice milling industry. These China made machines are available at the market from Rs 5 million upwards whereas the Japanese ones are more expensive. In Hambantota, the study has revealed that only 10 % of millers use color sorters.

4.8.4 Weighing Bridges

Weighing bridges are used to measure the weight of rice or paddy including that of the loading vehicle. With the introduction of these machines, the millers have received several advantages such as saving labor, accuracy of the measurement, and saving time. These bridges are available in three types: 20t, 30t and 40 tones. The paddy suppliers prefer mills with these weighing bridges due to convenience. The study found that 31% and 19% of millers in Polonnaruwa and Hambantota respectively, possess weighing bridges. The service of a bridge can be obtained on hire basis too. However, a miller with a weighing bridge has to spend nearly Rs 70,000 for licensing, and maintaining the machine. Three companies are involved in providing these bridges in the study areas.

¹¹ Used for producing highly polished rice

CHAPTER FIVE

The Conduct of Rice Millers in the Market

5.1 Introduction

In this chapter, the conduct of rice millers is analyzed. In general, conduct refers to a set of competitive practices that millers use. In order to analyze the market conduct of the rice millers, we focus on various aspects of trading such as buying, selling, marketing channels, transport, storage, labor usage and credit strategies. We also discuss the factors affecting paddy buying price, determination of rice selling price, and millers' response to the rice price ceiling.

Table 5.1: Main Method of Paddy Purchasing by Quantity (Per day Milling Quantity) of Millers in the Polonnaruwa District

Method	Quantity of Paddy Milling per Day			
	<8Mt	8-20Mt	>20Mt	Total
Purchase paddy through brokers	11	14	12	37(31)
Purchase paddy from farmers within the district	12	09	04	25(21)
Purchase paddy from farmers outside the district	02	01	01	04(03)
From farmers at the mill (farmers bring to the mill)	17	11	03	31(26)
From collectors	05	01	01	07(06)
From collectors at the mill(collectors bring to the mill)	09	06	01	16(13)
Total	56	42	22	120

Source: Authors' survey data, 2011
(% given in parenthesis)

Table 5.2: Main Source of Paddy Purchasing by Millers in the Polonnaruwa and Hambantota Districts (%)

Source	Polonnaruwa (N=120)	Hambantota (N=31)
Purchase paddy through brokers	31	03
Purchase paddy from farmers within the district	21	65
Purchase paddy from farmers outside the district	03	06
From farmers at the mill (farmers bring to the mill)	26	26
From collectors	06	-
From collectors at the mill(collectors bring to the mill)	13	-
Grand Total	100	100

Source: Authors' survey data, 2011

Tables 5.2 shows that the main paddy purchasing method of millers in Polonnaruwa is through brokers. In Hambantota, the major channel is millers purchasing from paddy farmers. Millers in both districts 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 brokers. However, most of the millers in Hambantota have their own farmer base and they purchase paddy at the farmer's door step. Even in Polonnaruwa, the main mode of purchasing paddy of small and some medium scale millers in distant regions in the district is farmers taking paddy to the mill.

Figure 5.1: Identified Major Paddy Marketing Channels in Polonnaruwa

1. Farmer → Collector → broker → Urban Millers
2. Farmer → Miller at Regional level
3. Farmer → Village level collector → Regional or Urban level Millers

Figure 5.2: Identified Major Paddy Marketing Channels in Hambantota

1. Farmer (Miller purchasing at the farm gate) → Miller at Regional level
2. Farmer → (Farmer brings to the mill) Miller at Regional level

Table 5.3: Factors Influencing Paddy Buying Price According to the Millers in Polonnaruwa

Parameter	Number of responses in different levels (n=120)				
	Not Important	Less Important	Important	Very Important	Average grading ¹
Differences in quality (Impurities)	16	09	36	59	2.15
Differences in moisture content	12	03	35	70	2.35
Buying in large or small volume	88	16	16	-	0.40
Distance of transport	80	28	10	02	0.45
Paddy supplying area	31	18	50	21	1.50
Regular Client	56	20	32	12	1.00

Source: Authors' survey data, 2011

Note 1 Average grading was calculated based on a number of responses at different levels and by using weighted average method

Grading for different levels

Not important grade 0

Less Important grade 1

Important grade 2

Very Important grade 3

Example: Differences in quality in table 5.3 : $\frac{(16 \times 0) + (9 \times 1) + (36 \times 2) + (59 \times 3)}{(16 + 09 + 36 + 59)}$

Table 5.3 presents some transaction specific characteristics that influence the buying price of paddy by millers. The difference in moisture content of paddy is the main factor that influences the buying price (Average grading is 2.35). The result also shows the difference in quality. That means the percentage of impurities is the important factor in determining the buying price. Another major factor in deciding the buying price is the area from which paddy is received. In sum, the quality of paddy is the main characteristic that most millers take into account when they purchase and price is negotiated. The low average grading reflects that the volume and the distance in transport are not decisive factors in paddy purchasing.

Table 5.4: Need of Brokers in Purchasing Paddy

Mill Size by paddy milled per day(Mt)	Polonnaruwa (N=120) Yes ((%)
<8	52
8-20	62
>20	73
Total	59

Source: Authors' survey data, 2011

The most popular way of purchasing paddy by millers in the Polonnaruwa district is through Brokers. This has been mentioned under the role of brokers in the paddy buying system. A major problem the millers face is low quality paddy reaching the market. The millers are unable to purchase paddy for their daily requirement from their surrounding areas especially in the off season. Therefore, they tend to buy paddy from outside areas especially from producing areas in the Eastern province. This is when the brokers intervene in purchasing paddy. Another important facility given by brokers is that they arrange a ten-day credit facility to the miller. The millers get the service of a broker as they can purchase quality paddy at the door step of their mill while saving time. Therefore, many of the medium and large scale millers get the service of a broker. Though the service of the broker is not very prominent in Hambantota, some of the millers in that district also emphasized the need of the service of a broker especially in the off season. However, the small scale millers in Polonnaruwa located in major producing areas like Medirigiriya, Hingurakgoda, Dimbulagala and Elahera have their own farmer base for purchasing paddy. The mills are not concentrated in those areas as in Kaduruwela, Lankapura and Minneriya. Therefore, these millers do not need the support of brokers.

Table 5.5: Constraints Faced by Millers in Paddy Purchasing

Constraint	% of Responses	
	Polonnaruwa(N=120)	Hambantota(N=31)
Receiving low quality paddy	68	80
Major millers purchase at higher Prices	24	06
Lack of Money	14	16
High fluctuation of paddy prices	08	10
Difficulty in obtaining Pledge Loans in time	04	-
Other	12	16

Source: Authors' survey data, 2011

5.2 Quality of Paddy

The study revealed that the major problem encountered by millers in both districts in paddy purchasing is receiving low quality paddy (table 5.5). The most prominent character which affects the quality is high moisture. Paddy with high degree of impurities is another characteristic of low quality. Impurities include mainly empty seeds and fragments of paddy stalk. The situation is more prominent during the harvesting season and it affects the quality of rice.

According to the millers, the harvest threshed by combine harvesters contains a higher degree of moisture and fragments of paddy stalk. The paddy threshed by semi combine harvesters (Tsunami) contains a lower degree of moisture when compared to the combine harvesters. The reason is the harvest is sun dried in the field for a certain time. This situation is more noticeable in the *Maha* season. Especially the harvest coming from the Eastern province during early March contains a higher percentage of moisture. This mainly takes place in long grain white (Nadu) paddy and the farm gate prices drop drastically during those periods, resulting in reduction of prices in the paddy market. In this situation, millers tend to purchase paddy with a deduction of Rs 1.00/Kg for each degree above 14% percentage of moisture. Especially in the peak harvesting period during early March, there is a sharp decline in the prices of long grain white as a result of receiving a bumper harvest of paddy with a high degree of moisture from Ampara and Batticaloa districts.

Meanwhile, previous studies have shown that approximately 75% of paddy coming for milling is of poor quality, falling into the lowest category or below the Sri Lanka Standards for paddy with a high degree of moisture, foreign matter, immature and unfilled grains, damaged or discolored grains. Farmers often harvest their paddy crop at an incorrect stage of maturity and this leads to serious quantitative and qualitative losses (Palipane, 2000).

Somarathne (1987) has studied that receipt of low quality paddy was the major problem faced by the millers when purchasing paddy. Damayanthi and Bulankulama (2006) have pointed out that the main constraint faced by 92% of the millers was receiving low quality paddy. This situation implies that receiving low quality paddy to the market was an unsolved problem during the last three decades. The studies conducted during the last decade also have shown that nearly 10%-15% of paddy is lost during post production operations (Palipane, 2000). It is observed that this situation remains unchanged even at present. Therefore, there is an utter need for improving the quality of paddy through proper post harvest management programmes. In order to implement such programmes, motivating farmers is essential. In India a recommended minimum support price which is changed annually has been fixed by the government for common paddy and grade A paddy in order to get two different prices to motivate farmers to produce quality paddy over a long period. The Minimum Support Price recommended by the Commission for Agricultural Costs and Prices of India for normal and Grade A paddy in 2011/12¹² Kharif season were Rs/¹³Quintal 1080 and 1110 respectively. Grade A paddy is considered the lowest moisture percentage (14%) paddy. Furthermore, a higher price was fixed for the off season, which encouraged farmers to store paddy for a certain period and this also helped improve the quality of paddy. It is essential to implement awareness programmes at farm level for farmers as well as operators to produce quality paddy by using combine harvesters.

5.2.1 Paddy Quality According to the Producing Areas

According to the information obtained from millers about the areas which provide quality paddy, the stocks from areas like Medirigiriya, Giritale, Diyabeduma, Hingurakgoda, and Kantale were of good quality. These stocks of paddy which had a high outturn contained very low amount of impurities. They also revealed that stocks coming from areas like Egodapattuwa, Ampara and Kalmunei were low in quality. It was also revealed that the price of paddy slightly differed according to the relevant producing area. According to the millers, milling outturn depends on climatic factors in specific producing areas, and the process of paddy harvest management.

Besides, the millers in Hambantota district say that paddy from areas of Debara wewa, Weerawila wewa, Tissa wewa, Pannegamuwa wewa and Goda wewa (*Wew Paha*) is of very high quality. In addition, paddy from Badagiriya and Lunugamwehera was of good quality. It was revealed by the Hambantota millers that paddy from Agunakolapalessa, Sooriyawewa and Meeegahajadura is of low quality.

5. 2.2 Major Millers Purchase at a Higher Price

In the purchasing behavior of millers, the small scale millers are compelled to purchase at higher prices in order to compete with the large scale millers who are

¹² Cropping season in India

¹³ Quintal = 100Kgs

always ready to purchase at high prices. This situation largely affects the small scale millers in the Polonnaruwa district as the majority of the major millers in the country operate in this district. According to millers, paddy prices remain high in the Polonnaruwa district due to this reason. Despite the uniformity of majority of millers, the Raw Red paddy prices in the Hambantota district also prevailed at somewhat high level due to high competition. Another reason for competition is that the highest amount of surplus of Raw Red paddy is limited to the Hambantota district and Embilipitiya. This reveals that there is a potential for cultivating additional extent of Raw Red paddy instead of long grain white in other major producing districts.

5.2.3 Shortage of Capital, High Fluctuation of Paddy Prices and Difficulty in Obtaining Pledge Loans in Time

Millers, especially small and medium scale, face financial constraints when purchasing paddy in both districts. Most of the millers claimed that they had to purchase paddy for cash whereas, rice is sold on credit. This situation makes the small scale millers who purchase paddy on a daily basis stop their operations in the off season in the Polonnaruwa district. The millers in Polonnaruwa also face difficulties in getting pledge loans in time. However, this is not prominent in Hambantota where the majority of pledge loans are provided by private banks. Small scale millers in both districts are also affected by high fluctuation of paddy prices in the year (Figure 5.3).

Other constraints faced by millers when purchasing paddy are lack of storage facilities, lack of transport facilities and difficulties in buying paddy from the Paddy Board during the off season. The small scale millers do not have proper storage facilities and most of them do not possess vehicles to transport paddy. The small and medium scale millers who operate their purchasing on a daily basis find it difficult to purchase paddy during the off season: December, January, June and July. In order to stabilize paddy market the stocks of the Paddy Marketing Board (PMB) are normally released during the off season.

Small scale millers point out that major scale millers give priority in purchasing stocks of the Paddy Marketing Board during the off season and medium scale millers also agree with this claim up to a certain extent.

This situation leads to creating a market power for large scale millers. This situation is further aggravated by large stocks of paddy which have been stored by large scale millers through high amount of pledge loans. Therefore, especially small scale millers should be given priority when the PMB stocks are released to empower them.

5.3 Storage, Credit Affordability and Market Power

Paddy is produced on a seasonal basis: *Maha* and *Yala*. In many rain fed settings there is one season which may be subject to fluctuations. Paddy storage, therefore,

occupies a vital place in the paddy/rice marketing process. The market for rice is characterized by fairly stable demand throughout the year, and widely fluctuating supply. Market supply, on the other hand, depends on the harvest of paddy which is concentrated within a few months of the year in any single area, and can fluctuate widely from one year to the next depending on climatic conditions. The main function of storage in the economy is to even out fluctuations in market supply, both from one season to the next and from one year to the next, by taking produce off the market during surplus seasons, and releasing it back to the market during lean seasons. This in turn smoothes out fluctuations in market prices. The desire to stabilise prices of rice is one of the major reasons why the government tries to influence the amount of storage, and often undertakes storage itself through PMB.

Table 5.6: Paddy Storage Ability of Millers

Mill category	Mean Storage(64 kg Sacks)
<8	5000
8-20	12000
>20	60000

Source: Authors' survey data, 2011

Millers must hold stocks to cover the needs of their urban clientele, and cannot rely on steady supplies arriving from rural areas. Large scale millers who become involved in the marketing chain tend to have good banking connections and can obtain capital at a reasonable cost. Studies by the Natural Resources Institute (NRI) in Indonesia and Pakistan indicate that wherever Government policy is conducive, millers enter the storage business on large scale. In Indonesia, traders and millers store about 50% of that part of the rice crop which is carried over from the first harvest (*Ellis et al., 1992*). Indeed it is common for them to store beyond the point when storage is profitable in its own right. This is because storage is only part of a business activity which involves milling and distribution of milled rice. Millers must store in order to keep the mills running out of season, and to maintain supplies to regular customers. Losses on storage are more than compensated by gains on other operations.

The study has found that (Table 5.6) the small scale millers in Polonnaruwa have limited facilities of proper storage. Meanwhile, most large scale millers have sufficient storage facilities: some have facilities to store more than 100,000 sacks of paddy. The normal practice of storage is using poly sack bags (Bag storage system). There is no regular practice of storing of paddy in the Hambantota district.

5.3.1 Farm Storage

For small farmers the main purpose in storing paddy is to ensure household food supplies. Farm storage also provides a form of saving, to cover future cash need through sale, or for barter exchange. Despite the desire to store grain in order to cover food requirements and future cash needs, farmers often sell a large

proportion of their produce at harvest, when prices are low. This is frequently the case with deficit producers, who must satisfy cash needs immediately after the harvest, only to buy food later in the season.

5.3.2 Credit Availability

Table 5.7: Details of Pledge Loans Obtained by Millers for Paddy Purchasing

Amount (Rs Mn)	Polonnaruwa (N=60)		Hambantota(N=26)	
	Number	%	Number	%
< 5	21	35	13	50
5 -10	14	23	05	19
10-20	07	12	06	23
20-30	09	15	01	04
> 30	09	15	01	04
		100		100

Source: Authors' survey data, 2011

Millers purchase paddy in the harvesting season through pledge loans from banks. The highest amount of purchasing is done by the millers during February to March and August to September periods when the *Maha* and *Yala* seasons' harvest reaches the maximum level. The millers are interested in purchasing paddy during this season and store as the price of paddy is relatively low when compared to the other months. Pledge loans have to be recovered within a period of nine months and the interest is 9% and 12% in state banks and private banks respectively. It was observed that pledge loans were granted mainly by state banks in Polonnaruwa and by private banks in Hambantota. The banks show a tendency to grant loans to large scale millers as they get high interest from these loans. There is a high degree of inequality in getting pledge loans in Polonnaruwa. This can be clearly observed (Table 5.7). All the 15% of pledge loan holders who received credit of more than 30 million rupees belong to the category of large scale millers. The millers who purchase and store paddy on large scale through loans have the ability to control the rice market at a certain level in the period of December to January when price of paddy as well as rice reaches their highest. Seasonal price index of farm gate prices has shown it clearly (figure 5.3, 5.4 and 5.5). The average monthly farm gate prices of long grain paddy during the period 2000-2011 have shown that prices in December compared to the March and August were higher than 35% and 26% respectively. Co-efficient of Variation values of Farm Gate prices (Annex 2.1, 2.2, 2.3) in Polonnaruwa reflected inter year variation of short grain (Samba) paddy which was higher than long grain (Nadu).

Table 5.8: Correlation Matrixes: Correlation between Storage, Credit Affordability and the Scale of Milling (Paddy Milled per Day)

	LA	PD	ST
LA	1.000		
PD	0.742	1.000	
ST	0.864	0.825	1.000

LA = Loan Amount

PD = Paddy Milled per Day

ST = Storage Capacity (No of Sacks)

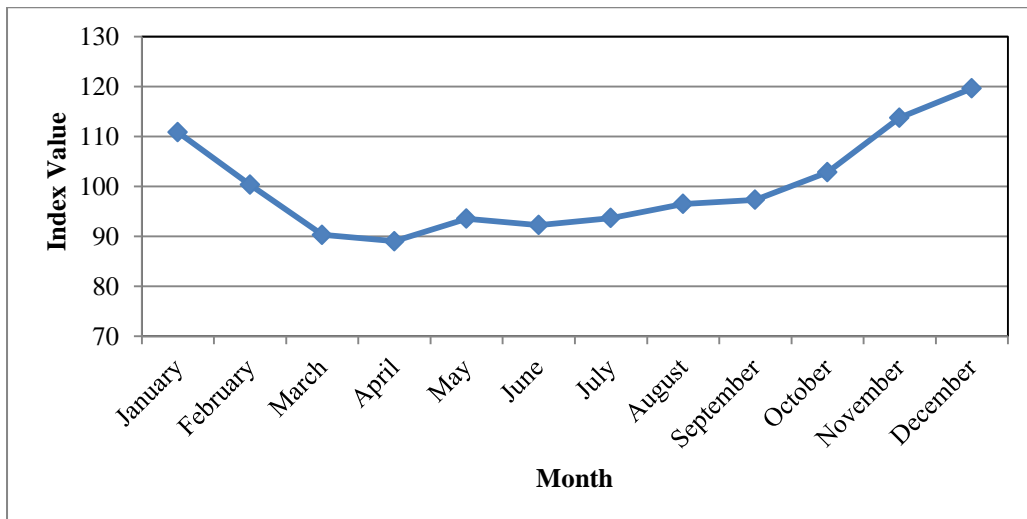
Correlation is significant at the 0.05 level (1-tailed)

Box 1: Storage, Credit Affordability and Market Power of the Millers

Paddy is produced on a seasonal basis: *Maha* (October to March) and *Yala* (April to September). Market supply depends on the harvest of paddy which is concentrated within a few months of the year in any one area, and can fluctuate widely from one year to the next depending on climatic conditions. Paddy storage therefore occupies a vital place in the paddy/rice marketing process. The market for rice is characterized by fairly stable demand throughout the year, and widely fluctuating supply. The main function of storage in the economy is to even out fluctuations in market supply, both from one season to the next and from one year to the next, by taking produce off the market during surplus seasons, and releasing it back to the market during lean seasons. This in turn smoothes out fluctuations in market prices. The desire to stabilise prices of rice is one of the major reasons why the government tries to influence the amount of storage occurring, and often undertakes storage itself through PMB.

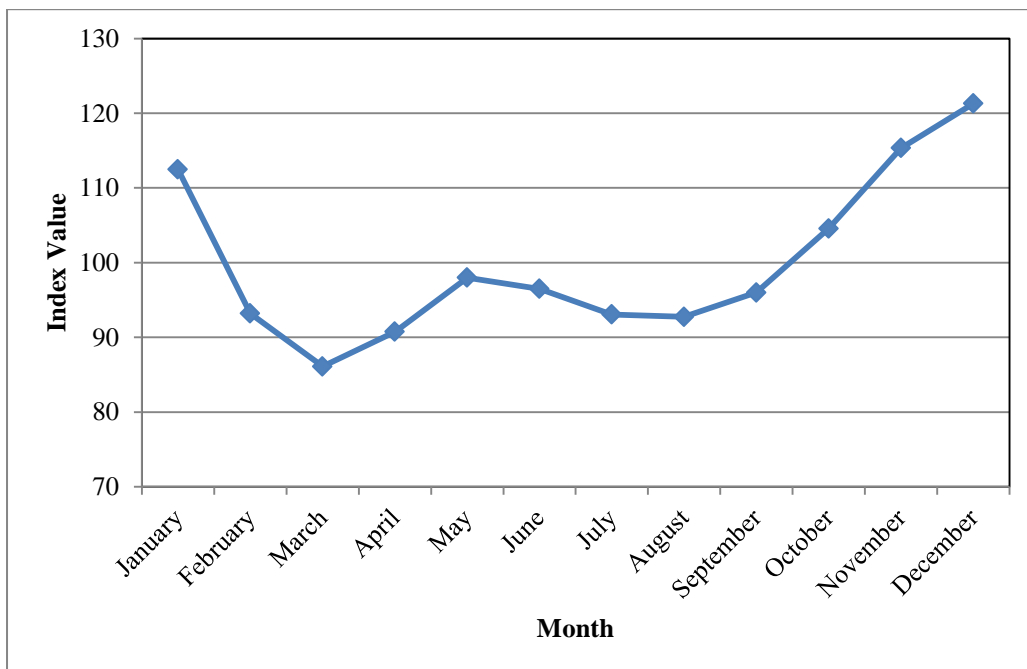
The seasonal the price index values of paddy varieties (Figure 5.3-5.5) show that the prices during December lean season is 30%-35% more than those that in March which the peak is harvesting season. Details of pledge loans obtained for paddy purchasing and the storage ability of millers are shown in the tables 5.6 and 5.7. Study has found that the Correlation Coefficients among storage, credit and the scale of rice production of millers are highly significant and it is reflected by the Correlation Matrix table 5.8. It is revealed that there is a strong relationship among storage ability, credit affordability and the market power. Therefore, large scale millers who have access to credit and huge storage facilities are able to purchase paddy in March and store until the off season and thereby take an advantage of 30% to 35% premium. This situation enables large scale millers to exercise market power in the rice selling market. It is clear that the small and the medium scale millers should also be given access to these facilities and empowers them in order to reduce the impact of market power. For this, government paddy stocks should be released especially to small scale millers. Empowering small scale millers during the off season is vital as those millers who supply lower grade rice to the low income groups like the estate sector.

Figure 5.3: Seasonal Price Index of Farm Gate Prices of Paddy (Short grain white) in Polonnaruwa, 2007 – 2011 = 100



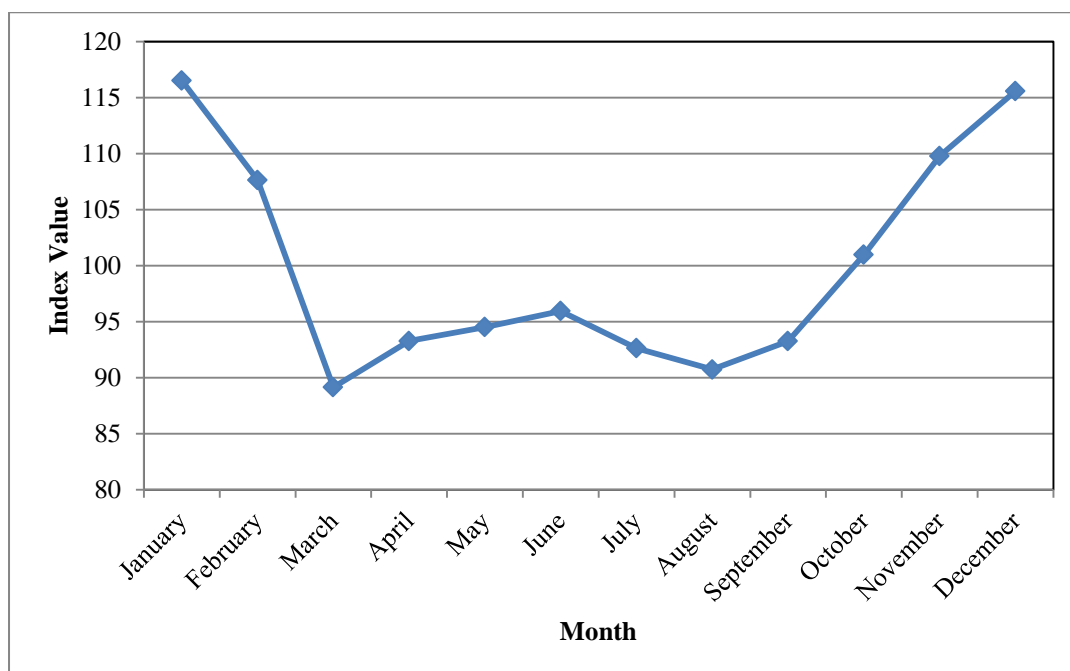
Source: Marketing Food Policy and Agribusiness Division, HARTI

Figure 5.4: Seasonal Price Index of Farm Gate Prices of Paddy (Long grain white) in Polonnaruwa, 2007 – 2011 =100



Source: Marketing Food Policy and Agribusiness Division, HARTI

Figure 5.5: Seasonal Price Index of Farm Gate Prices of Paddy (Long grain red) in Hambantota, 2007 – 2011 =100



Source: Marketing Food Policy and Agribusiness Division, HARTI

5.4 Labor Use in Rice Processing

As far as labor use in rice processing is concerned, the majority of the millers (49%) practise the contract system in both districts. There are some mills which employ laborers by paying daily wages and certain mills practise both methods. The contract system is prominently used in soaking, parboiling, drying and milling paddy.

Table 5.9: Type of Labour Use (%)

(N=151)

Mill Size (Mt/Day)	Contract (%)	Daily Wage (%)	Both (%)
<8	39	38	23
8-20	54	25	21
>20	60	08	32
Total	49	28	23

Source: Authors' survey data, 2011

The mills that pay daily wages mainly employ people in activities like loading, unloading, packing and transporting of paddy and rice. The daily wage rates range between Rs. 600.00-650.00/Kg and Rs. 700.00-750.00/Kg in Polonnaruwa and Hambantota respectively. Furthermore, the laborers do not work continuously for a long period due to the hardships they encounter due to sound pollution and dust in

the milling environment. Labor is in high demand in Hambantota as less strenuous employment opportunities are available in development sites like the harbor, airport and highways. This situation has become a problem in Hambantota. However, the laborers employed in major mills have less work as the whole process is mechanized through elevators. Therefore, the labor cost in major scale mills is relatively low when compared to the medium and small scale mills. The involvement of family labor (table 5.10) is significant in all the mills but it is more prominent in medium scale mills.

Table 5.10: Labor Force under Different Categories of Mills

Mill Size(Mt/Day)	Avg of Family labor
<8	02
8-20	03
>20	02

Source: Authors' survey data, 2011

Table 5.11: Transport Facilities of Millers (%)

Type of Transport	Polnaruwa(N=120)	Hambantota (N=31)
Container Lorries	25	23
ELF Trucks	47	81
1615 Large Lories	19	19
Lack of transport	20	07

Source: Authors' survey data, 2011

Millers need transportation facilities for buying paddy and selling rice. Each medium and large scale miller has at least a vehicle while all large scale millers have a number of vehicles for purchasing paddy and distributing rice to destination markets. All large scale millers and some medium scale millers have container lorries in which a higher amount of rice can be transported. As a container normally transport 16000-18000Kgs of rice, the transport cost of these millers is minimized.

However, the study reveals that about 20% in Polonnaruwa and 7% in Hambantota do not have transport facilities (Table 5.10). Out of them, the majority of small scale millers in Polonnaruwa sell their rice to large scale millers their own mill premises. These millers are small scale. Thereby they also do not spend an extra cost for transportation. The rest of the millers who do not own vehicles either hire vehicles or their buyers purchase rice at the mill premises. The millers in Hambantota who do not own vehicles have their buyers purchasing rice at the mill premises itself. All the mills surveyed have one or more 2W or 4W tractors for their domestic use.

Table 5.12: Constraints Faced by Millers in Rice Processing

Constraint	% of Responses	
	Polonnaruwa (N=120)	Hambantota (N=31)
Lack of Uniform Electricity Supply	39	48
Lack of Modern Milling Equipments	24	03
Receiving Low Quality Paddy	21	48
Labor Problems	18	28
High Electricity Bills	14	03
Financial Constraints	12	10
Other(Environmental)	12	08

Source: Authors' survey data, 2011

5.4.1 Lack of Consistent Electricity Supply

Electricity is the principal source of energy used in all the stages in processing of rice. Lack of consistent or uniform electricity supply is a major constraint faced by all the millers especially in rural areas. Millers in both districts emphasized this. High electricity cost is another problem emphasized by 14% millers in Polonnaruwa (table 5.12). This situation implies that electricity is one of the major factors that affect the performance of the industry. Most of the millers emphasized frequent breakdowns, delays in repairing breakdowns, difficulties in operating the machines simultaneously due to low voltage supply as major issues related to electricity. Several millers pointed out that fluctuating voltage affect the life time of modern machineries. All large scale millers and most of the medium scale millers have separate transformers to obtain electricity. Those who have a transformer receive the electricity bill according to the KV system. The millers claim that frequent breakdowns result in a high electricity bill in the KV system. It was also said that the highest benefit of this KV system is for the mills which operate at a stretch for a long period. According to the millers, electricity cost remains unchanged the duration the, irrespective of transformer is functions per day. Therefore, there is an urgent need to conduct a technical study on electricity consumption of different type of millers with special reference to cost effectiveness, constraints and solutions to overcome them.

5.4.2 Lack of Modern Milling Equipment

The technology use in paddy/rice processing has been changing rapidly in all the rice processing Asian countries including in Sri Lanka. Equipment with technology is a major determining factor in producing quality rice. Improved color sorters, modern polishers and graders, new improved parboiling techniques; weighing bridges are some of them. However, this type of equipment is very expensive and the small scale millers do not have access to it. As a result, they are quite unable to produce

quality rice according to market requirements. Furthermore, they are unaware of the sources from where they can obtain technical know-how and availability. Anyway large scale millers travel to countries like India and Thailand at their own expense and obtain this technology. Therefore, a mechanism that would facilitate especially small scale millers in this regard is vital. This mechanism should include low interest credit programmes, information regarding the accessibility of new equipment, Operations and maintenance etc.

5.4.3 Receiving Low Quality Paddy

Receiving low quality paddy is another constraint emphasized by the millers when processing rice. Low quality paddy produces low quality rice with high percentage of broken, low retainability and off color. This factor is described in detail under constraints faced by millers in paddy purchasing.

5.4.4 Labor Problems

The milling Industry involves many hardships for workers like working with dust, lifting heavy sacks and noisy working environment. Therefore, laborers are reluctant to work at a stretch regularly and as a result, the millers experience shortage of laborers very often. This situation is noticeable in Hambantota where the laborers have many other favorable options in terms of employment in road development sites, airport site, and the harbor construction site.

5.4.5 Financial Constraints

- 1) Another constraint faced by millers in rice processing is the shortage of capital. This capital is needed for purchasing new improved machineries in order to produce high quality rice. Most of the millers complained about non-availability of low interest credit programmes to buy these equipment. It was noted that more than Rs. 25 million should be spent to provide modern machineries to a small or medium scale mills. Literature has shown that the credit programmes implemented by the Bank of Agriculture and Agriculture Cooperatives (BAAC) in Thailand mainly led to a highly competitive rice milling industry in Thailand.

5.4.6 Other Constraints

Among the other problems, the small scales millers find it difficult to produce rice in the rainy season as they do not possess mechanical dryers, are without a proper disposal of waste matter and strict environmental regulations.

5.5 Rice Selling Process in the Study Areas

It was found that the main selling markets of 35% of the millers are in Colombo and its suburbs (table 5.13), and Gampaha Districts which are the most densely

populated urban areas. The majority of millers are large or medium scale. They supply polished, color sorted short grain (Samba) and long grain (Nadu) varieties in their own brand names. However, the study has found that the majority of millers in both districts have their selling markets in outstations. The selling market of about 28 % of millers is the Sabaragamuwa province of which the majority is in the estate sector. Most of these millers are small scale millers who produce unpolished lower grade samba and nadu rice for low income consumers in the estate sector. Majority of the millers supply to the Central province. The other group of millers in Polonnaruwa either sells their production to large scale millers and to traders who buy at the mill or to economic centers or super markets.

Table 5.13: Main Rice Selling Markets of Polonnaruwa Millers (N=115)

Market	% of Responses
Colombo Suburbs & Gampaha	35
Sabaragamuwa Province	28
Central Province	18
Pettah Wholesale Market	05
Maradagahamula	03
Galle District	03
Other	08
	100

Source: Authors' survey data, 2011

Table 5.14 : Rice Selling Markets of Hambantota Millers

Market	% of Responses (N=31)
Colombo & Suburbs	35
Southern Province	34
Bandarawela, N'eliya & Badulla	17
Rathnapura District	14

Source: Authors' survey data, 2011

The study illustrates that some millers (22%) in Polonnaruwa sell their products through other millers on certain occasions (table 5.15). The millers in this group, who possess a brand name practised this method only during the off season when paddy stocks are rare. However, 6% of millers without a brand name frequently sell their brown rice to major and medium scale millers. The majority of these millers are small scale millers who mill less than 8Mt of paddy per day. However, a few medium scale millers also practised this method in some instances. This is mostly practised by those who do not have brand names and established output markets, polishing grading and value addition facilities, and transport facilities.

Table 5.15: Millers Who Sell Their Rice through Other Millers

District	Through other Millers (%)
Polonnaruwa (N=120)	22
Hambantota (N=31)	19
Both (N=151)	25

Source: HARTI, Survey

Table 5.16: Response of Millers to the Rice Ceiling Price (Polonnaruwa)

Parameter	Number of Responses in Different Levels (N=120)				
	Fully Agree	Agree	Partially Agree	Disagree	Average Grading
Convenient to Consumer	54	39	11	16	2.13
Help the stability of GP	10	30	22	58	1.03
A barrier to produce quality rice	25	51	20	24	1.70
Revised based on quality	36	38	14	25	1.87

Source: Authors' survey data, 2011

GP (Guaranteed Price)

Note 1 - Average grading was calculated based on a number of response at different levels using weighted average method

Grading for different levels

Disagree grade 0

agree grade 2

Partially agree grade 1

fully agree grade 3

Example: Convenient to Consumer in table 5.14: $\frac{(16 \times 0) + (11 \times 1) + (39 \times 2) + (54 \times 3)}{(16 + 11 + 39 + 54)}$

According to the response of majority of the millers, the ceiling price of rice is a relief for consumers (table 5.16 & 5.17). Many millers in both districts are under the impression that the ceiling price does not have a favorable impact on the government guaranteed paddy price (GP) to remain stable. This is clearly depicted through the low average grading value for both districts.

Many millers revealed that the ceiling price is a constraint to produce quality rice. It is clearly seen through the high average grading value. Furthermore, they also said that the ceiling price should be revised according to the quality and standards of rice. This may be helpful to increase the quality of rice reaching international standards. In Malaysia, ceiling prices for rice vary according to the rice grades. In 2010, a price for 15% standard rice was RM 1.60/Kg, 10% rice was RM2.40/Kg and 5% rice was RM 2.60/Kg respectively.

Table 5.17: Response of Millers to the Rice Ceiling Price (Hambantota)

Parameter	Number of Responses at Different Levels (N=31)				
	Fully agree	Agree	Partially Agree	Disagree	Average Grading
Convenient to Consumer	10	10	3	4	1.96
Help the stability of GP	1	4	6	9	0.85
A barrier to produce quality rice	3	6	7	6	1.27
Revised based on quality	7	7	5	1	2.00

Source: Authors' survey data, 2011

Table 5.18: Determination of Rice Selling Price (% of responses)

Method	Polonnaruwa	Hambantota	Total
Adding value to paddy price	62	52	60
After discussing with other millers	27	16	24
Decided by Buyer	08	19	10
Negotiating with Buyer	22	13	20
Other	13	10	12

Source: Authors' survey data, 2011

The study reveals that most of the millers determine the selling price of rice by adding a certain value to the price of paddy (table 5.18). Therefore, each miller has a common formula to decide the selling price. According to the information of millers that formula is as follows.

$$\text{Rice Selling Price(50 Kgs)} = \frac{(P \times 100)50}{\text{Milling Yield}} + \text{Processing cost (50 Kgs)} + \text{Profit}$$

Processing cost, Milling Yield and the Profit are the variables which depend on the quality of paddy, milling technology used, and the output market.

P = Paddy Purchasing Price

Processing Cost = Processing Cost for 50 Kgs of rice, its include Millers Cost for Labor, Electricity, and Machinery. According to the millers it's nearly Rs 250 -300 per 50 Kgs of parboiled rice and Rs 125-175 for raw rice.

Milling Yield = White Rice Outturn of 100 Kgs of Paddy (Depend on Paddy Quality)

It varies between 60% to 68%

The service of brokers was observed in some instances in the Hambantota district in which the price is mostly decided by the buyer. When rice is supplied to super markets, and government establishments the same practice is observed.

Table 5.19: Millers' Response to the Competitiveness of the Industry

Activity	Polonnaruwa(N=120)	Hambantota (31)
When paddy is bought	36	41
When rice is sold	54	59
Quality of rice	10	-

Source: Authors' survey data, 2011

Many millers revealed that the industry is competitive. The competition is higher in selling rice than in buying paddy. According to them, it is difficult to find output markets for selling rice. They also added that the normal practice in buying paddy is by using cash and selling rice on credit. It was highlighted that they were unable to obtain the payments in certain situations. The millers also revealed that in case of failure of a miller to supply rice to a shop once, the other millers try to grab this chance. In addition, 10 percent is of the opinion that it is difficult to compete over the quality as they are unable to produce quality rice as large scale millers do.

Table 5.20: Problems Faced by Millers when Selling Rice

Constraint	% of responses	
	Polonnaruwa (N=120)	Hambantota (N= 29)
Lack of stable output market	35	17
Difficult to compete with large millers	32	—
Frequent price fluctuations	14	06
Low bargaining power due to high competition	12	17
Selling entirely on credit and is risky	16	28
No problem	-	10
Other	12	17

Source: Authors' survey data, 2011

35% of millers (table 5.20) in Polonnaruwa stated that lack of a stable selling market was the major problem faced by them. Majority of them are small scale millers whose selling markets are in the estate sector in the Sabaragamuwa and the Central provinces. Another significant problem in Polonnaruwa is that small and medium scale millers cannot compete with the large scale millers especially in term of quality. During the off season, the small and majority of medium scale millers have to depend on the paddy purchased on a daily basis at high prices whereas, the large scale millers have enough stocks purchased at low prices in the season. Due to this reason small and medium scale millers are unable to compete with large scale millers regarding the price. However, such a situation cannot be observed in Hambantota where there is a balance in the number of millers in every category to a great extent. Furthermore, in Hambantota, millers produce only raw red rice and rice grading is not observed as in Polonnaruwa. It was also observed that millers have limited opportunities in bargaining the selling price due to high competition

and the situation is further difficult in Hambantota. A common problem faced by the millers in both districts is that they have to sell their stocks on credit, taking a great risk. According to the millers unrealizing of cheques and credit defaults are the common problems.

Among the other problems faced by the millers, is their inability to produce quality rice due to the impact of the ceiling price. This issue was mainly pointed out by the large scale millers followed by medium scale millers who mainly supply rice to the urban consumers. Lack of facilities to transport rice to target markets is another issue. The millers in Hambantota also pointed out that the rice treated with dye reaching the markets from the Eastern province is a threat to their business.

Table 5.21: Millers Suggestions for Improvement of the Industry (N=151)

Suggestions	% of Responses
Arrange Concessionary credit programmes so that all get equal benefits	32
Ensure uniform electricity supply at a reasonable pricing method	30
Create opportunities to access new technology, facilities to obtain supply high tech machineries and necessary training	20
Establish a Dedicated Economic Center for rice marketing	17
Create awareness programmes for farmers for quality paddy production	30
Implement a rice export promotion programme	18
Reduce taxes	11
Establish fair mechanism for disposal of government paddy stocks	10
Create control price for paddy	10
Focus on government protection programmes to farmers as well as millers	10
Encourage rice flour based manufacturing programmes	06
Other	16

Source: Authors' survey data, 2011

According to some of the millers, credit programmes are mostly available only for large scale millers, hence, there is a strong suggestion from them that special credit programmes should be arranged for small scale millers too.

Creating opportunities for access to new technology, facilities to obtain high tech machineries and necessary training is another important suggestion highlighted especially by small scale millers. It is observed that a certain mechanism is needed to provide services such as technical guidance, awareness of machinery and quality improvement techniques under one roof.

The millers also emphasized the need to solve problems related to electricity supply which has been discussed in detail in a previous chapter. The need of establishing a dedicated economic center for rice marketing was also suggested by the small and medium scale millers.

Especially the large scale millers pointed out that assistance should be given to encourage millers to initiate a rice export programme. The millers highlighted the need for fair taxation procedure with transparency as the prevailing procedure is problematic to them. They requested that the nation building tax should be removed from the rice milling industry. The small scale millers must be given priority when the stocks of Paddy Marketing Board are released. Ten percent of millers pointed out that a control price must be imposed on paddy as well as on rice.

Other suggestions included : making the consumers aware of identifying quality rice, millers who process improved rice using proper grading and process Sri Lanka Standards Certification should be given an opportunity to sell their products over the ceiling price, implementing government intervention programme for the activities of rice mills, conducting training sessions on procedures of quality rice production and making arrangements to minimize the oligopsony behavior in the industry.

CHAPTER SIX

Analysis of Rice Milling Industry Performance

6.1 Introduction

In this chapter rice milling industry performance will be examined along several dimensions. By using secondary data, an attempt is made to examine the behavior of price spreads and compare rice retail prices with other countries. Based on the primary data, conversion rates, brand loyalty, Sri Lanka Standards, trainings, methods adopted to minimize environmental problems, good manufacturing practices and by-product utilization methods are also discussed.

6.1.1 Conversion of Paddy to Rice

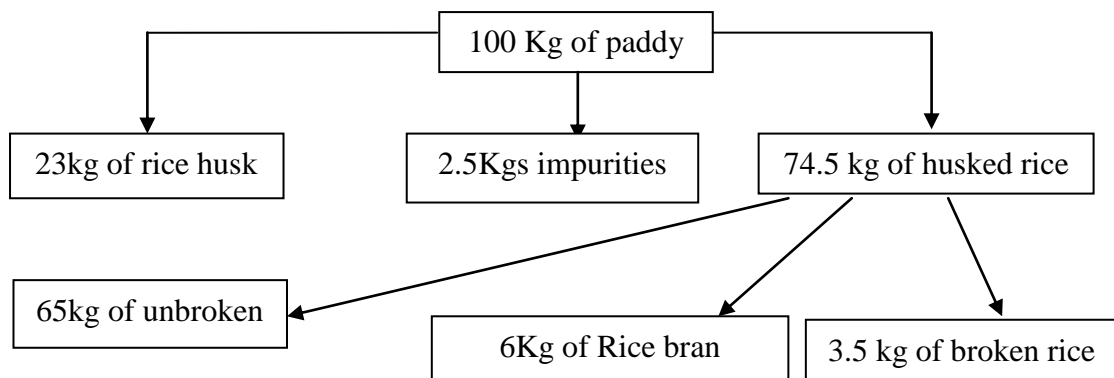
The conversion ratio or milling outturn from paddy to rice is about 65% for parboiled *Nadu* rice. The details are given in the figure 6.1 The rice outturn highly depends on quality of paddy. It includes the moisture degree and type of paddy. The outturn of paddy with high amount of moisture and impurities is low. The millers revealed that outturn also depends on paddy supplying areas. Moreover, the different processing techniques also influence the “conversion ratio”. The modern rice mills with new processing machines and experienced millers usually get a higher outturn.

Compared to the parboiled rice processing, the milling outturn of rice is slightly low in raw processing. The amount of bran obtained from raw processing is high when compared to the parboiled processing. However, Hambantota millers reveal that high outturn can be obtained from paddy from ‘*wew paha*’ areas. They normally say 100 kg of rice can be obtained from one “*Amuna*”¹⁴(100 kg of paddy). Same situation persists in Polonnaruwa. High outturn can be obtained from paddy coming from areas like Medirigiriya, Hingurakgoda and Kantale. According to the information, paddy from those areas have better grain weight and a thin husk layer. Millers reveal that, the outturn also depends on soil and other climatic factors in producing areas.

The average outturn of nadu in Polonnaruwa and red paddy in Hambantota was 65 kg and 64 kg respectively (Figure 6.1 & 6.2).

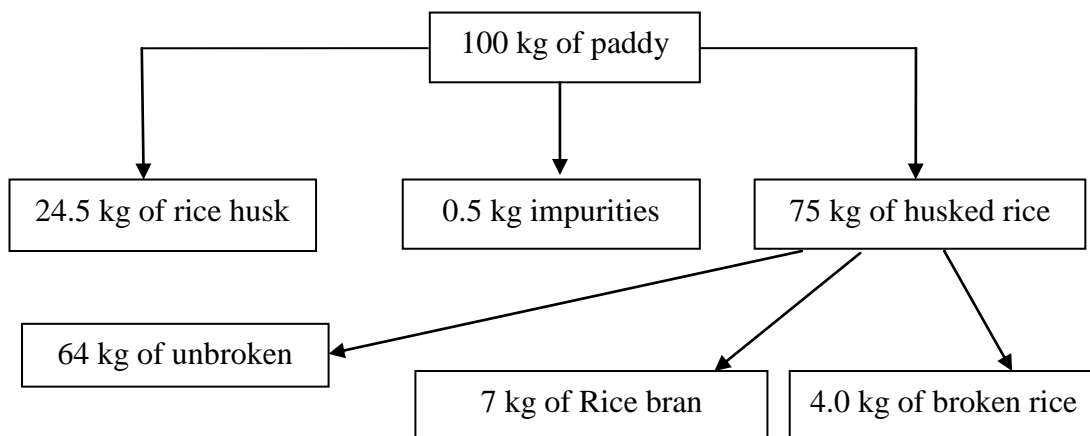
¹⁴ *Amuna*- In Hambantota it equals to 150 kg of paddy

Figure 6.1: Conversion of Paddy to Long Grain White Paddy (Nadu) in Polonnaruwa



Source: Authors' survey data, 2011

Figure 6.2: Conversion of Paddy to Rice (Long grain Red Paddy) in Hambantota



Conversion rates of paddy into rice in other rice producing countries: Thailand-0.66, Vietnam-0.65, Myanmar-0.64, and Cambodia- 0.63 (Boonjit 2012).

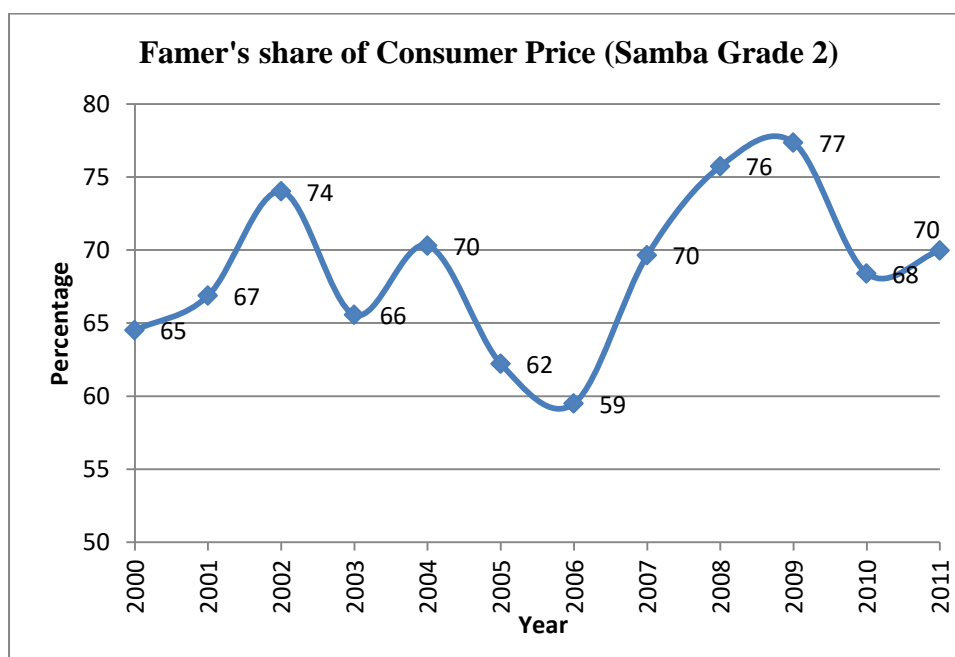
Source: Authors' survey data, 2011

6.2 Farmer's Share on Consumer Price of Rice in Colombo Market

The farm value share of rice is computed by dividing the farm value of equal quantity of paddy by the rice retail value, and is reported as a percentage. The monthly farm gate prices of Polonnaruwa and rice retail prices of Colombo market during the last decade were analyzed. It is observed that the producer's share on consumer price frequently fluctuates (Figure 6.3 6.4 and 6.5). This situation is common for both samba and nadu varieties. During this analysis the conversion rate

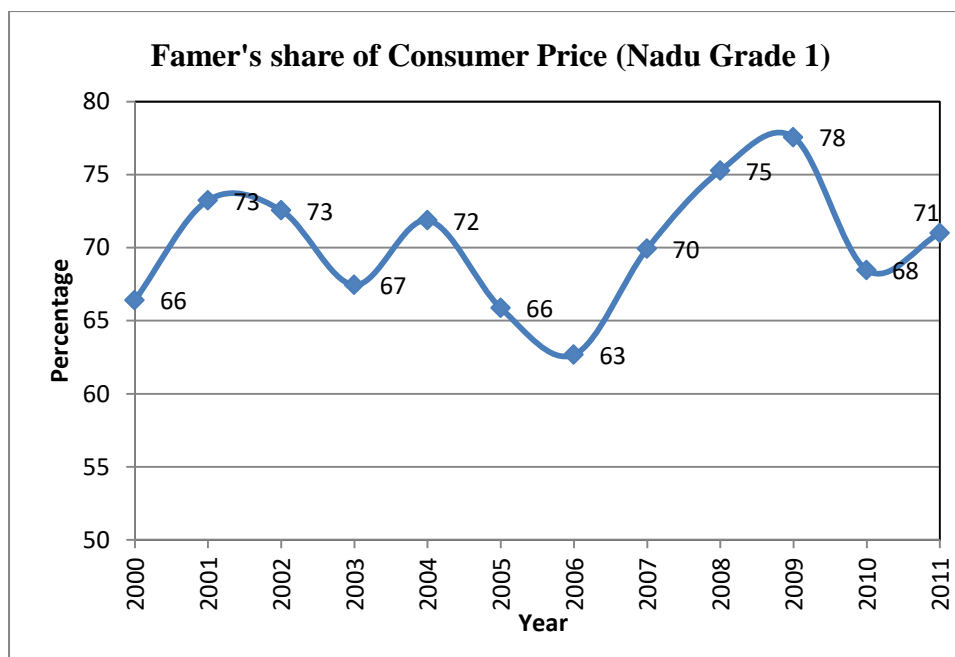
of paddy into rice was considered 0.65 for both Samba Grade II and *Nadu* Grade I rice varieties. Monthly variation of farmers' share on different rice varieties is shown in the Annex 2.

Figure 6.3: Farmer's Share of Consumer Price of Samba Rice



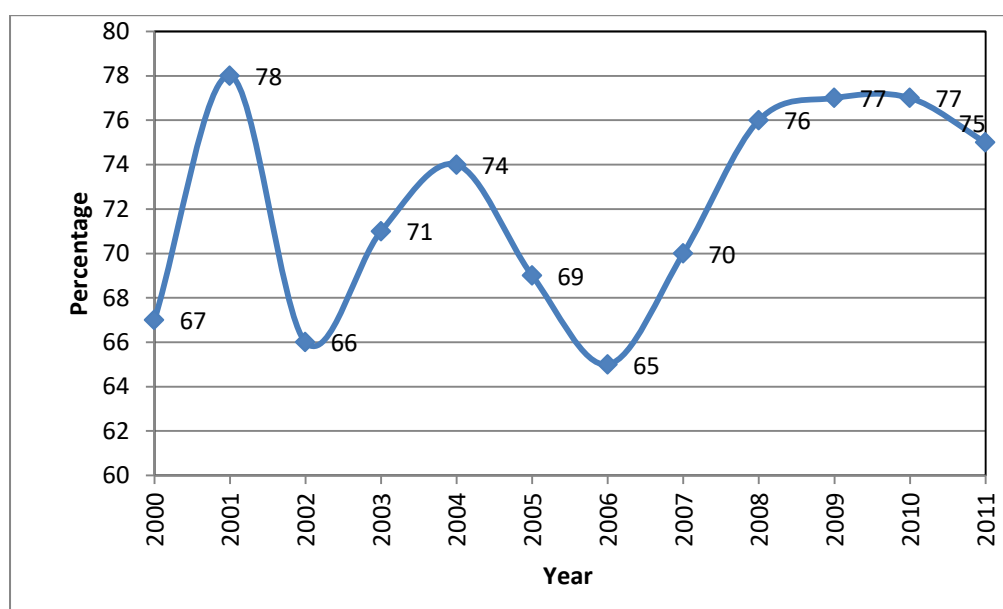
Source: HARTI

Figure 6.4: Farmer's Share of Consumer Price of Nadu Rice



Source: HARTI

Figure 6.5: Farmer's Share of Consumer Price of Raw Red Rice



Source: Department of Census and Statistics

Concentrated market power is an important reason for the decline of farm income and it undermines the viability of rural economy (Murphy, 2006). Over time, the share reflects relative changes due to a number of reasons like excess or deficit production deteriorated paddy quality during the harvesting seasons as a result of weather related setbacks and pest and diseases outbreaks, the degree of government intervention (effectiveness of the paddy price stabilization programmes), and government policies. The two major paddy growing seasons are *Maha* from October to March and *Yala* from April to September. The *Maha* harvest reaches the market from February to March and the *Yala* reaches during July to August. The peak harvesting period moves slightly according to the commencement of the season which depends on the onset of monsoon rains and issuing of water in major irrigation schemes. In *Maha* which is the main season, the harvest of paddy crop from the Eastern province and Kurunegala reaches the market first and is followed by paddy from Polonnaruwa. The above mentioned movement of peak harvesting in major producing areas sometimes overlaps. In such a situation, a huge production reaches the market in a short period of time causing a drastic decline in paddy prices.

The farmer's share of consumer price of all the rice varieties has shown a volatile trend. However, it has shown a slightly increasing trend during recent years, which is quite apparent in Hambantota. When the fluctuation in the year is considered it has increased during the off season and decreased during the harvesting season (Annex 2.4, 2.5 & 2.6). This reveals that the farmer has certain bargaining power during the off season due to low availability of paddy stocks. However, the majority of small scale farmers do not have paddy stocks during the off season. Therefore, some strategies must be implemented to motivate small scale farmers to retain their

paddy stocks until the off season. Paddy Pledging Scheme in Thailand, and special off season price scheme in China are some examples.

Table 6.1: Millers with Their Own Brand Names

Mill Size by Paddy Milled per Day (Mt)	Polonnaruwa (N=120) %	Hambantota (N=31) %
<8	89	58
8-20	98	80
>20	100	100
Total	94	77

Source: Authors' survey data, 2011

Each miller has attempted to sell his rice to the market under a certain brand name as a result of the expansion of the rice milling industry during the last decade. The increasing competition and the changing consumer behavior have also caused this. The Table 6.1 shows that almost all the medium and large scale millers especially in Polonnaruwa possess a brand name. The millers in Polonnaruwa have to issue their rice production to market under different brands as they do so under different categories like supiri samba, normal samba, *keeri* samba, hotel samba, supiri nadu, normal nadu, and *bada bath*. Therefore, they need to use brand names which add value to their products.

However, in Hambantota a wide variation is not observed in products as almost all the millers produce raw red rice. In Hambantota nearly 42 % of small scale millers sell their rice without brand names. It was clear that only some small scale millers in both districts sell their products without a brand name. It was observed during the study that some of the small scale millers in Hambantota obtain the service of a broker for selling rice to estate sectors in Bandarawela, Nuwaraeliya, Badulla and Rathnapura areas. The brand of the rice which is sold to those areas is not of much importance.

6.3 Sri Lanka Standards (Specifications) for Rice

Table 6.2: Requirements for Raw Milled Rice

Characteristics	Requirements for Grades			
	Premium	1	2	3
Moisture (% by mass,max)	14.0	14.0	14.0	14.0
Foreign matter(% by mass max)	nil	nil	0.5	1.0
Type admixture(% by mass max)	nil	2.0	6.0	10.0
Damaged grains((% by mass max)	nil	1.0	2.0	4.0
Broken grain(% by mass max)	8.0	20.0	30	45.0
Paddy seeds(grains/Kg)	nil	5	15	30

Source: Sri Lanka Standards Institution SLS 633: 1995 & AMD 2

Table 6.3: Requirements for Parboiled Milled Rice

Characteristics	Requirements for Grades			
	Premium	1	2	3
Moisture (% by mass,max)	14.0	14.0	15.0	15.0
Foreign matter(% by mass max)	nil	nil	0.5	1.0
Type admixture(% by mass max)	nil	2.0	6.0	10.0
Damaged grains((% by mass max)	0.5	2.0	4.0	5.0
Broken grain(% by mass max)	1.0	5.0	15	20.0
Paddy seeds(grains/Kg)	nil	nil	15	30

Source: Sri Lanka Standards Institution SLS 633: 1995 & AMD 277

The above tables show Sri Lankan standards for raw milled rice, parboiled rice and paddy recommended by Sri Lanka Standards Institution (SLSI). These specifications were made in 1995 and some amendments have been added in the year 2001. Rice has been categorized into four groups according to conditions such as moisture, foreign matter, damaged and broken grains and paddy seed content. A survey conducted in the year 2000 revealed that, 75% of locally produced rice in the open market did not meet the above standards. However, the rice milling industry has undergone a rapid improvement during the last decade. It is observed that many modes of advanced technology have been added to rice milling, polishing, grading, sorting and packing. Therefore, there is an urgent need for studying the quality of rice presently available in the market. The study also reveals that 75% of paddy coming in for milling was of poor quality and did not meet the specifications (Table 6.6) prescribed by the SLSI.

The study attempts to compare the standards of local rice with that of some other Asian countries. The relevant standards are shown in the table 6.4 and the Annex 3. The information relevant to the standards implies that there is no considerable variation between the local standards and the standards in other countries. However, there is a need to revise some areas like maximum percentages of discolored grains, chalky grains, immature grains, red grains, and red streaked grains. Studying those factors is quite necessary if the country plans future rice, export programme. Furthermore, though they have been initiated these standards are not practised in the domestic rice market. Therefore, uplift the quality of rice, present standards should be implemented in the domestic rice market. Hence, all the stakeholders must be made aware of implementing those standards and they should be encouraged to adhere to the relevant standards.

Table 6.4: Comparison of Sri Lankan Rice Specifications with Those of Other Countries

Description	Sri Lanka			Thailand	Vietnam	Pakistan	
	Gr1	Gr 2	Gr 3	25% broken	25% broken	Grade 3 15-20% broken	Grade 4 20-25% broken
Whole Kernels (min %)				40.0	50.0	} NS	} NS
Head rice (min %)				NS	NS	} 80-85	} 75-80
Broken (max %)	20.0	30.0	45.0	28.0	27.0	15-20	20-25
Small broken/chips/brewers (max %)				/1 1.0	0.3	-	-
Damaged grains (max %)	1.0	2.0	4.0	1.0	/3 2.5	} 4.0	} 5.0
Discolored/yellow grains (max %)				1.0	1.0	}	}
Chalky grains (max %)				7.0	8.0	8.0	10.0
Immature grains (max %)				/2 1.0	0.5	-	-
Under milled grains (max %)				} 5.0	-	-	-
Red grains (max %)				}	} 5.0	-	-
Red streaked grains (max %)				}	}	3.5	4.0
Foreign matter (max %)	nil	0.5	1.0	/2	/4 0.4	1.0	1.2
Paddy (max No./Kg)				15	30	0.6%	0.8%
Moisture (max %)	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Milling degree				RWM	WM/RM	RWM	RWM
Size of broken (of Avg. Length of unbroken kernel)				<5/10th	<5/10th	<3/4th	<3/4th

NS-Not Specified

Source: FMRSP Synthesis Report, 2001, FMRSP/IFPRI

The study has also found that all the major scale and some medium scale mills have adequate resources to produce quality rice according to the international standards, thereby, the progress so far achieved in the milling industry can be enhanced.

Table 6.5: Definition of Technical Terms Used in Rice Grading in Sri Lanka

Sri Lanka
Long red (LR) = >6.0mm Long white (LW) = >6.0mm Medium red (MR) = 4.5mm- 6.0mm Medium white (MW) = 4.5mm-6.0mm Short red (SR) = <4.5mm Short white (SW) = <4.5mm Mixed type = mixed rice which contains less than 90 per cent by mass of any one of above types.
Broken = <3/4 th of grain length Head rice = ≥ ¾ of grain length
Damaged kernels = Kernels which are distinctly identified as having been visibly affected by insects, heat, water , diseases or any other causative agent.
Discolored kernels = kernels ,whole or broken ,that are discolored materially affecting the quality
Foreign matters = all matter other than rice or paddy.
Milling degree = under-milled, Reasonably well-milled, well-milled

Source: Sri Lanka Standards Institution

Table 6.6: Sri Lanka Standards for Paddy

Characteristics	Requirements for Grades			
	Premium	1	2	3
Moisture (% by mass,max)	14.0	14.0	15.0	15.0
Foreign matter(% by mass max)	0.5	0.5	1.0	1.5
Type admixture(% by mass max)	1.0	2.0	6.0	10.0
Damaged grains((% by mass max)	0.5	2.0	6.0	10.0
Immature grains(Chaft)(% by mass)	0.5	5.0	15.0	20.0

Source: Sri Lanka Standards Institution

6.4 Good Manufacturing Practices (GMP) in Rice Milling Industry

Good Manufacturing Practices Certification scheme was introduced by the Sri Lanka Standards Institution (SLSI) as a stepping stone for SLS, ISO 9001, HACCP & ISO 22000 certifications. GMP Certificate is issued by the SLSI for complying with the requirements to manufacture quality products. It assures that the entire manufacturing process is continuously complying with the quality requirements from raw materials to finished products. The scheme is monitored by a pool of well experienced and qualified auditors of SLSI conforming to the internationally accepted procedure. GMP certification allows number of benefits to the manufactures by establishing company reputation, developing consumer confidence, improving the image of the company, increasing competition , improving the productivity, reducing customer complaints, certifying export products, and marketing for promotion of sales. At present, nearly four rice millers

have obtained this facility and some other applications are being processed. In Polonnaruwa, there are two mills with GMP certification and both of those millers export small quantities of rice .

Table 6.7: Participation in Formal Trainings on the Industry

District	% of Received Formal Trainings
Polonnaruwa(N=120)	09
Hambantota(N=31)	45

Source: Authors' survey data, 2011

Frequent trainings which scale up the competency of millers are vital in rice milling industry as its technology changes rapidly. The awareness of modern machinery and new processing techniques are necessary for the sustainability of this industry as these aspects undergo regular changes and improvements in other rice processing countries in Asia. However, the study has revealed that this area is weak specially in Polonnaruwa. However, there have been constant training in this regard conducted by IPHT in the Hambantota district with the intervention of Southern Province Chamber of Commerce. Therefore, this area should be given special emphasis as Sri Lanka anticipates implementing a programme of exporting rice in the near future.

Table 6.8: Methods Adopted to Minimize Environmental Problems in Polonnaruwa District (%)

Method	% of Responses (N=116)
Establishing improved Bacteria cultured water filtering systems	22
Disposal of ash residues through water tanks transferring	40
Giving ash to farm lands to be use cultivations	23
Not reported	15

Source: Authors' survey data, 2011

Implementation of proper disposing of waste materials from rice mills is vital for minimizing environmental problems. Adopting cleaner production techniques is widely spreading worldwide as it contributes a lot towards the sustainability. The water in which paddy is soaked is the major waste from mills in Polonnaruwa which is the main parboiling rice producing area. An improved Bacteria cultured water filtering system is used in 22% of mills, most of which are major millers. However, the majority of small and medium scale millers dispose waste water into waterways and paddy cultivations.

6.4.1 Utilization of By-products

In Polonnaruwa, paddy husk is entirely reused as a fuel for boilers to be used in the process of parboiling and drying paddy. In one major rice mill, electricity is

generated by this paddy husk using advanced technology. In Hambantota, almost all the millers process raw rice, without soaking and boiling. Therefore, a large amount of paddy husk which is nearly 25 mt is produced daily. A certain amount of husk is supplied to cement factories but majority of millers dump it in large pits dug in government lands. This has created a number of environmental problems. This wasted resource can be utilized effectively as a source of energy in various industries. A recent study has found that (Asanka, 2011) Sri Lanka annually produces nearly 0.656 million Mt of paddy husk that can generate 40 MW of electricity. The author has found that 4.3 MW electricity, can be generated from the annual paddy husk production in Polonnaruwa. The table below shows some alternative ways of utilizing rice mill residues in other countries.

Table 6.9: Rice Mill Residue Usage Options in Other Countries

RESIDUE	TECHNOLOGY	ENERGY USE	RESIDUE USE
Rice husk	Fuel for paddy drying	Hot air for paddy drying	Mix in cement kiln
Rice husk	Fuel for high pressure steam generation	Cogeneration ; steam for paddy drying, for parboiling of rice noodles, electricity for milling and other processing	Mixing with cement /sale as high crystalline silica
Rice husk	Fuel for high pressure steam generation	Condensing steam turbine, electricity generation for sale to public grid	Mixing with cement/sale as high crystalline silica
Rice husk	High temperature combustion > 850 Deg C	Heat recycling for paddy drying/no heat use	Sale as very high quality crystalline Silica
Rice husk	Fuel for gasifier	Cogeneration; Hot water for paddy drying, electricity for milling and grid sale	Charcoal part might be briquetted
Rice husk	fuel	Fuel for processing of Alcohol	
High Carbon ash	Briquetted	Cooking fuel	Cleaning utensils
Rice husk	Briquetted	Sold as fuel	
Rice husk	Bulk	Sold as fuel	

Source: International Finance Corporation

Table 6.10: Comparison of Rice Retail Prices with Other Countries

Retail Prices of Rice Prices by Countries					<i>(Price = US\$/Kg)</i>		
Year	2011				2012		
Period	Jan	Apr	July	Nov	Jan	Apr	July
Asia/Bhutan	-	0.40	0.40	-	0.31	0.37	0.35
Bangladesh	0.44	0.46	0.41	-	0.33	0.35	0.35
Cambodia	0.41	0.41	0.44	0.44	0.54	0.42	0.43
China	0.43	0.49	0.53	0.54	0.56	0.85	0.86
India	0.50	0.51	0.51	0.50	0.45	0.47	0.44
Indonesia	1.00	1.00	1.02	1.11	1.11	1.14	1.10
Japan	4.94	4.91	4.99	5.38	5.49	5.58	-
Rep; of Korea	1.76	1.94	2.07	-	-	-	-
Myanmar	0.45	0.51	-	0.52	0.50	-	-
Pakistan	0.42	0.49	0.50	0.52	0.54	0.54	0.55
Philippines	0.78	0.80	0.80	0.82	0.81	0.82	0.82
Sri Lanka	0.48	0.54	0.52	0.47	0.51	0.43	0.40
Thailand	0.47	0.48	0.43	0.52	0.56	0.49	0.57
Viet Nam	0.44	0.39	0.41	0.47	0.45	0.35	0.35
Africa							
Burkina Faso	0.73	0.82	0.84	0.81	0.74	0.75	0.69
Cape Verde	1.16	1.17	1.24	1.27	1.17	1.11	1.24
Chad	0.72	0.9	1.04	1.14	1.24	1.01	1.05
Mali	0.64	0.69	0.77	0.79	0.75	0.75	0.64
Mauritania	0.98	-	1.04	0.77	-	0.69	0.69
Senegal	0.85	0.81	0.80		0.72	0.81	0.81
Burundi	1.01	1.08	1.08	1.08	1.35	-	-
Rwanda	0.77	0.84	0.86	0.85	1.07	1.16	1.26
Somalia	0.71	0.77	0.69	0.76	0.83	0.77	0.78
Uganda	0.64	0.75	0.94	0.96	1.15	1.34	1.10
Tanzania	0.75	0.80	0.82	0.66	-	-	1.19
Madagascar	0.57	-	0.52	0.56	0.62	0.59	0.52
Malawi	1.04	-	-	-	-	-	-
Mozambic	0.87	0.88	0.88	0.97	0.94	0.86	0.9
Central and South America	1.04	1.05	1.07	1.05	1.05	1.04	1.02
North America							
U.S.A	1.60	1.64	1.69	1.59	1.61	1.54	1.49
Europe							
Italy	1.47	2.01	2.07	1.62	1.41	1.25	1.04

Source: Food and Agriculture Organization

Central and South America retail prices of rice were given by averaging the prices of 8 countries. (Dominican Rep, El Salvador, Gauthamala, Haiti, Honduras, Bolivia, Colombia, Uruguay)

An attempt was made to compare and contrast series of recent rice prices of over 40 major rice consuming countries. Implementation of paddy pledging scheme in order to favor the farmers in Thailand which is the world's largest rice exporter, greatly changed global rice market equation. A gradually increasing trend of prices can be observed in countries like Thailand, Indonesia, Pakistan, Philippines and China. However, as far as the main countries in Asia are concerned, rice prices in Sri Lanka have been stable for over a considerable period. When the rice prices in the world are considered, the countries with the lowest prices are Vietnam, Bangladesh, Bhutan and Cambodia. However, it should be noted that the prices in Bangladesh are for the coarse category. There is a gradually increasing trend with high rice prices in most of the countries (table 6.10).

Therefore, it is implied that there is a potential for Sri Lanka too, to take a competitive advantage through increased productivity. The country has already planned to export some quantity of rice within the next five years for which above mentioned price trend is an opportunity. The above table reveals that the prices of all the Western and Eastern African countries are two or three times higher when compared to prices in Sri Lanka. Those African countries heavily depend on imports and the market is very much catered by Thailand, and Vietnam. Therefore, it is essential to focus on the demand behavior and preferred rice qualities of these countries in planning a rice export programme.

6.5 Rice Processing Cost

An attempt was made to calculate the rice processing cost during the study. The processing cost of milling consists of fixed and variable costs. In this study, under the fixed cost, depreciation charges and administrative charges are included. The administrative cost included postage and stamps, auditors remuneration, travelling charges, insurance, building maintains, rates and taxes, environmental license fees, mill license, weighing bridge maintains, and charity and donation. Fixed cost estimation excludes investment on machines. The variable cost consists of labor cost, electricity, packing charges, maintenance charges, etc. The rice processing cost basically depends on milling outturn and type of machinery in use. The cost of a medium scale rice mill with a daily dryer capacity of 16,000 kg of paddy was calculated (Table 6.11). Normally this type of a mill employs 15 permanent laborers. The laborers are normally paid the E.P.F and E.T.F allowances in medium scale as well as large scale mills.

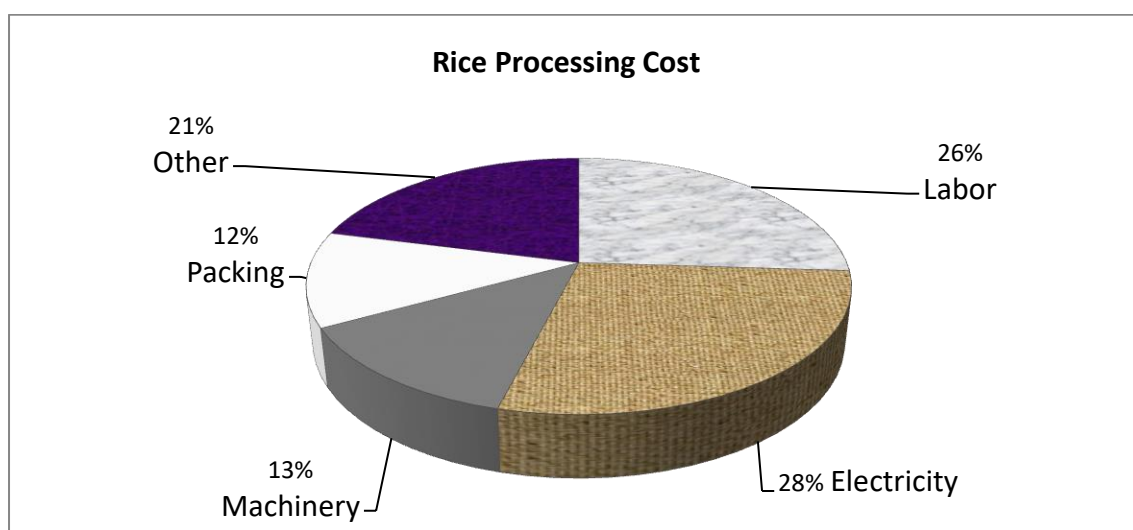
Table 6.11: Per Day Milling Quantity of Paddy Equal to 16,000 Kg of Paddy, Medium Scale Rice Mill. Outturn 65 kg of Parboiled Nadu Rice

Type of cost	Cost per 1 Kg of Rice(Rs)
Salaries (15 labors *Rs 600* 22 working days)	0.87
Over time and other allowances)	0.27
E.P.F and E.T.F	0.10
Labor Cost	1.24
*Electricity cost	1.31
Mill maintains cost	0.37
Machinery depreciation	0.23
Machinery cost	0.60
Packing material	0.58
Other	
Mess expenses	0.14
Vehicle maintenance	0.44
Administrative cost	0.24
Pledge loan interest	0.17
Sub Total of other cost	0.99
Processing Cost	4.72
Transport cost	1.30
Total Cost	6.02

Source: Rice Millers Association and a Authors' survey data, 2011

Note : Details of the Cost components given in Annex 4

Figure 6.6: Rice Processing Cost Breakdown in Polonnaruwa



Source: Authors' survey data, 2011

According to the electricity costs of surveyed medium scale rice mills, the unit cost of electricity ranged between Rs.0.85 - 1.60 kg/Rs for rice and the average was 1.31 Rs/kg. millers' information reveals that it is necessary for any mill which consumes more than 60 mp of electricity to get a separate transformer. Otherwise, the modern machinery like polishers and color sorters cannot be operated. Almost all the medium scale and all large scale mills use a transformer of their own. These mills get to separate electricity bills- one according to the transformer KV value and another normal according to use. It was observed that nearly 28% expenses are for electricity when processing parboiled rice in Polonnaruwa (figure 6.6). The millers emphasized that the electricity cost based on the KV value is favorable for the large scale mills operated the whole day to full capacity, whereas it is not beneficial for the medium scale millers who do not fully utilize electricity. Therefore, the major scale millers who utilize full capacity of electricity can take the maximum benefit compared to the medium scale millers. On the other hand, the electricity cost mainly depends on the type of machinery in use. If the milling process is more automatic the electricity cost is higher. The electricity unit cost varies from Rs 13.60 per unit in peak hours, Rs 10.45 in day time, and Rs 7.35 in off peak hours. In addition, one unit of transformer use KV cost is Rs 850. Apart from the labor cost and electricity cost, the miller has to bear rice packing material cost, machinery cost and vehicle maintenance cost. The pledge loan for paddy purchasing is another cost factor and the study has found that most of the medium scale millers receive a loan of nearly thirty million Rupees and the loan interest is also added to every kilogram of rice produced.

CHAPTER SEVEN

Findings, Conclusions and Policy Recommendations

7.1 Major Findings

7.1.1 Structure of the Rice Milling Industry

- 1) According to the quantity of paddy milling per day in Polonnaruwa, 47 % of rice mills are less than 8Mt/Day while 34 % is 8-20 Mt/day and the rest (19%) is more than 20 Mt/day. In the Hambantota district, the milling capacity remains almost the same in most of the mills (8 – 20 Mt/day).
- 2) There is no proper classification system for rice milling industry in Sri Lanka. The available classification system is relatively outdated. But during the last decade, rapid development has taken place in the industry.
- 3) According to the Concentration Indices based on the survey, paddy milling industry in Polonnaruwa district can be classified as slightly concentrated. But in the Hambantota district there is a highly competitive market structure.
- 4) According to the daily rice production, Gini Ratio and Lorence curve Polonnaruwa district shows a moderate degree of inequality (Gini Ratio – 0.58), while Hambantota district shows a similarity (Gini ratio – 0.28) within the milling industry in that area.
- 5) Due to the fact that, 38% of the studied mills in Polonnaruwa district had started milling in the last decade, a remarkable amount of new entrants can be seen. However, almost all of those mills are small scale. Large scale mills were established over 25 years ago.
- 6) The main barriers for the new entrants for the industry are (a) requirement of a large amount of capital (b) requirement of a vast knowledge and experience about the industry (c) access to technological knowledge about milling industry and (d) industry competition.
- 7) Nearly 23% of paddy mills in Polonnaruwa and 10% in Hambantota are equipped with high technological modern machinery like Color Sorters and modern polishers. Nearly 80% of the mill owners in Polonnaruwa own dryers, so that rice processing in the rainy season also can be carried out.

7.1.2 Rice Miller Conduct in the Market

- 1) Most of the large scale and medium scale mill owners in Polonnaruwa buy paddy mostly from collectors through brokers. With the assistance of brokers, good quality paddy can be obtained on credit. But, in mills located in major producing areas, the main paddy collecting method is purchasing paddy directly from farmers and from farmer level collectors. In the Hambantota district, the presence of brokers is minimum and mill owners directly purchase paddy from farmers.

- 2) The difference in moisture content of paddy is the main factor that influences the buying price. Receiving of low quality paddy (over 70% of millers responded) lack of consistent electricity supply and high electricity price are another main constraints (nearly 50% of millers responded),
- 3) High degree of inequality was found in storage ability, and pledge loans obtained among different categories of millers
- 4) Nearly 6% of millers without a brand name frequently sell their brown rice to major and medium scale millers in Polonnaruwa.
- 5) Large scale mills do rice marketing mainly in Colombo and suburbs and for small scale mills, major marketing channels are cities in other districts and the estate sector.

7.1.3 Rice Market Performance Analysis

- 1) By analyzing secondary data of the past 10 years, analysis of producer shares of Polonnaruwa and Hambantota shows a slightly increasing trend with frequent fluctuations.
- 2) Most of the millers have attempted to sell their rice to the market under a certain brand name. In Polonnaruwa and Hambantota, 94% and 77% of millers sell their rice under their own brand names.
- 3) The results of the price data analysis show that the average farmer's share of consumer price of rice for Hambantota is 77% and for Polonnaruwa 70%.
- 4) Training for mill owners remains minimum but the proper training is very important for producing good quality rice. Large scale millers are mostly trained in India at their own expense. Therefore proper process in this is a must.
- 5) Only 04 mills in Sri Lanka have received the certificate of Good Manufacturing Process from Sri Lanka Standardization Institute. Among them, 02 mills are situated in Polonnaruwa. Each of these mills exports rice and SLSI monitors each and every steps from farmer to consumer.
- 6) 94% of millers in Polonnaruwa and 77% in Hambantota have their own brand names for their rice.
- 7) Nearly 28% of electricity cost comprises of the processing cost of parboiled rice in Polonnaruwa
- 8) Sri Lanka exports 3000 metric tons of rice bran monthly to India in order to produce rice oil.
- 9) The amount of paddy husk collected per day in the Hambantota district is nearly 300 metric tones and it is a huge environmental problem in those areas.

7.2 Conclusions

The increasing paddy production, stabilization of domestic rice consumption and the increasing dynamism of rice processing and domestic markets call for a rethinking of the general direction of the rice milling industry in Sri Lanka. The study found that

during the last decade, rice milling industry has undergone rapid structural changes in technology, product upgrading and rice quality. At the beginning of the last decade, the use of new technology for parboiling, drying, polishing and grading was minimum and was available only in few mills in Polonnaruwa. However, diffusion of new technology has taken place rapidly during the last decade. As an example, the study has found that nearly 80% of mills use dryers instead of old method of sun drying. The rice quality has also improved in line with the upgrading of new technology. Despite the improvement of the quality of rice, the quality of paddy is still a burning issue faced by the millers. Lack of consistent electricity supply and high electricity charges, lack of modern milling equipment for small scale millers, lack of stable output market, and difficulty to compete with large scale millers are the other major problems faced by the millers.

The results of market structure analysis indicate that the rice milling industry in Polonnaruwa can be characterized as slightly concentrated while in Hambantota, the industry is highly competitive. However, the study has found that a high degree of credit affordability, large quantity of paddy storage ability during the harvesting season and their established brand loyalty, provide major rice millers an opportunity to exercise market power during the off season. The lack of investment capital, experience about the sector and the technical know-how in milling are major entry barriers to the industry. The method of classification of rice mills in Sri Lanka is largely conventional. It is time for the introduction of a new classification. A proper data base on rice milling industry in the country is still a weak area although it is vital for food security. Therefore, there is a need of a detailed census.

Market conduct analysis indicates that the role of brokers is dominant in paddy purchasing in Polonnaruwa mainly because the millers can obtain quality paddy on credit basis from brokers. Therefore, many of the medium and large scale millers obtain the service of a broker. Though the service of the brokers is not very prominent in Hambantota, many millers revealed that the ceiling price of rice is a constraint to produce quality rice. The study revealed that the major problem encountered by the millers in both districts, is receiving low quality paddy. The difference in moisture content of paddy is the main factor that influences the buying price. There is a strong relationship between storage ability, credit affordability and the market power especially during the off season. The major selling markets of the majority of millers in both districts were outstation markets.

The analysis of industry performance has found that farmers share in consumer price of rice has shown a volatile trend. However, it has shown slightly increasing trend during recent years which is quite apparent in Hambantota. Upgrading the competency of personnel in milling industry in new milling technologies especially of small scale millers is vital for the sustainability. The information relevant to the standards implies that there is no wide variation between the local standards and the standards in other countries. Millers who process improved rice using proper grading and Sri Lanka Standards Certification should be given an opportunity to sell

their products with exemption of ceiling price to a certain extent. Price fixing mechanism according to the rice grades practised by Malaysia is a good example. Awareness of adopting cleaner production techniques in rice milling industry is another area of concern. Analysis of rice retail prices of all rice consuming countries show that the Sri Lankan rice prices are competitive. Despite the gradual increasing trend of prices in countries like Thailand, Indonesia, Pakistan, Philippines and China, prices in Sri Lanka have been stable for a reasonable period.

7.3 Recommendations

- 1) A proper data base on rice milling industry in the country is still lacking despite its significance in food security. Study recommends the need of a detailed rice mill survey including available machinery, milling capacity, rice quality and work force etc. Therefore, the need of a detailed census is vital.
- 2) The study points out the necessity of a new classification based on the literature in some other rice producing countries. It should be as follows: Per day milling quantity of paddy (Mt) of less than 8 is small, 8-20 is medium and more than 20 is large.
- 3) Low interest credit programmes through a Credit Guarantee Fund should be implemented especially for small and medium scale millers for modernization of mills. The small scale millers must be given priority when the stocks of Paddy Marketing Board are released during the off season.
- 4) It is essential to implement awareness programmes at farm level for farmers as well as operators to produce quality paddy in using combine harvesters. Incentives should be provided for supply of higher quality paddy. Implementing government purchasing prices separately for high quality and normal quality as practised in India is necessary. There is also a need to Encourage the use of simple moisture meters at farm level.
- 5) Sri Lanka has already planned to export rice in the near future. There is a growing trend among the consumers for well graded quality rice in Sri Lanka as well as in other rice consuming countries. Defining mandatory grading and standards for Sri Lankan rice and collaborating with the private sector to enforce them as a vital step. Technical capacity to achieve the required standards needs to be build. Hence, introducing ceiling prices based on graded rice according to the standards is recommended. This may be helpful to increase the quality of rice reaching international standards.
- 6) There is an urgent need to conduct a technical study on electricity consumption of different type of millers with special reference to cost effectiveness, constraints and solutions to overcome those problems. Introduction and creation of awareness for millers about generation of electricity from paddy husk

are necessary. Research should also be strengthened in this area. The authorities need to Take measures to ensure effective, efficient energy supply, best practices, and an appropriate tariff.

- 7) A vibrant mechanism like market intelligence unit to facilitate especially small scale millers for increasing the affordability and accessibility of modern technology is vital. This mechanism should include low interest credit programmes, information regarding the accessibility of new equipment, operations and maintenance etc.
- 8) Color sorters, water jet polishers and modern graders are heavily expensive machineries in the industry. Two millers found during the study carry out color sorting, polishing and grading rice on hire basis from millers. This is a method found in Vietnam rice milling industry. This mechanism can be promoted in order to enhance the capacity of small scale millers.
- 9) In order to enhance the industry, there is an urgent need to upgrade the competency of personnel in the milling industry in new milling technologies as per the needs of changed environment.
- 10) When new mills are established, they must be centralized in major rural producing areas. That will minimize environmental problems caused by the mills centralized in urban areas. It will also reduce interference of brokers and enhance the rural economy.
- 11) Measures should also be taken to find out ways and means of utilizing paddy husk wasted on large scale in the Hambantota district. A huge amount (nearly 3000mt) of rice bran is monthly exported to India from major rice processing areas. This can be used for extracting rice oil which is one of the finest edible oils. Therefore, encouraging investment for establishing rice bran oil manufacturing plants in Polonnaruwa area is recommended.
- 12) The present taxation procedure needs to be restructured in order to ensure sustainability of the industry. It is further recommended that a detailed study be conducted to evaluate the merits and demerits of different taxation systems with a view to designing an appropriate taxation system.

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Annex Table 1: Minimum Purchasing Price of Paddy by the Government during the Period 2000-2011

Year	Purchasing Price (Rs/kg)	Purchasing Authority
2000	Nadu -10.00-12.00	Cooperative Wholesale Establishment
	Samba -14.00	
	Raw red -13.00	
2001	Nadu -13.00	Cooperative Wholesale Establishment
	Samba -14.00	
	Raw red -13.00	
2002	Paddy purchasing price - 13.00	Alevi Saviya Programme
2003	Paddy purchasing price - 13.50	-
2004	Nadu -15.50	Cooperative Societies, Agrarian Centers and Farmer Organization
	Samba 16.50	Cooperative Societies, Agrarian Centers and Farmer Organization
2005	Nadu -15.50	Cooperative Societies, Agrarian Centers and Farmer Organization
	Samba 16.50	Cooperative Societies, Agrarian Centers and Farmer Organization
2006	Nadu -16.50	Agriculture Production & Marketing Authority
	Samba -16.50	
2007	Nadu -16.50	Agriculture Production & Marketing Authority
	Samba -16.50	
2008	Nadu -28.00	Agriculture Production & Marketing Authority
	Samba -30.00	
2009	Nadu -28.00	Agriculture Production & Marketing Authority
	Samba -30.00	
2010	Nadu -28.00	Paddy Marketing Board
	Samba -30.00	
2011	Nadu -28.00	Paddy Marketing Board
	Samba -30.00	

Source: MFPAD/ HARTI

Annex Table 2.1: Monthly Producer Prices of Short Grain (Samba) Paddy

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	13.11	16.02	16.28	20.67	15.12	19.50	16.92	17.07	36.02	38.50	41.53	31.98
February	11.87	16.45	16.89	17.59	14.96	16.56	13.64	16.63	29.77	38.25	37.55	33.03
March	10.23	12.80	14.95	11.81	14.42	13.88	12.01	14.65	31.51	31.64	32.44	29.76
April	9.99	11.53	14.11	11.86	14.88	14.32	12.71	14.87	32.93	30.48	29.56	30.23
May	10.52	11.79	14.51	12.36	15.67	14.54	12.05	15.38	35.45	33.74	30.03	30.48
June	10.62	11.95	14.71	12.35	15.75	13.92	12.29	16.50	34.89	33.22	28.00	29.68
July	11.03	12.13	14.80	11.29	16.28	12.31	13.32	18.35	35.39	31.68	28.05	27.78
August	12.42	12.58	16.24	11.31	17.57	13.10	12.68	18.63	38.73	34.66	25.95	25.76
September	11.83	12.38	15.87	12.05	19.74	17.00	14.59	19.82	35.14	36.09	26.09	26.23
October	11.59	12.28	17.90	12.54	19.16	18.44	14.97	22.96	35.86	37.66	27.76	30.51
November	13.99	14.09	19.03	13.58	21.75	18.37	15.34	28.93	37.03	39.31	33.39	33.89
December	14.65	14.84	21.40	14.56	21.50	18.67	18.19	30.32	38.84	41.68	32.93	34.86
Average	11.82	13.24	16.39	13.50	17.23	15.88	14.06	19.51	35.13	35.57	31.11	30.35
S.D.	1.43	1.62	2.06	2.74	2.54	2.38	1.91	5.04	2.56	3.39	4.53	2.71
C.V.	12.07	12.25	12.59	20.31	14.74	14.98	13.60	25.86	7.28	9.53	14.56	8.94

Source Hector Kobbekaduwa Agrarian Research and Training Institute

Annex Table 2.2: Monthly Farm Gate Prices of Long Grain White (Nadu) Paddy

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	11.53	12.75	17.48	13.27	14.90	16.21	13.72	15.26	32.93	34.50	37.60	27.17
February	9.88	13.31	17.06	12.67	14.82	12.63	10.97	15.15	26.39	28.55	29.99	28.89
March	8.19	10.20	12.27	10.99	13.84	13.34	10.63	13.00	26.89	27.62	24.46	27.68
April	8.09	9.82	12.53	11.21	13.94	13.81	11.86	13.47	29.94	27.82	25.03	28.26
May	8.04	10.65	12.76	11.47	14.07	13.78	11.48	15.32	32.47	31.55	25.94	28.52
June	7.87	11.16	12.83	11.34	14.76	12.88	11.97	16.73	31.72	31.42	23.13	27.93
July	8.08	12.73	12.12	11.13	15.33	11.25	12.64	18.24	27.60	29.64	22.78	26.50
August	9.32	12.83	12.56	11.08	16.11	11.20	11.93	18.42	30.43	30.45	19.28	23.42
September	9.36	11.36	11.82	10.94	16.61	11.85	13.23	16.78	29.22	30.88	24.28	23.33
October	9.88	12.22	12.56	11.80	16.62	13.50	13.21	18.95	33.30	33.00	26.13	26.77
November	11.98	13.75	12.95	13.17	19.05	14.13	13.18	26.64	34.03	34.54	29.04	29.38
December	11.57	14.21	14.29	13.77	17.31	15.33	15.76	28.10	36.14	36.60	27.92	30.05
Average	9.48	12.08	13.43	11.90	15.61	13.33	12.55	18.00	30.92	31.38	26.30	27.32
S.D.	1.46	1.37	1.81	0.98	1.51	1.45	1.34	4.56	2.91	2.72	4.40	2.02
C.V	15.36	11.30	13.47	8.26	9.65	10.86	10.68	25.32	9.41	8.66	16.74	7.40

Source: Hector Kobbekaduwa Agrarian Research and Training Institute

Annex Table 2.3: Producer Prices of Paddy (Red Nadu) in Hambantota - Rs/Kg

Period	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	12.75	12.62	16.60	16.33	16.00	20.00	13.93	18.13	34.33	33.89	39.33	27.92
February	11.33	12.94	15.00	14.83	15.83	16.80	13.13	18.23	28.42	29.33	35.00	31.11
March	10.71	12.61	15.73	13.08	15.00	15.29	12.55	18.32	31.70	27.00	28.13	27.83
April	11.36	12.46	14.00	12.13	16.10	14.84	12.48	15.70	34.23	24.18	27.82	27.67
May	11.00	12.67	13.65	12.75	17.00	14.58	12.16	15.68	34.01	29.26	27.35	28.46
June	10.35	13.12	13.50	12.10	17.50	14.17	12.13	20.62	35.35	30.41	24.30	28.50
July	10.10	13.50	13.75	12.20	19.67	13.87	12.34	17.28	29.43	26.96	24.74	25.04
August	10.60	13.75	13.75	11.38	17.90	12.38	11.80	17.28	29.33	29.61	19.79	24.47
September	10.87	13.81	13.10	12.05	17.90	13.24	12.30	19.22	28.10	30.07	22.10	24.92
October	10.40	14.50	14.71	12.15	17.75	13.94	13.26	20.59	30.37	32.22	25.35	27.60
November	11.65	16.75	13.50	13.00	21.40	14.30	14.23	25.64	32.00	33.42	28.54	29.46
December	12.90	16.00	14.77	15.50	21.43	14.68	15.19	24.60	33.85	35.58	27.58	29.92
AN-AVG	11.17	13.73	14.34	13.13	17.79	14.84	12.96	19.37	31.76	30.16	27.50	27.74
S.D.	0.86	1.33	1.00	1.50	2.00	1.87	0.98	3.02	2.46	3.11	5.07	2.05
C.V.	7.69	9.67	6.98	11.43	11.27	12.59	7.57	15.59	7.76	10.31	18.45	7.39

Source: Department of Census and Statistics

Annex Table 2.4: Farmers Share on Consumer Price (Colombo) of Samba Grade II Rice

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg
January	66	78	72	77	73	63	64	68	77	83	76	74	73
February	66	78	75	67	73	55	54	67	65	83	69	72	69
March	58	64	67	54	70	53	51	62	66	70	65	66	62
April	56	59	66	60	69	59	56	65	59	68	65	69	63
May	60	61	68	65	68	62	54	65	78	74	67	69	66
June	61	63	70	65	68	60	56	68	77	73	65	67	66
July	64	63	71	61	69	53	59	74	79	71	66	65	66
August	70	68	78	62	74	58	57	74	85	78	62	61	69
September	64	66	75	66	71	71	63	70	77	79	65	64	69
October	64	64	83	69	67	74	63	70	80	82	69	73	71
November	73	69	79	69	72	71	64	78	81	85	76	79	75
December	72	70	84	71	69	69	73	77	84	81	75	80	75
Average	65	67	74	66	70	62	59	70	76	77	68	70	69
S.D.	6	6	2	7	6	5	8	5	5	6	4	6	4
C.V	9	8	3	11	9	8	13	8	6	7	6	8	6

Source: Hector Kobbekaduwa Agrarian Research and Training Institute

Annex Table 2.5: Farmers Share on Consumer Price (Colombo) of Nadu Grade I Rice

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg
January	69	78	85	70	74	67	65	65	80	80	78	72	74
February	64	81	80	68	72	55	54	63	66	67	64	73	67
March	57	65	62	63	69	66	57	57	65	70	60	70	64
April	59	63	70	66	69	70	63	61	68	73	68	72	67
May	60	67	71	68	67	71	60	65	79	80	71	73	69
June	60	71	71	64	70	66	62	70	76	80	65	71	69
July	63	79	68	66	70	60	64	75	68	75	65	68	68
August	69	78	71	66	73	61	62	74	77	77	55	61	69
September	67	69	68	65	73	63	66	67	74	78	71	64	69
October	72	73	71	70	73	72	66	73	82	83	75	73	74
November	80	78	72	71	78	71	62	79	83	85	77	78	76
December	74	74	78	70	72	70	69	79	86	82	72	76	75
Average	66	73	73	67	72	66	63	70	75	78	68	71	70
S D	7	6	6	3	3	5	4	7	7	6	7	5	4
C V	11	8	8	4	4	8	6	10	9	7	10	7	5

Source: Hector Kobbekaduwa Agrarian Research and Training Institute

Annex Table 2.6: Farmers Share on Consumer Price (Colombo) of Raw Red Rice

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg
JAN.	74	82	75	82	84	76	72	81	90	87	96	81.72
FEB.	67	80	62	76	81	68	71	69	70	76	87	73
MAR.	66	79	69	73	76	68	70	72	79	72	80	73
APR.	70	80	70	68	80	74	69	66	82	70	81	74
MAY	68	79	68	73	83	75	67	67	86	80	81	75
JUN.	65	82	71	71	85	74	67	84	89	82	74	77
JULY	65	83	73	73	85	75	69	69	76	73	80	75
AUG.	72	85	71	70	75	69	66	69	76	82	67	73
SEP.	73	84	68	80	67	74	68	76	73	82	76	75
OCT.	72	87	77	76	69	77	72	79	83	89	86	79
NOV.	79	92	69	77	84	78	71	84	84	90	92	82
DEC.	82	80	76	88	81	76	69	74	88	96	83	81
AVG	71	83	71	76	79	74	69	75	81	82	82	77
S D	5	4	4	6	6	3	2	7	7	8	8	3
C V	8	5	6	7	8	5	3	9	8	10	10	5

Source: Department of Census and Statistics

Annex Table 3: Rice Specification in India, Pakistan, and Bangladesh

India	Pakistan	Bangladesh
Long grain = 6.2mm	Extra long grain = ≥ 7.00 mm Long grain = ≥ 6.00 mm-6.9mm Medium grain = ≥ 5.0 mm-5.9mm Short grain = ≤ 5.0 mm	Extra long grain = > 7.00 mm Long grain = 6.0mm-6.99mm Medium grain = 5.0mm-5.99mm Short grain = ≤ 5.0 mm Shape= length/breadth Slender = > 3.0 Medium = 2.4-3.0 Bold (coarse)=2.0-3.39 Round = < 2.0
Broken = $< 2/3$ th of grain length Fragments = $< 1/4$ th of grain length	Head rice = $\geq 8/10$ th of grain length Broken = $3/4, 1/2, 1/4$ th of grain length, varying according to grades of rice Small broken = $\leq 2/10$ th of grain length	Head rice = $\geq 8/10$ th of grain length Broken = $\geq 1/2$ th of grain length Small broken = $\leq 1/4$ th $< 1/2$ th of grain length
Chalky kernels = kernels that at least half of which are milky white in color and brittle in nature	Chalky kernels = kernels of which 50% or more of the surface area white like the color of chalk	Chalky kernels = kernels ,whole or broken ,one half or more of the surface of which is white like the color of chalk.
Damaged kernels = kernels ,whole or broken ,that are internally damaged	Damaged kernels= kernels of which 25% or more are distinctly discolored or damaged by heat ,water ,diseases, insect or other means.	Damaged kernels= kernels, whole or broken ,which are distinctly damaged by insects ,water, fungi or any other means which materially affect the quality of the grains.
Discolored kernels = kernels ,whole or broken ,that are discolored materially affecting the quality	Yellow kernels= kernels of which 25% or more the surface area have turned yellow in color.	Yellow kernels= kernels of which 25% or more the surface area have turned yellow in color.
Foreign matter = include dust ,stones, lump of earth, chaff, stem or straw and any other impurities	Foreign matter = all materials other than rice kernels ,bran or paddy	Foreign matter = all matter other than rice kernels ,rice polishing and paddy
Other rice = contrasting and / or inferior varieties of rice	Green rice = kernels of green color in cargo (Brown) rice which when broken are also green in color from inside or in the endosperm	Green rice = kernels ,whole or broken ,which are unripe and under developed
Red kernels = kernels ,whole or broken ,which have 25% or more of their surface coated with red bran	Shriveled kernel = kernel which are spear like in shape and whose widths are distinctly thinner than normal.	
Dehusked grain = kernels ,whole or broken ,that have more than $1/4$ th of surface of the area covered with bran	Red striped kernel = kernels of which 25% or more of the surface area are covered with outer red bran layer	
Milling degree = well milled ,reasonably well milled (varying according grades of rice)	Foreign grains = seeds other than rice such as wheat pulses, etc.	Foreign grains = head rice and broken other than the variety concerned
	Under milled rice = rice which is not equal to the milling requirements for "extra well milled, "reasonably well milled "or "ordinary milled "as defined under grades of milled rice for milling degree.	
	Milling degree=extra well milled ,well milled, reasonably well milled ,ordinarily milled (varying according to grade of rice)	Milling degree= husked rice, under milled rice, reasonably well milled ,well milled, extra well milled

Annex Table 4: Details of Rice Mill Expenses

Variety - Nadu Grade I

Rice Mill Capacity Paddy -16000Kg/Rice- 10400Kg Output -65%, 22 Working Days

Labour Charges	Monthly Expenses	Per day	Rs/1Rice Kg
Salaries (15 labour *Rs.600*22 working days)	198,000	9,000	0.87
O.T and other Allowances , Loading and Unloading	62,700	2,850	0.27
E.P.F and E.T.F	23,760	1,080	0.10
	284,460	12,930	1.24
Factory Overheads			
Electricity Charges	299,728	13,624	1.31
Mill Maintenance	84,656	3,848	0.37
Depreciation	52,083	2,367	0.23
	426,811	19,400	1.91
Other Direct Expenses			
Packing Material	132,000	6,000	0.58
Mess Expenses (Rs. 1500 /day)	33,000	1,500	0.14
	165,000	7,500	0.72
Distribution Expenses			
Transport Charges	297,000	13,500	1.30
Motor Vehicle Maintenance	100,000	4,545	0.44
	397,000	18,045	1.74
Administration Expenses			
Total	54,575	2,481	0.24
Finance Expenses			
Loan Interest	40,000	1,818	0.17
	40,000	1,818	0.17
Total Expenses	1,328,166	64,916	6.02

Source: Authors' Survey, 2011