

Rice Value Chain in Polonnaruwa, Sri Lanka

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FOREWORD

Rice to Asians is like McDonalds or Coca Cola to someone in the United States of America. This is shorthand, obviously, for emphasizing nutritional dependencies and cultural associations with respect to rice. Indeed, rice and culture are inextricably intertwined in vast swathes of the massive region that is Asia.

As is the case with most Asian countries, Sri Lanka still views paddy/rice as a strategic commodity due to its importance in the diet of the population and given as the sole or principal value-generating activity among a significant segment of farmers. As important is the fact that the relationship between Sri Lankan life and rice cultivation is so intimate that it permeates all aspects of Sri Lankan culture and history. Paddy is cultivated in almost all parts of the country, except at very high altitudes. It is the main contributor to the rural economy since the majority of rural households are engaged in rice production as their main or supplementary source of livelihood.

The overall objective of this study is to carry out a detailed analysis of the paddy/rice value chains in the Polonnaruwa District which is the largest milling zone in the country. The specific objectives are to examine the existing practices of the supply chain of paddy/rice and its allied products, estimate the gross margins, market share and returns received, mapping and thereby ascertaining value additions created by different actors throughout the paddy/rice value chains.

It is therefore an exercise that seeks to discover the strengths, weaknesses, opportunities and threats of key value chain actors. The study provides related information on other rice producing countries, different practices of value chain actors, costs and margins, value additions, by products, constraints and opportunities, leveraging points and recommendations for upgrading. The outcome is an in-depth overview of the nature of the farm to fork paddy rice value chain in the major milling zone of Polonnaruwa Sri Lanka with significant insights on social, economic, cultural, environmental, political and theoretical frames that could be of immense value when examining and advocating for other such processes.

I congratulate the coordinator of this study, Nalaka Wijesooriya, and the research team for completing this important task and sincerely hope that the knowledge produced and recommendations offered will receive the attention they deserve from all stakeholders including policymakers and the implementers of strategies they design.

Malinda Seneviratne
Director/Chief Executive Officer

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At the outset we warmly acknowledge the co-operation extended by the farming community in Medirigiriya and Dimbulagala producing areas, paddy and by product collecting traders, rice mill owners in Polonnaruwa district for their assistance during the field survey. Without their support, this project would not have been a success.

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Nalaka Wijesooriya
Virajith Kuruppu
Duminda Priyadarshana

EXECUTIVE SUMMARY

The relationship between Sri Lankan life and rice cultivation is so intimate, that it permeates all aspects of Sri Lankan culture and history. Like most Asian governments, Sri Lanka still views paddy/rice as a strategic commodity due to its importance in the diet of the poor in employment and income generation of farmers. Our ancestors made the country the “Granary of the East”. Rice production is an important source of livelihood for around 3.6 million rice-farmers with their family members included. In addition, a large number of people engaged in each node of the farm to consumer paddy rice value chain runs both vertically and horizontally. The overall objective of this study is to carry out a detailed analysis of the paddy/rice value chains in Polonnaruwa district which is the largest milling zone in the country. The specific objectives are: to examine the existing practices of supply chain of paddy/rice and its allied products, to estimate the gross margins, market share and returns received and value additions created by different actors throughout the paddy/rice value chains through mapping the value chain (VC), to discover the strengths, weaknesses, opportunities and threats of key value chain actors throughout the VC.

Multi-stage random sampling was used to select the paddy farmers for the study and purposive sampling for other stakeholders in order to ensure the information richness. Sampling procedure is mainly determined by the conceptual requirements and farmer survey was done in the Medirigiriya and Dimbulagala producing areas in 2019 *Yala* and 2019/20 *Maha* season. Apart from the farmers, other key informants like collectors, rice millers, by product collectors, by product users, key officials and rice traders were selected carefully who hold special and expert knowledge about the phenomenon to be studied and are willing to share information and insights.

The average yield of paddy under major irrigation in Polonnaruwa district is often 6 to 8 percent higher than the normal average yield under major irrigations in the whole country. Further, the average yield of Medirigiriya and Dimbulagala indicates a higher yield than that of Polonnaruwa district. The study shows that the average yield ranged between 89 - 138 Bu/ac in the above producing areas under the major irrigation schemes. The farm gate price for an Rs/kg of quality paddy ranged between Rs 48.00 - 52.00, which showed an increase of 25 percent compared to that of 2018. This was due to the decision to increase the guaranteed price of paddy to Rs 50.00/Kg from the *Maha* season 2019/20. The most popular paddy/rice marketing channel in the surveyed producing areas is,

Farmer ➡ Collector ➡ Rice Miller ➡ Wholesaler ➡ Retailer ➡ Consumer
Sometimes brokers function between collectors and millers. The role of brokers becomes prominent in the time when paddy stocks are scarce. The analysis found that value addition takes place only in two points in the entire value chain at the farmer and the miller levels.

Value addition by the farmers at farm gate level was about 13 percent of the cost of production which is the cost for drying paddy to the standard quality (14% moisture). A major problem faced by farmers is the lack of an appropriate way to dry paddy. At present, one side of the carpeted road is used for this purpose.

Millers add a higher percentage in value chains. Value is added for cleaning paddy stocks, storing and packing rice and transportation of rice to the major cities and this value addition is 24 percent of the cost of production of rice. There are about 100-110 functioning rice mills in the district which need about 832400 mt of annual supply of paddy. The marketable surplus of paddy in the district in a normal producing year is 471,000mt and nearly 50,000 farmers throughout the Polonnaruwa district annually release this quantity to the market. Thus the shortage quantity which is about 360,000 mt is obtained mainly from the Ampara, Batticaloa and Anuradhapura districts by the large scale millers in Polonnaruwa.

Rice mills annually produce 44,000mt of rice bran and nearly 13,000 mt of rice polish as major by-products in the process of rice production. Rice bran is provided to RICE-O Company, an Indian processing company, which produces rice oil in “Laxa Uyana” Industrial park in Polonnaruwa. The rice polish is supplied to animal feed producing industries in Bingiriya, Kuliypitiya, Udubaddawa in North Western Province. The major problem faced by animal feed manufacturers is suppliers adulterating rice bran and polish.

The husk is mainly used in boilers to produce the steam for parboiling and drying of the paddy in the rice mill is operated on paddy rice mills. The excess is provided to cement factories in Trincomalee and Puttalam as a raw material. There are about 20 collectors each for collecting rice bran and polish and husk connected to the rice mills in Polonnaruwa.

It was found that in 2011, there were three paddy collecting centres in one village. However, at present the number of collecting centres at village level has reduced giving way to about nearly 20 multipurpose purchasing and selling centres in one Divisional Secretariat for purchasing paddy, selling agro chemicals, fertilizers, seeds and sometimes hardware items.

Rice milling industry has undergone vast structural changes with a concentrated market power. This is mainly because of the high degree of credit affordability, large quantity of paddy storage ability during the harvesting season and established brand loyalty. In comparison to 2011, by 2019 the production of four largest millers in major milling zone Polonnaruwa has been doubled while their market power too has significantly increased. Simultaneously, five forces in the industry are also favouring the millers providing more market power. The four largest millers in Polonnaruwa are the four largest millers in the

country too. Their share of the total rice production in Polonnaruwa is nearly 50 percent. In calculating these concentration values, inadequacy of proper updated information about the number of rice millers in the country and their capacity is a limitation.

The rice millers could be identified as the major actor in the paddy/rice value chain in Sri Lanka. More importantly, millers exercise dual roles as the buyer when purchasing paddy and as the seller when selling rice to the wholesalers and retailers. The large scale millers as the most specific actor in the middle of the paddy rice value chain has the ability to impose market power either upstream or downstream. This is specific when compared with most of the rice producing countries. In addition to that there are less number of actors in value chain in Sri Lanka than that of other countries. In other words, the length of value chain is comparatively short. In addition, a certain number of small scale rice mills have left the industry. The capacities of major and medium scale rice mills have increased. This strongly justified the oligopolistic/oligopsony nature of the paddy/rice milling industry in Polonnaruwa.

Large scale rice millers have entered the seed paddy manufacturing, fertilizer trading and paddy/rice packing material manufacturing businesses and they contribute the chain development as well. In the meantime they penetrate their market power both up and down stream of the paddy to rice value chain.

The ceiling price law was active for rice during the study period. The rice prices become stable for a certain extent when the ceiling is implemented. During that period, the ratio between the farm gate price of paddy and the retail price of *Nadu* rice ranged between 1.97 -2.2. The mostly prevailed price ratio was 2.04. When the absence of price ceilings is considered the ratio between the farm gate price of paddy and the rice retail price tends to exceed the above value. Accordingly, it is necessary to increase the number of the largest millers which will result in an increase competition.

For this purpose, investments should be made to establish large automated rice mills in major producing areas with few mills at present and allow to value chain development. It will upgrade the value chain and increase the competition causing equal opportunities for all the actors.

According to the identified constraints through the VC analysis some leveraging points can be undertaken. Those points are helpful to VC development, creating business models by focusing special emphasis for small holder paddy farmers, identifying the interventions, investment opportunities and VC financing needed to strengthen the chain at farm level.

It was recommended to design strategic programmes to replicate among the other farmers the agronomic practices that obtain a high yield in producing areas like Medirigiriya and facilitate to increase their average yields, establish a proper mechanism for fixing Minimum Support Prices or Guaranteed Prices for the staple crops and a Price Ceilings for food commodities. A formal mechanism with the participation of HARTI, CBSL, DOA, and Universities & Consumer Authority is recommended in this regard. Further, facilities should be provided to farmers to feed information about their stocks to a digital platform, through which a programme can be implemented to link buyers. Developing horizontal linkages (farmer-farmer) and vertical linkage (farmer- large scale milling company) for reducing marketing costs, establish farm machinery hubs which will provide custom services to farmers, with an appropriate public private partnership strategy (PPP). Providing mechanical dryers and multipurpose drying pavements to farmers, farmers' associations, paddy collectors under the PPP strategy and Introducing credit schemes to encourage the private sector and establishment of systems like warehouse receipt marketing (WHRM) which are familiar to the farmer are also recommended.

Recommendations

At Rice processing and distribution level include establishment of modern automated private sector mills in high surplus producing rural areas especially in the Eastern and North Central Provinces, promoting local engineering companies for manufacturing rice milling equipment's, encouraging rice bran oil industry with investments. RHA is a very good source for Silica industry which is practiced in other countries. Encouraging private sector to invest in rice based other foods like rice biscuits, rice snacks which are popular in all other rice producing countries.

Similarly, the government should encourage the medium scale successful millers to establish modern automated private sector mills in high surplus producing rural areas especially in the Eastern and North Central Provinces. Strengthening small scale rice millers for collective actions. And the private sector should be encouraged to establish rice based and by-product based industries in rural producing areas like Dimbulagala, Padaviya, Kebithigollewa, Ampara, Lahugala, Pothuvil, Elehera, Vilachchiya, Mannar, Mulativu, Kilinochchi and Batticaloa.

Study recommends the need of a detailed rice mill and stakeholder survey covering the whole country including capacity, machineries, storages, rice types etc. Therefore, the need for a detailed census and ICT based regular updating database is vital. It is suggested to collaborate a study through HARTI, IPHT, PMB and the Ministry of Finance. Enhancing transparency, traceability and trust between stakeholders across the supply chain is vital. Avoiding delayed data release and inconsistent data among different sources through collecting the data diligently for the paddy/rice industry is also recommended. For this

purpose, possibility of introducing the Block Chain Solution Technology to the paddy/rice industry should be examined.

A detailed study is needed for the Rice Oil industry in which only two companies are presently engaged. It is needed to identify the potentials and strategies to popularize the rice oil among the local community. The quantity exported to India as raw rice bran should be investigated. It is needed to investigate the huge amount of by-product released by the industry, Rice Husk Ash (RHA) currently completely underutilized and to find out the strategies for making Silica from RHA.

Innovative millers involved in making value added rice based novel food products (eg: fortified rice products, organic and traditional rice products, rice *Kottu*, cooked rice, biscuits, bread) from rice need to be encouraged by providing finance, technology, research facilities and market and export assistance. Facilitating product upgrading through grading, labelling and certification is also recommended.

Poor and the poorest people in urban, rural and estate sectors need to be correctly identified and their data bases should be digitised. During the high rice price periods, targeted safety net programmes to distribute rice need to be implemented in order to protect poor people. Targeting the poor can be successfully done through Smart cards or Biometric cards. Indonesia's *Raskin*¹ rice distribution programme for vulnerable groups is an example.

¹ Indonesia's subsidized rice programme.

LIST OF CONTENTS

	Page No.
FOREWORD	i
ACKNOWLEDGEMENT	ii
EXECUTIVE SUMMARY	iii
LIST OF CONTENTS	viii
LIST OF TABLES	xi
LIST OF FIGURES	xiii
ABBREVIATIONS	xiv
CHAPTER ONE	
Introduction	1
1.1 Introduction	1
1.2 The Value Chain Approach	4
1.3 Research Problem	5
1.4 Significance of the Study	7
1.5 Objectives of the Study	7
1.5.1 The Broad Objective	7
1.5.2 The Specific Objectives	7
1.6 Limitations of the Study	8
1.7 Organization of the Report	8
CHAPTER TWO	
Review of Literature	11
2.1 Introduction	11
2.2 Rice Sector in India	12
2.3 Rice Sector in Bangladesh	13
2.4 Rice Sector in Philippines	17
2.5 Rice Sector in Myanmar	18
2.6 Rice Sector in Indonesia	20
2.7 Rice Sector in Vietnam	22
2.8 Rice Sector in Bhutan	23
2.9 Rice Sector in Nepal	24
2.10 Rice Sector in Pakistan	24
2.11 Rice Sector in Malaysia	25

CHAPTER THREE	
Conceptual Framework and the Methodology	27
3.1 Introduction	27
3.2 Conceptual Framework	27
3.3 Market Power	29
3.4 Research Design	29
3.4.1 Sampling and Composition of the Sample	30
3.4.2 Study Area	31
3.5 Methods of Data Collection and Data Analysis	32
3.5.1 Gross Margin Analysis (GMA)	33
3.5.2 Value Addition	33
3.5.3 Measures of Concentration of Market Power	33
3.6 Chapter Summary	34
CHAPTER FOUR	
Value Chain Mapping	35
4.1 Paddy/Rice Value Chain	35
4.2 Production and Utilization of Paddy in Sri Lanka and the Study Area Polonnaruwa District:	35
4.3 The Key Actors Involved in Paddy/Rice Value Chain in Polonnaruwa	39
4.4 Farmers	40
4.5 Paddy Collectors (Assembly Traders)	41
4.6 Millers	43
4.7 Paddy Stockists	44
4.8 Degree of Millers Concentration and Market Power in Polonnaruwa District	45
4.9 Brokers in the Paddy Buying System	45
4.10 By-Product Collectors	46
4.11 VC Supporters in Different Levels of the Paddy/Rice Value Chain	46
4.12 Facilitating Functions in the Paddy/Rice Value Chain	47
4.13 Paddy Marketing Board (PMB)	48
4.14 The National Institute of Post-Harvest Management (NIPHM)	49
4.15 Banks	50
4.16 Value Chain Influencers: Policies and Institutions	50
4.17 Paddy/Rice Value Chain Map	51
Paddy/Rice Value Chain in Polonnaruwa and Porter's Five Forces Model (Box 1)	53
CHAPTER FIVE	
Results and Discussion	57
5.1 Farmer Characteristics	57

5.2	Main Cultural Practices	61
5.3	Paddy Production and Utilization	62
5.4	Economic Analysis	65
	5.4.1 Cost of Cultivation Related Agronomic Information	67
	5.4.2 The Yield, Unit Cost and Farm Gate Price	67
	5.4.3 Paddy to Rice Formula	72
	5.4.4 Paddy to Rice Processing Cost	73
5.5	Value Additions along the Paddy/Rice Value Chain	76
	5.5.1 Value Addition at the Farm Level	76
5.6	Marketing Channels	78
5.7	Determination of Guaranteed Price for Paddy and Maximum Retail Price of Rice	80
5.8	By-products Process of Paddy/Rice Value Chain	81
	5.8.1 The Main Paddy Husk Supply Chain	81
	5.8.2 Rice Bran	82
5.9	SWOT Analysis for Paddy/Rice VC	83
CHAPTER SIX		
Findings, Conclusion and Recommendations		
		85
6.1	Findings of the Study	85
6.2	Leveraging Points of Paddy/Rice Value Chain, Need Interventions (Policy Issues)	86
	6.2.1 Pre-Production and Production of Paddy	87
	6.2.2 Rice Processing and Distribution	87
6.3	Conclusion	88
6.4	Policy Recommendations for Paddy/Rice Value Chain Development	89
	6.4.1 Farm Level	89
	6.4.2 At Collector and Miller Level	90
REFERENCES		
		92

LIST OF TABLES

		Page No.
Table 1.1	Trends of Annual Paddy Production, Average Yield, Rice Imports and Population Growth Over the Past Decades	1
Table 1.2	Paddy Productivity of Sri Lanka (Kgs/Ha)	2
Table 2.1	Comparison of Cost of Production and Prices of Paddy and Rice in Sri Lanka and Bangladesh.	15
Table 2.2	Relative Financial Position of Value Chain Actors in Philippines and Sri Lanka	18
Table 2.3	Relative Financial Position of Value Chain Actors in Myanmar and Sri Lanka	20
Table 2.4	Margin Analysis of Domestic Rice Value Chain in Mekong River Delta in Vietnam	22
Table 3.1	Study Sample	31
Table 3.2	Number of Paddy Farmers by DSDs in Polonnaruwa District	32
Table 4.1	The Paddy Surplus Production in Sri Lanka and Polonnaruwa District	38
Table 4.2	Annual Paddy Utilization of Rice Mills in Polonnaruwa	39
Table 4.3	Different Participants in Paddy/Rice Value Chain in Polonnaruwa	39
Table 4.4	Number of Paddy Farmers by DSDs in Polonnaruwa District	41
Table 4.5	Classification of Rice Mills	44
Table 4.6	The Values of Concentration Indices on Milled Rice Production in Polonnaruwa District	45
Table 5.1	Demographic Characteristics of the Sample	57
Table 5.2	Types of Occupation	58
Table 5.3	Experience in Farming	58
Table 5.4	Land Extent	59
Table 5.5	Land Ownership	59
Table 5.6	Satisfactory Level with Irrigation Schemes	60
Table 5.7	Paddy Production & Utilization	62
Table 5.8	Methods of Paddy Marketing	63
Table 5.9	Major Reasons for Selling Wet Paddy	63
Table 5.10	Major Paddy Purchasing Actor	64
Table 5.11	Reasons for Selling to a Particular Actor	64
Table 5.12	Major Problems Faced by the Farmers	65
Table 5.13	Cost of Cultivation per Acre of Paddy (Irrigated) - Polonnaruwa	66
Table 5.14	Milling Outturn of 100 Kgs of Long Grain White Paddy in Parboiled Processing	69
Table 5.15	Millers Earnings from By Products	70
Table 5.16	Rice Value Chain Analysis (VCA) : Post Harvest VCA (Post Production) Parboiled Nadu Rice From Farm Gate at Polonnaruwa to Consumer in Colombo	71
Table 5.17	Summary of the Ratio of Rice Retail and Paddy Farm gate Price in Different Countries	72

Table 5.18	Comparison of Farm gate Price of Paddy, Rice Processing Cost and Rice Retail Price	73
Table 5.19	Cost of Paddy Processing to Rice in Automated Modern Rice Mill, Polonnaruwa (Average 50 mt of Paddy Milled per Day, Rice Variety: Nadu Parboiled)	74
Table 5.20	Relative Financial Position of Actors in the Paddy/Rice Value Chain	76
Table 5.21	Value Addition by the Farmers	77
Table 5.22	Value Addition by the Miller	78

LIST OF FIGURES

		Page No.
Figure 1.1	Seasonal Price Index of Long Grain White (<i>Nadu</i>) Paddy in Sri Lanka	4
Figure 1.2	Typical Paddy/ Rice Value Chain and Associated Business Development Services in Sri Lanka.	6
Figure 3.1	Conceptual Framework for Rice Value Chain	28
Figure 3.2	UNIDO Concepts of Value Chain Analysis	30
Figure 3.3	Annual Marketable Surplus of Paddy in Sri Lanka (%) in an Average Production Year, 2013	31
Figure 4.1	Paddy/Rice Surplus Districts	36
Figure 4.2	Paddy/Rice Deficit Districts	37
Figure 4.3	Distribution of Paddy Farmers by DSDs in Polonnaruwa	40
Figure 4.5	Distribution of Paddy Farmer by Land Size (Acres) in Polonnaruwa District	42-43
Figure 4.6	Paddy Collecting Centers in Polonnaruwa	52
Figure 4.7	Porter’s Five Forces of Competitive Position Analysis	53
Figure 5.1	Cultivated Varieties by Farmers	60
Figure 5.2	Seed Source	61
Figure 5.3	Pre-Production Value Chain 1 for Paddy (<i>Nadu</i> Variety) - Cost of Production in Polonnaruwa	68
Figure 5.4	Milling Outturn of 100 Kgs of Long Grain White Paddy in Parboiled Processing	69
Figure 5.5	Channel One	78
Figure 5.6	Channel Two	79
Figure 5.7	The Guaranteed Price of Paddy in India and Sri Lanka	81
Figure 5.8	Main Paddy Husk Supply Chain	82
Figure 5.9	SWOT Analysis for the Paddy/Rice Industry	84

ABBREVIATIONS

AMIS	-	Agriculture Marketing Information System
BDT	-	Bangladesh Taka
CACP	-	Commission of Agricultural Costs and Prices
CARP	-	Council for Agricultural Research Policy
CBSL	-	Central Bank of Sri Lanka
COL	-	Cost of Living
COP	-	Cost of Production
CR	-	Concentration Ratio
CWE	-	Cooperative Wholesale Establishment
DAE	-	Department of Agricultural Extension
DCS	-	Department of Census and Statistics
DGF	-	Director General Food
DOA	-	Department of Agriculture
DSD	-	Divisional Secretariat Division
FAO	-	Food and Agricultural Organization
FCI	-	Food Cooperation in India
FGP	-	Farm Gate Price
FMCL	-	Farm Machinery Corporation Limited
GM	-	Gross Margin
GP	-	Guaranteed Price
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
HIES	-	Household Income and Expenditure Survey
ICT	-	Information and Communication Technology
IFPRI	-	International Food Policy Research Institute
INR	-	Indian Rupee
IPHT	-	Institute of Post-Harvest Technology
IRRI	-	International Rice Research institute
MADA	-	Malaysian Agriculture Development Authority
MGP	-	Breakeven Price at the Mill Gate
MMK	-	Myanmar Kyat
MOT	-	Ministry of Transport
MPCS	-	Multi-Purpose Cooperative Society
MS	-	Marketable Surplus
MSP	-	Minimum Support Price
mt	-	Metric Tons
NARC	-	Nepal Agricultural Research Council
PDS	-	Public Distribution System
PHP	-	Philippine Peso
PMB	-	Paddy Marketing Board
PPP	-	Private Partnership Strategy
RHA	-	Rice Husk Ash
RICO	-	Rice Oil Brand –Sri Lanka
SWOT	-	Strengths, Weaknesses, Opportunities and Threats
UNIDO	-	United Nations Industrial Development Organization

USD	-	United States Dollar
USDA	-	United States Department of Agriculture
VC	-	Value Chain
VCA	-	Value Chain Analysis
VFA	-	Vietnam Food Association
WRS	-	Warehouse Receipt System

Chapter One

1.1 Introduction

Rice is the world's most important staple food and will continue to be so in the coming decades, be it in terms of food security, poverty alleviation, youth employment, use of scarce resources, or impact on the climate (IRRI, 2016). Rice is the basic grain consumed as a staple food in Sri Lanka which is found in every Sri Lankan kitchen and is the only staple food grain, providing a reasonable amount of food nutrients and nearly half of the calories in the Sri Lankans diet. Rice is the most important crop in Sri Lanka and this sector received utmost attention from governments since it involves the majority of farmers on one hand and all citizens are rice consumers on the other hand. The paddy/rice industry includes which is nearly 3.6 Million farmers and their families, thousands of input and service providers, millers, retailers, and individuals employed in the production, processing, and marketing of its related products. Owing to its significant contribution to the country's economic development, the government has initiated programmes to increase productivity and improve the competitiveness of the rice sector. The rice industry is vital for food security and the economic development of Sri Lanka as its economy relies on the agricultural sector. Promoting the marketing capability of farmers especially the smallholders is the key challenge of increasing farm investment. According to the importance of the rice sector, 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. Like most Asian governments, Sri Lanka still views rice as a strategic commodity because of its importance in the diet of the poor and as an occupation and a source of income generation of farmers.

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

Decade	Population (Millions)	Production (Mn.tonnes)	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	20.6	3.12	4.45	<1
2012	20.3	3.84	4.29	1
2015	20.9	4.81	4.42	<1
2020	21.9	5.12	4.80	<1
Increase Over 1940	3.65fold	20 fold	7.4 fold	

Source: Department of Agriculture, 2010 and Department of Census and Statistics, 2020

According to the Household Income and Expenditure Survey (HIES) of the Department of Census and Statistics the expenditure on rice as a percentage of total food expenditure in 2006/07, 2009/10, 2012/13 and 2016 was 13.9 percent, 17.3 percent, 13.6 percent and 12.5 percent respectively. The ratio of expenditure on food and drink to total expenditure is called the food ratio. The report also revealed that the average food ratio is 37.8 percent in Sri Lanka and the sectorial composition is 32.1 percent in urban, 39.2 percent in rural and 49.8 percent in estate sectors. Among low income groups the percentage expenditure on rice was comparably higher. Hence rice prices play a significant role in consumer food expenditure. According to the HIES, the annual per capita rice consumption was 100.76 kg, 108.9 kg, 110.27 kg and 110.19 kg and 107 kg in 1995/96, 2006/07, 2009/10, 2012/13 and 2016 respectively. It is clear that during the recent past, per capita consumption shows a degree of stability. However, the consumption of rice based food products needs to be added.

Today, patterns of cultivation, marketing, and consumption of rice are changing faster than ever before however it has been observed that there are strong forces working to stabilize and conserve rice systems. Key factors that affect the demand for rice in different ways are income, prices, population growth, and urbanization. As income rises, consumers tend to shift from standard-quality rice to better and high-quality rice. As shown in Table 1.1 Sri Lanka has shown a progressive development in rice production, but marketing remains as a critical issue in the country. This has created an adverse impact on farm income.

Table 1.2: Paddy Productivity of Sri Lanka and Other Asian Countries, 2020 (kg/ha)

Country	Average Yield (kg/ha)
Afghanistan	2999
Bangladesh	4740
Bhutan	4072
Cambodia	3627
China, mainland	7060
Taiwan	6632
India	4058
North Korea	6018
South Korea	6873
Japan	6827
Indonesia	5114
Iran	4558
Iraq	4501
Lao PDR	4386
Malaysia	4255
Myanmar	3796
Nepal	3761
Pakistan	3664
Philippines	4045
Sri Lanka	4795
Thailand	2919
Viet Nam	5816

Source: FAOSTAT, 2020

Some performance indices of the paddy sector are shown in Table 1.1 & 1.2. It clearly shows that both production (tonnes in million) and productivity (t/ha) have increased during the last 70 years. Due to the intervention of all successive governments, rice researchers and the experienced farming community our productivity is competitive compared to the major rice producing countries (Table 1.2).

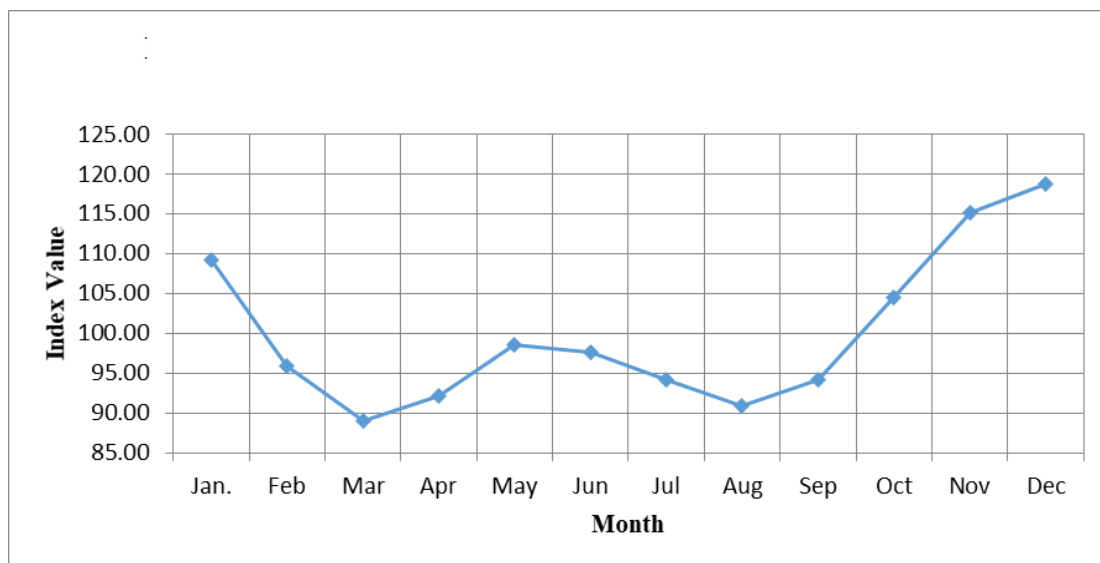
The political economy of rice is changing, and this shapes rice production and consumption. Even though there has been a long history of state engagement in rice stockholding and trading, the state's role is declining sharply. However, rice remains a strategic food security crop for policymakers and voters. There are tremendous variations in tastes and preferences 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 colour pericarp (Ferrero and Nguyen, 2004). The demand for rice is shifting from lower-quality rice to higher-quality rice.

Paddy is cultivated in two main seasons: *Maha* under North east monsoon and *Yala* under South-west monsoon. *Maha* (October to March) usually accounts for about 65 per cent of the annual production and the remaining 35 per cent comes from the *Yala* crop (April to September). The paddy production in the war affected areas like Batticaloa, Trincomalee, 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 these areas.

The marketing institutions played a prominent role to stabilize the market. According to the Department of Census and Statistics of Sri Lanka 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 cultivation in war cleared areas.

In Sri Lanka the seasonal variation of rice prices starts to rise in the month of September every year and reaches the maximum in December and then registers a declining trend. The inter annual fluctuation of long grain white (*Nadu*) paddy is shown in Figure 1.1. As shown in Figure 1.1 price increases nearly 20 per cent and decreases by 15 percent of average price of hundred. 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 (Figure 1.1). During December and January rice prices increase to unaffordable levels and it badly affects urban consumers and other low income groups. In February and March paddy prices decline sharply and this in badly affects the marginalized farmers. At present both paddy purchasing and rice processing are dominated by the private sector millers. To understand the gains and losses along the rice supply chain, from smallholder farm gate to consumers, a value chain analysis is necessary. A comprehensive value chain analysis will show the players that have an advantage over others for which appropriate policy decisions can be formulated. As a descriptive tool, value chain analysis forces the analyst to consider both the micro and macro aspects involved in production and exchange between different actors.

The increasing paddy production, stabilization of domestic rice consumption and the increasing dynamism of rice processing and domestic markets calls for an overhaul in terms of attitudes with regard to the rice industry in Sri Lanka.



Source: HARTI, 2015

Figure 1.1: Seasonal Price Index of Long Grain White (*Nadu*) Paddy in Sri Lanka

This study provides information to understand the structure of rice markets, relationships among market players, value addition in the rice chain, as well as production, processing and marketing constraints that limit the competitiveness of the rice industry in the major milling zone Polonnaruwa.

1.2 The Value Chain Approach

The value chain is a key concept in the development of sustainable food systems. Food Value Chains (VC) are particularly important for the poor and impacts food security directly. As such, food VCs are of strategic importance in national (and global) politics, which in turn often directly impacts the business environment in which VC actors operate. Therefore, understanding value chains requires understanding their complex environment.

The agricultural value chain concept has been used since the beginning of the millennium, primarily by those working in agricultural development in developing countries. The term value chain was first popularized in a book published in 1985 by Michael Porter, who used it to illustrate how companies could achieve what he called “competitive advantage” by adding value within their organization. Subsequently the term was adopted for agricultural development purposes and is now very much in vogue among those working in this field, with an increasing number of bilateral and multilateral aid organizations using it to guide their development interventions.

Agricultural value chains link urban consumption with rural production. Value chain analysis has gained considerable importance in recent years because of the need to

assess the key sources of cost efficiency or the lack of it along the value-chain of the commodity in order to come up with appropriate policy interventions aimed at raising overall value-chain efficiency. The United Nations Industrial Development Organization (UNIDO, 2009) describes a value chain as the entire range of activities that are undertaken to bring a product from the initial input-supply stage, through the various phases of processing, to its final market destination, including its disposal after use. For instance, agro-food value chains encompass activities that take place at the farm or rural level, including input supply, and continue through handling, processing, storage, packaging and distribution. As products move successively through the various stages, transactions take place between multiple chain stakeholders, money changes hands, information is exchanged and value is progressively added. Hence a value chain is a system of interdependent activities.

According to the Kaplinsky & Morris (2000), “Value Chains describe the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use”. In reality, value chains are very complex. Many input supplies are used at the different levels of the chain. For instance, seeds and fertilizers are used in the production of agricultural raw materials; machinery and packaging material are used in the manufacturing of food products. Furthermore, agricultural raw materials can be processed in a wide variety of food products and outputs at different levels of the chain might be flowing into several other chains.

The actors who are directly involved with transforming the physical product into the final product are called the value chain players. The relationships between the value chain players, especially between the farmers and their buyers, are crucially important. Study identified six chain actors who directly deal with the products in the rice value chain in Polonnaruwa district. These are: Farmers, collectors (Assembly Traders), millers, by product traders, rice wholesalers, and rice retailers (Figure 1.2).

1.3 Research Problem

The paddy/rice industry has now become an important issue and sometimes has created political instability in the country. It has been recorded that during the harvesting season farm gate prices declined drastically and during the off season prices increased. Hence, in this situation both farmers and consumers were affected. This has become a major issue discussed by the media and general public in relevant periods. In order to prevent these adverse fluctuations, the government intervenes in paddy/rice marketing in numerous ways, like adjusting Guaranteed Prices (GP), Imposing Price Ceilings in retailing, Government purchasing paddy & selling rice and Paddy Pledging Credit Programmes. Therefore, it is necessary to examine the transmission of values and the forward and backward linkages of farmer to consumer paddy/rice value chain in order to achieve more precise decisions.

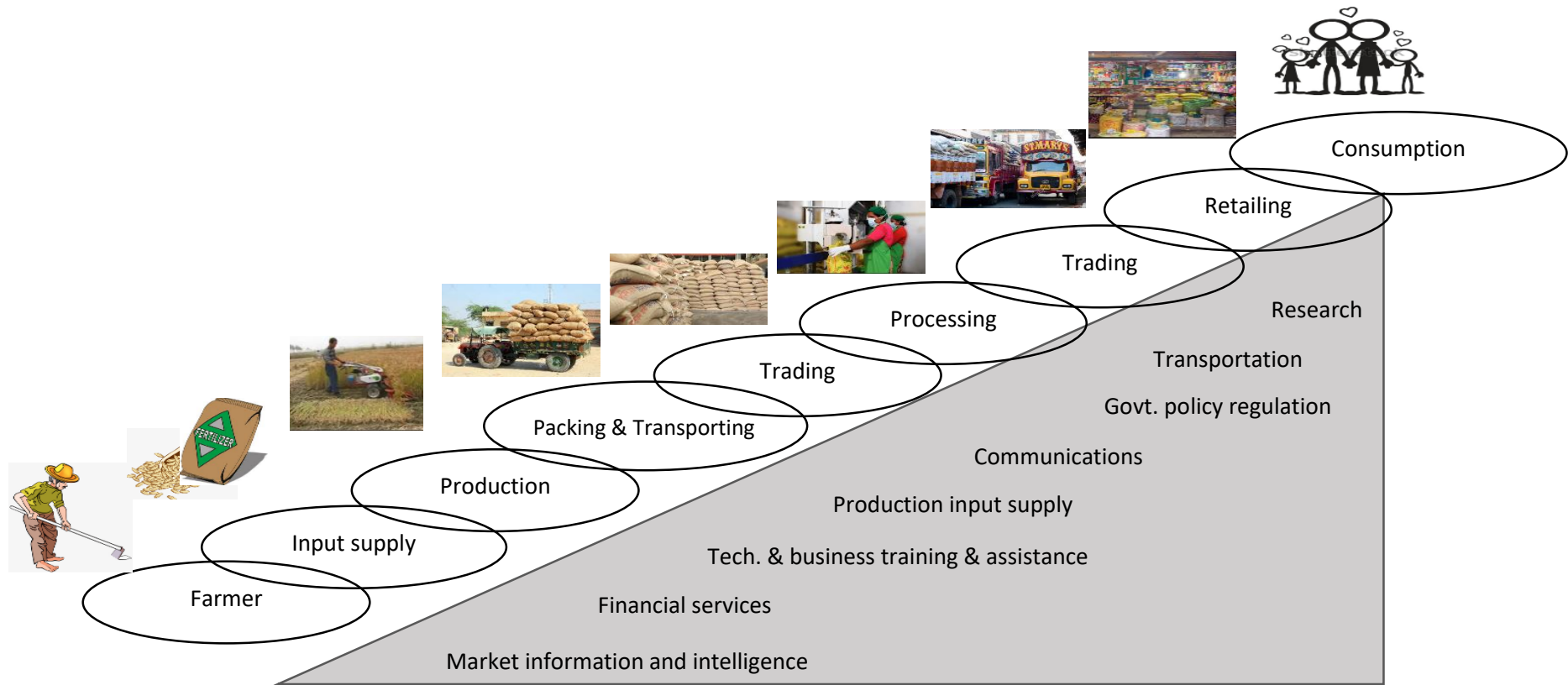


Figure 1.2: Typical Paddy/Rice Value Chain and Associated Services in Sri Lanka.

1.4 Significance of the Study

According to the present government as well as the previous government's policies, paddy is considered as the national crop and it is envisaged to ensure a remunerative price to paddy farmers in order to ensure the sustainability of the agricultural sector. Agri-business development, establishing agricultural mega zones, and strengthening value chain development, establishment of large scale agro enterprises are the key priority areas in government policy. Mapping of the VC, identification of inefficiencies of each node of the VC can identify the points of leveraging and VC financing. The logical framework described each actor's level, outcomes and how it's measured. The Government facilitates efficiency in agricultural markets, strengthening value chain development and agribusiness development analysis of the value chains of principal crops, and identifying the potential development areas is one of the research priorities on CARP, 2017-2021. The development of agricultural VC is one of the priority investment areas of the Agriculture Modernization Project.

Findings of this research on factors affecting value chain efficiency in different marketing stages are useful for researchers, policy makers, and development practitioners and most importantly for actors in the rice value chain in Sri Lanka. The research would help to formulate recommendations to reduce the marketing cost of rice, and identify institutional constraints to solve problems in the entire rice value chain. Value chain analysis would help understand how to improve the farmer's performance at every step in value addition. Therefore, this study provides an in-depth understanding of how to increase farmer's share of rice price and reduce the share of middlemen. Efficient value chain means efficient rice marketing. The understanding of the efficient market chain would facilitate how to formulate the country's food security. Thus this study might be of importance to the policymakers, individual farmers, consumers i.e. both macro and micro level. Moreover, this study examines the process of derived products of the paddy rice milling industry.

1.5 Objectives of the Study

1.5.1 The Broad Objective

The overall objective of this study is to carry out a detailed VCA of the paddy/rice value chains in Polonnaruwa district which is the largest milling zone in the country.

1.5.2 The Specific Objectives

1. To examine the existing practices of the supply chain of paddy/rice and its allied products.
2. To estimate the gross margins, market share and returns received and value additions created by different actors throughout the paddy/rice value chains through mapping the VC.

3. To discover the strengths, weaknesses, opportunities and threats of key value chain actors throughout the VC.
4. To identify the key policy initiatives, need to upgrade and enhance the efficiency of paddy/rice value chain in the country

1.6 Limitations of the Study

The current study could not fully avoid the following limitations:

- i. The first limitation of this study was the shortage of time. The primary data and other necessary information were collected within a short period of four months (September to December, 2019) and hence could not cover a wider area. The month of December was subjected to heavy floods in the study area, Polonnaruwa.
- ii Lack of proper updated databases for the number of paddy traders and rice millers with their capacities is a serious limitation.
- iii Rice millers and paddy rice traders had records of transaction and price in many cases but they were reluctant to disclose their records due to fear of any adverse situation for example imposition of tax. They were reluctant to disclose the actual figures on purchase price, processing costs, sales price, production, monthly sale, income, profit.

1.7 Organization of the Report

Chapter I

This chapter deals with the relevancy and scope of the research problem, objectives of the study and the background information on the study aspects.

Chapter II

Provides a review of literature on historical and empirical views. The purpose of this chapter is to review previous studies, which are related with the present study. There are some studies on the value chain of fruits in Sri Lanka but studies on the rice value chain in Sri Lanka are limited. Special attempt was given to rice by product utilization in Sri Lanka and other countries. It also discusses the Value Chain Analysis of Rice in developing countries particularly the major rice producing countries.

Chapter III

Describes the conceptual framework related to the value chain analysis. Also describes in detail the research methodology employed and includes research design and data, sampling technique, study area and the analytical framework. This chapter presents a detailed methodology adopted in this study which includes the selection of study area, selection of sample, preparation of survey schedule, data collection method, period of survey, editing and tabulation of data and analytical techniques to be used. Also describes the nature and the functions of different actors engaged in the paddy/rice value chain and in addition gives the total value chain map of the study area.

Chapter IV

Deals with the socio economic profile of the sample paddy farmers and other stakeholders in Polonnaruwa district and throughout the entire VC. Value addition activities are mainly concerned with the changes of utilities. The chapter describes the functions and value addition activities performed by different actors. This chapter explains the rice by product value chain. The total value chain map and activities are described in detail. Hence this chapter is concerned with the estimation and analysis of costs, returns and value addition of paddy and rice in different value adding stages by farmers, collectors, rice millers and rice traders.

Chapter V

Chapter describes the Strengths, Weaknesses, Opportunities and Threats of the entire value chain and explains the leveraging points in order to increase the efficiency of the value chain.

Chapter VI

Summarizes the findings, and indicates policy implications and recommendations

Chapter Two

Review of Literature

2.1 Introduction

The purpose of this chapter is to review previous studies, which are related with the present study. The research studies on rice value chain in Sri Lanka are limited. Study attempts to review the rice value chain studies in some major rice producing countries in the region. Rice value chains are rapidly changing in many parts of the world mainly due to the rapid urbanization. A value chain can be defined as the full range of activities which are required to bring a product or service from conception, through the different phases of production delivery to final consumers, and final disposal after use (Food and Agriculture Organization (FAO), 2006).

A value chain consists of all stages of a technical production process as well as of the interaction between these stages. The production process starts at the stage of input supply, then covers production, processing and marketing and ends with the consumption of a certain product. It can be seen as the hard skill of a value chain. The second part of a value chain, the interactions between the single stages, is the relationships and contractual linkages that not only determine the way the goods are traded between the different stages but are decisive for the overall character of the chain. The linkages between the stages lead to the so-called governance structure of a chain that can be seen as the soft skill of it (Schipmann, 2006). Kaplinsky and Morris, (2001) defined the food VC's as the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad based benefits for society and does not permanently deplete natural resources.

Rupasena (2006), pointed out that seasonal price fluctuation of rice reduced during the post-liberalization regime as compared to the pre-liberalization regime in Sri Lanka. This is due to expansion of private trade. Private traders, especially, millers purchase paddy at low price at harvest time and hold stocks to release during the off-season.

Wijetunga, (2011), found that the terms of trade of paddy unfavourable to the paddy farmers in Sri Lanka is due to the continuous rise of production cost, low paddy prices and a significant increase in the prices of consumer goods. Prasanna, et al (2011) explained in his study related to the paddy marketing conducted in North Central Province, poor returns of paddy farming is mainly due to marketing issue and emphasized the need of better marketing practices for paddy farmers, however there are no adequate theoretical and empirical studies that have been undertaken to analyse the issue from farmers' perspective. Samaratunga et al (2012), stated that there is a need to examine whether the government pricing has been successful in building up stocks, public policy packages and institutions which have managed the stocks efficiently and those stocks have contributed to the gain of price stability in Sri

Lanka. Study conducted by Ahamed (2014) in the Sammanthurai area in Ampara district, stated that the mean expenditures of paddy farmers exceed their mean income. Study also revealed that all paddy farmer households have spent more than 50 percent of their total expenditure on food.

During the peak harvesting month more than 50 percent of the Divisional Secretariat Divisions (DSD) farm gate price of paddy was below the guaranteed price in many of the districts especially in Ampara and Batticaloa. Farm gate prices of all DSD's in Ampara district were well below the guaranteed price in 2010 and 2013. The situation was more or less the same in all major producing districts. Regular low price in harvesting seasons in DSD's could be identified in all major producing districts (Wijesooriya, et al 2017). Senanayake and Premaratne, (2016) conducted a paddy/rice value chain study in which the presence of several models of integration were found. Most of the small producers within the value chain work together forming producer groups while large firms take a leading role in integration. The study suggested improving this integration model so that small farmers get benefits. The study also revealed that the profit margins accruing to almost all the players involved in the paddy / rice value chains of both *Nadu* and *Samba* varieties are not excessive when compared with the bank rate. In addition, the study suggested a need for a comprehensive value chain analysis prior to arriving at firm conclusion.

Weerahewa (2017), explained that, despite ample opportunities in the world market for the food and agriculture commodities that Sri Lanka could produce, domestic value chains have not been sufficiently connected to global value chains to take advantage of the opportunities. The main causes are the inadequate awareness of export demand and inadequate linkages among exporters with other players in the value chains.

Wijesooriya et al (2017) found that the determination of Guaranteed Prices (GP) for especially paddy and ceiling prices for rice occurs in an ad hoc system which has created certain problems. There is no proper mechanism or proper time for the announcement of the GP for paddy and fixing GP is episodic. After 1977 the GP for paddy remained unchanged for long periods as in 1993-1999 and 2008-2012.

Value chain analysis studies in Sri Lanka focused on mapping of the value chain but value chain analysis at each stage (value flow/financial flow and governance of value chain information flow/relationship) were not studied. The present study aims to fill this information gap. The current study attempts to capture the dynamics of the paddy rice sector in other South Asian countries. This provides sound knowledge to compare the Sri Lankan situation with the global situation. In the following section value chain studies in selected countries are reviewed.

2.2 Rice Sector in India

Rice is the dominant cereal in the country. Rice is being cultivated in three different seasons in diverse ecologies by nearly 67 million of farm families. There are three major market segments for rice due to diverse consumption patterns namely: rice

seed market, rice grain market and rice product market. The domestic value chain for rice is complex and three major routes for delivery of rice could be seen. Only the private sector is involved in the first channel. The length of the rice value chain ranges from shortest to longest hence, the share of producers varies across the chain. Further, this channel is exploitative in terms of pricing for the producer. The second chain represents the rice trade via regulated marketing channels through Agricultural Produce Marketing Committee (APMC). Here trade is practiced between the producers and the registered traders. These markets offer relatively higher remunerative prices to the producers. The third one is referred as contingent or distributive value chain for rice wherein the State Trading Corporations (STC) or Food Corporation of India (FCI) procures paddy directly from producers at priority basis (pre-emptive purchase) or directly from the markets (open market operation) by competing with the other actors in the market. Then after milling, a portion is kept to meet contingent situations and the rest to feed the Public Distribution System (PDS). This channel ensures the minimum support price for the farmer.

Ahmed and Baktiar (2020), carried out a study to examine the ways to improve the food grain procurement system in Bangladesh. In their report stated the paddy procurement in Indian state of West Bengal. Paddy is procured from farmers primarily through two approaches. Under the first approach, farmers bring paddy to centralized procurement centres (CPCs), or *Kishan Mandis*², and receive an INR 20 per quintal transport allowance. The study revealed that since 2016/2017, the West Bengal State Government has implemented an electronic paddy procurement (e-procurement) system. Between 2017/2018 and 2019/2020, farmers' participation in the e-procurement system has increased five-fold, from 465,000 to 2.36 million farmers.

Private sector channel is focused more on demand driven production whereas, processors are purchasing only certain varieties of rice to cater the demand of specific segments of the consumer market. It is important to understand that numerous actors are involved in the rice value chain in India. However, the supportive services like research, extension, warehousing, logistics and financial services are kept out of trade gamut and assumed to facilitate the trade between actors in the value chain. India currently focuses on 3I's (Infrastructure, Information and Institutional) framework to develop rice marketing systems (Kumar et al, 2018).

Pavithra et al (2017), worked out the prices, costs and margins of the paddy/rice value chain in Karnataka state in India in 2015. The results showed that the average farm gate price of dried paddy was INR1793/Quintal³ and the rice retail price was INR 3734/Quintal. It was revealed that the ratio of rice retail price and paddy farm gate price was 2.08.

2.3 Rice Sector in Bangladesh

Bangladesh is self-sufficient in rice and focuses more on sustainability of production. Thus, the country introduced improved varieties strengthening the input sector of the

² *Kisan Mandi* is an online platform operated by the Small Farmers Agribusiness Consortium in India

³ Quinta = 100kg

value chain. Rice is the most widely cultivated staple food crop in the country. Currently, rice production is 3.5 times higher than that of 1971. This is due to the improvement in irrigation schemes which facilitate rice cultivation in the dry season as well. However, the country also imported rice in recent years due to domestic crop damage. The main issue faced by the country is climatic risk in agriculture. Rice value chain in Bangladesh has been rapidly transforming to modern from the traditional value chains. Four channels have been identified within the rice value chain in Bangladesh. Traditional channels are relatively short, consisting of small-scale farmers to local village miller and thereafter the consumer. The second channel which is rather long and consists of rural-urban traditional channels from local broker or village trader, village miller, rural wholesaler, semi-wholesalers and retailers are identified as additional actors in this channel. The transitional rice value chain is geographically long and intermediately medium. In this channel mills sell rice to city wholesale market traders and thereafter to the traditional retailers. The modern rice chain value is geographically long and intermediately short. Farmers directly sell paddy to large millers and millers process and sell it to supermarkets. Further, the rice value chain in Bangladesh has three segments namely: rice upstream segment (farm segment), midstream segment (mills and domestic traders) and downstream segment (retail). It is reported that marketable surplus of small commercial farms accounted for 80-90% and marginal farm households for over 50%. Price premium is mainly captured by both millers and wholesalers. Farmers tend to sell 63% of total marketable surplus to wholesalers and about 30% directly to mills. Milling segment has shifted to semi-automatic and automatic with increased private sector initiatives. Retailing segment has improved through greater quality differentiation, packaging, and brand development. The government has a trivial role in the rice retailing sector (Kabir et al, 2018).

Ahmed and Baktiar (2020), of International Food Policy Research Institute (IFPRI), carried out a study to examine the ways to improve the food grain procurement system in Bangladesh, with the assistance of USAID, and Bangladesh Ministry of Agriculture. The study was conducted during the Boro paddy season. "Boro" is the dry season where irrigated rice crops are planted from December to early February and harvested between April and June. In 2018/2019, the total production of rice in Bangladesh was 36,391,000 (36.4 million) metric tons (mt), of which Boro rice accounted for 53.8 percent; Aman rice, 38.6 percent; and Aus rice, 7.6 percent. In 2019, paddy prices in Bangladesh were depressed due to a bumper harvest of the Boro rice crop.

The study found to raise the market price of paddy to the level of the procurement price of BDT 26 per kg (Government Guaranteed price), the procured quantity would need to be 3.1 million mt of paddy, which accounts for 18.7 percent of market supply of paddy (that is, farmers' marketed surplus), or 10.5 percent of total paddy-equivalent Boro production in 2019. Study also found that the rice millers are the most benefited actor in the paddy/rice value chain. The current study attempts to compare the information (Table 2.1) related to the paddy/rice value chain in Bangladesh and Sri Lanka.

Table 2.1: Comparison of Cost of Production and Prices of Paddy and Rice in Sri Lanka and Bangladesh

Item	Units	Sri Lanka	Bangladesh
Annual Paddy Production	Million mt	4.6	36
Main Seasons		<i>Maha & Yala</i>	<i>Boro & Aman</i>
Per Capita Rice Consumption	kg/person/Annual	107	134
Cost of Production of Paddy	BDT/Ha (2019)		100,408
Cost of Production (COP)	SLR/Ha (2019)	124,550	
Cost of Production	USD/Ha	710	1215
% of Cash Cost in COP	%	70	65
% of Hired Labour Cost in COP	%	16.3	36.2
Unit Cost of Production	USD/kg	0.134	0.216
GP of Paddy (Early, 2019)	BDT/kg		26
GP of Paddy (Early, 2019)	LKR/kg	41	
GP of Paddy	USD/kg	0.234	0.315
Average Yield	mt/Ha	4.0-5.2	5.2-6.5
Farm Gate Price	BDT/kg		16.56
Farm Gate Price (Early,2019)	LKR/kg	42.00	
Farm Gate Price	USD/kg	0.239	0.200
Rice Retail Price	BDT/kg		40.99
Rice Retail Price (Early 2019)	LKR/kg	93.00	
Rice Retail Price	USD/kg	0.53	0.50
Retail/Farm Gate	Ratio	2.2	2.5

Source: Compiled by the Author, 2019

Exchange Rate: 1 BDT = 0.012 USD

Transplanting is the main agronomic practice of paddy cultivation in Bangladesh in contrast to sowing in Sri Lanka. In Bangladesh authorities considered the paddy to rice milling ratio equal to 0.67.

Ahmed et al (2019), studied the Rice Market in Bangladesh and the role of key intermediaries. The study describes the flow of rice to consumer's takes place through the market intermediaries or different value chain actors, such as *farias*⁴, *beparis*⁵, millers, *aratdars*⁶, commission agents, wholesalers and retailers. These intermediaries involved in paddy collection and selling and also rice trading and storage. The study explains the role of intermediaries: *Faria* operate in local village markets procuring supplies from growers in the market or at the farm gate and selling to *beparis* in the same market or to local *aratdars*. The dominant mode for *farias* is to sell to *beparis* within the village market. A *faria* has no fixed premises. A *beparis* trade's long

⁴ Village Level Paddy Collectors in Bangladesh

⁵ Large Paddy Collectors

⁶ Commission Agents in Paddy/Rice Trade in Bangladesh

distance collecting from *farias* and growers in a village market, carrying out some sorting, grading and bulking and connecting to an *aratdar* generally located in a larger market some distance away. Like the *faria*, the *bepariis* also an itinerant trader.

An *aratdar* is a broker or a commission agent who connects sellers (*beparis*) with buyers (other *beparis*, millers or processors, even retailers). A fixed commission is charged from both buyers and sellers so that the main goal of an *aratdar* is to have a high turnover. The *aratdar* is really the central actor in the market playing the all-important role of enabling stranger-transactions, creating trust, and in general, supporting credible contracts to be entered into and leading to repeat transactions. The *aratdar* is the ultimate guarantor in an exchange; without whom the local village markets would remain unintegrated.

The study highlighted close to 20,000 registered millers in the market, spread in different districts of the country. Among them there are 949 automated rice mills spread over the country. The four firm concentration ratio of the four largest millers was only three percent. It can be calculated mainly due to the availability of mill information with the Director General Food (DGF) in Bangladesh. Therefore, study revealed that the likelihood of an effective cartel working for a longer period of time is low. The median milling capacity of the mills is 72 ton/day, in the range of 15-140 tons. Study identified the supply chain is mainly dominated by the millers. There is strong belief among the market participants that millers influence the market price, however the evidence is not absolutely concrete.

The most interesting information can be obtained from the Bangladesh government acts the legislative restriction on storage limit: SRO No 113-Ayne/2011-Control of Essential Commodities Act, 1956. The storage limit for rice millers was five times the fortnightly capacity of the mill with a maximum limit of 30 days. And for rice the limit was two times the fortnightly capacity to mill with a maximum of 30 days. It is also applicable for rice wholesalers. Maximum allowable storage capacity for the wholesalers is 300 mt for 30 days.

Bangladesh DGF is the responsible government organization for procuring paddy and milled rice. Field-level officials under the Department of Agricultural Extension (DAE) of the Ministry of Agriculture prepare lists of farmers who are eligible to sell paddy to the DGF. These include farmers who have an agricultural input support card or “*Krishi card*”⁷ and meet other selection criteria. Eligible farmers are often selected via lottery because the number of farmers interested in selling paddy to the government typically exceeds the number of farmers who can participate in the procurement process. Listed farmers bring their paddy to DGF’s local supply depots (LSD). Selected farmers bring either their agricultural input support card or national identification (NID) when they sell paddy. However, the majority of the farmers except large scale farmers are entitled to sell paddy to the government centers.

⁷ Agricultural Input Support Card

The DGF has the full database of rice millers and other value chain actors like collectors, traders operating in the country with their relevant details. Under the digital Bangladesh programme, it maintains a large number of registered farmers by union level and rice mills throughout the country. Also DGF introduced Farmers App (mobile application) for selling paddy to the government. The mandate of the Bangladesh government is to bring government services from the doorsteps to the fingertip of the citizens. This, Farmers App⁸ has been developed considering this objective in mind. A farmer can easily obtain the following services from this mobile application. From this service farmer can sell paddy to the government in a shorter time, at lower cost and with a minimum number of visits. It will decrease harassment and suffering of farmers. Using this App, farmers can get the latest information about registration, expression of interest application, and allotment orders instantly. They will be able to obtain information about the current season and paddy specifications. They can also submit complaints in case of harassment. Study also stated that the large corporate houses in the country have entered the rice business very recently with huge establishment and milling capacity.

Khatun et al, (2020), studied the farmers' supply response and perception of the rice procurement programme in Bangladesh. Study found that the middlemen gained the actual advantage of the government procurement programme because they purchase rice from the farmers and sell it to the government procurement center. Results also revealed that none were aware of the rules and regulations of the procurement programme. Moreover, no farmers sold their rice to the procurement center directly. It was found that they sold rice to the middleman like *bepari*, *faria* or near the village market at a lower price.

According to all the above information the current study identifies the Bangladesh paddy/rice value chain as having a lengthy nature mainly due to the presence of those three intermediaries' *faria*, *bepari* and *aratdar* when compared to the paddy/rice value chain in our country.

2.4 Rice Sector in Philippines

The rice industry includes more than three million farmers and their families, thousands of traders, millers, retailers, and individuals employed in the production, processing, and marketing of its related products. In 2014 and 2015, domestic rice was about 50 percent more expensive than imported rice. Moreover, price data from the Philippine Statistics Authority (PSA) show large price margins between farm gate and retail prices. Some analysts attribute this wide price spread to inefficiencies along the RVC, which was characterized by high production and marketing costs, driving the domestic price above that of the world market. The major paddy producing areas in the Philippines contribute an average of 9.8– 12.23 million tons per year (65% of total annual paddy produced). The average yield in 2015 was 3.37 t/ha, which was below national yield average (3.90 t/ha). Rice processing is performed by custom millers and miller-traders. In 2015, a total of 8,249 rice millers were licensed to operate, 60

⁸ Digital Paddy Marketing Application for Farmers in Bangladesh

percent of which are concentrated in Luzon major producing areas. The considered Paddy to rice milling outturn is 64 percent in 2015.

Mataia, et al (2015), analysed the paddy/rice value chain in the Philippines in 2015 and results indicated that the largest margin (Table 2.2) and added cost was incurred by millers in the value chain and millers dominated the RVC.

The marketing function including delivery of milled rice from the mills to the distribution channels to final users involves rice trading, transportation/shipping, and storage. This function involves rice traders consisting of an established network of wholesalers, wholesaler-retailers, and retailers. The National Food Authority released licenses to 4,052 wholesalers and 61,463 retailers in 2015. This means that wholesale is less competitive, and is mostly controlled by few highly capitalized traders located in main cities. These actors have strong linkages and are largely organized having control over the price of milled rice.

Table 2.2: Relative Financial Position of Value Chain Actors in Philippines and Sri Lanka

VC Actor	Philippines in 2015			Sri Lanka in 2019/20		
	Selling Price (PHP/kg)	Unit Margin (PHP/kg)	% to Price	Selling Price (LKR/kg)	Unit Margin (LKR/kg)	% to Price
Farmer	16.31(46.64)	16.31(46.64)	40	50.00	50.00	49
Trader/Collector	19.37(55.40)	3.06(8.75)	8	52.50	2.50	2.5
Rice Miller	35.86(102.57)	16.49(47.16)	40	94.00	41.50	40.5
Wholesaler	38.51(110.15)	2.65(7.58)	7	97.00	3.00	3
Retailer	40.75(116.55)	2.24 (6.41)	5	102.00	5.00	5
Total			100		102.00	100
Farm/Retail Ratio	2.50			2.04		

Note: Equal SLR Value given in Parenthesis

Source: Compiled by the Author, 2019

The major constraints identified in the RVC included high production and marketing costs of paddy and rice which is attributed to low yield, high labour cost and material inputs, and insufficient crucial infrastructure and market facilities (e.g., modern mills, dryer, cheap transport, and energy), which resulted in high domestic paddy and rice prices, and low competitiveness of the entire rice VC. To enhance the level of competitiveness, the rice industry should concentrate on generating and promoting yield-increase, postharvest loss-reduction, and cost-minimizing technologies, as well as those that improve overall efficiency in the RVC such as investments in enabling infrastructure, and facilities for transport, handling, storage, drying and milling.

2.5 Rice Sector in Myanmar

The rice industry is the most important agriculture subsector in the country, accounting for about half of the cultivated land. In 2016, paddy production in

Myanmar ranked seventh among all the paddy-producing countries in the world (Statista, 2017). Official data also cite that paddy has the highest percentage share (46%) among all the crops grown in Myanmar (MOALI, 2016). Zorya, (2016), stated that most of the household income of the country's population comes from rice farming and related activities. In 2013–2014, the net profit from producing monsoon paddy averaged USD 114 per hectare (ha). However, these farm profits, in general, are not sufficient to raise households' per capita income above the regional rural poverty line. Compared with the rice value chains in the neighbouring countries Thailand and Vietnam, those in Cambodia, Lao PDR, and Myanmar are characterized by less efficient input supply systems, lower farm productivity and profitability, higher milling and export costs, and lower quality of exported rice (Zorya, 2016). As a result, rice value chains in Cambodia, Lao PDR, and Myanmar are less competitive than those in Thailand and Vietnam. Such a situation is detrimental in the international market as Cambodia, Lao PDR, and Myanmar are net rice exporters and have much lower export volumes. The average per capita consumption of rice is 165 kg/year in rural Myanmar and 133 kg/year in urban areas, for a total domestic demand of around 8 million tons. World Bank, (2019) examined the farm production economics and value chain dynamics of rice and pulses in Myanmar. The study found that between 2013 and 2017, labour use declined very significantly in paddy production in the monsoon and dry seasons, and the use of both family and hired labour fell dramatically across all regions. One of the most notable changes in farm practices in recent years has been the increased use of agricultural machinery. The study stated that the 63 percent of larger farmers now own tractors, compared with 10 percent of small-scale farmers and used for the land preparation and harvesting. Small and medium farmers have increased their use of agricultural machinery by hiring equipment or, more commonly, by hiring mechanization services. Another beneficial intervention would be to provide vocational training for machine operators and further facilitate equipment leasing. There is a significant rise in the use of agrochemicals in paddy production.

Thuzar and Broos ((2019), Analysis of the operational constraints of the rice value chain in Ayeyarwaddy major paddy producing region, Myanmar (Table 2.3). The study found one major constraint inhibiting the actors in the rice value chain of Ayeyarwaddy Region from working more efficiently as the lack of financial means, particularly credit or working capital. All actors in the supply chain experience this constraint. Gross marketing margin across the global value chain is very wide, and is not equally distributed among the different actors. Not all actors receive a reasonable profit margin. Rice millers are by far the most profitable actors, whereas, farmers are the most vulnerable in the value chain who are given a moderate profit margin and large number of constraints. The actors suffer from constraints of material input, production, financial, distributional, and institutional nature. All these limitations have significant and negative impacts on profitability that hinder the development of the value chain. In Ayeyarwady the average size of a small farm is 1.28 hectares, while a medium farm is 3.03 hectares and a large farm is 8.10 hectares.

Table 2.3: Relative Financial Position of Value Chain Actors in Myanmar and Sri Lanka

VC Actor	Myanmar in 2017			Sri Lanka in 2019/20		
	Selling Price (MMK/kg)	Unit Margin (MMK/kg)	% to Price	Selling Price (LKR/kg)	Unit Margin (LKR/kg)	% to Price
Farmer	236	236(26.04)*	43	50.00	50.00	49
Trader/Collector	241	5(0.55)	01	52.50	2.50	2.5
Rice Miller	402	161(17.77)	30	94.00	41.50	40.5
Wholesaler	448	46 (5.08)	08	97.00	3.00	3
Retailer	545	97 (60.15)	18	102.00	5.00	5
Total			100		102.00	100
Farm/Retail Ratio	2.3			2.04		

*Note: Equal LKR Value given in Parenthesis

Source: Compiled by the Author, 2019

2.6 Rice Sector in Indonesia

Octania, (2021), studied the government's role in the Indonesian rice supply chain. While Indonesia still imports rice, the country fulfils the largest share of its rice demand domestically. The domestic supply chains are therefore of utmost importance for stable, affordable and accessible rice supplies. However, distribution channels vary in each province throughout Indonesia. From farmers to consumers, the chains may include middlemen, millers, wholesalers, and retailers, each with their own unique function. Regulating the number of intermediaries involved in the distribution and processing chain of domestically produced rice is not desirable as these intermediaries are required to connect farmers with consumers.

The state owned paddy/rice logistics company in Indonesia labelled *Bulog* is supposed to help ensure food security by being involved in the domestic supply chain. However, they face their own challenges on both upstream and downstream levels. *Bulog* is obliged to maintain national rice stocks and distribute them for direct welfare assistance. However, since the new Non-Cash Food Assistance programme relies largely on private suppliers, the distribution of public rice stocks has been compromised. Furthermore, the poor quality of rice stocks in *Bulog* warehouses cannot compete with those of private suppliers. Under these circumstances, *Bulog's* role needs to be reconsidered. The private sector should play a greater role in domestic rice markets and *Bulog* should only participate in rice distribution during emergency situations. Presidential Regulation 48/2016 Article 8 needs to be revised to allow *Bulog* to focus on protecting consumers through disaster-relief programmes. As a practical short-term solution to lower rice prices, the efficacy of *Bulog needs to be improved and Bulog's monopoly* on imports of medium-quality rice should be removed. Private companies should be eligible to access an automated licensing system and to import medium-quality rice to Indonesia.

Rice prices are generally lower during harvest season, from around February until April, and gradually increase towards the end of the year and early the following year

due to reduced supply. In light of this, the Indonesian government has imposed a minimum purchase price policy for farmers and a maximum retail price policy for consumers in an effort to control prices (Hermanto, 2017). The state-owned logistics company *Bulog* manages the national rice stock by purchasing paddy at floor price and milled rice from farmers at the regulated price. Moreover, on the retail side, once *Bulog* detects prices above the maximum reference price, it conducts Market Operations by supplying more rice from its own warehouses. It also tries to force rice retailers to sell their rice within the price limits. *Bulog* collaborates with the special Food Task Force of the National Police to track down rice retailers who sell above the government-set maximum retail price. This is not an easy task given the immense number of rice retailers and traditional markets in Indonesia (Fatimah, Arifin, & Tey, 2019). Based on the MOT Regulation, retailers who sell above the maximum retail price will receive warnings that can escalate to getting their license revoked and thus having to stop operation.

In managing rice as the staple food, Article 3(2) of the regulation mandates *Bulog* to stabilize rice prices at the farmer and consumer levels; to manage Government Rice Reserves, to conduct rice procurement, rice distribution, and rice imports; and to develop rice-based industry as well as managing rice warehouses. Besides stabilizing food prices, Article 9 of the same regulation also mandates *Bulog* to allocate reserves for other significant matters, such as natural and social disasters and any emergency situations.

As a state-owned enterprise, *Bulog* has two channels in procuring rice: a public channel and a commercial channel. The commercial channel operates through procurement partners including some large rice millers that have also engaged in public rice procurement contracts with *Bulog* (Aji, 2012b). Meanwhile, in the public channel, local *Bulog* working units purchase floor price from farmers and process it in *Bulog's* own rice mills. Assigned with such complex tasks, *Bulog* must maintain national rice stocks to avoid rice shortages. Any threat of rice scarcity will lead to a public backlash against *Bulog*. Rice stocks at *Bulog* warehouses are obtained from domestic procurement and imports. Study recommends *Bulog's* role in the rice supply chain needs to be reconsidered.

In Indonesia Paddy is also known as *Gabah Kering Panen* (GKP), harvested rice paddy with maximum water level of 25 percent and foreign materials maximum 10 percent. Dried un-milled rice is also known as *Gabah Kering Giling* (GKG), ready-to-mill rice paddy with maximum water level of 14 percent and foreign materials maximum 3 percent. In the end, setting minimum prices for farmers has proven unnecessary because market prices at the farm gate remained continuously higher than the price set by the government. The farmers prefer to sell rice to private buyers who are willing to pay more than the mandated price. As a result, *Bulog's* total rice procurement from farmers has also declined from 2.96 million tonnes of unmilled rice in 2016 to 1.48 million tonnes in 2018 as *Bulog* is unable to compete given its budgetary restrictions (*Bulog*, 2020c). Meanwhile, rice prices in the Indonesian retail markets consistently hover significantly above the government's maximum retail prices. The maximum

price of medium-quality rice is set to be around IDR 9,450-10,250 per kilogram in MOT Regulation No. 57/2017.

According to the farm gate price of paddy (INR4200/kg) and the retail price of medium quality rice in the domestic market is INR 9450/kg. It reveals the ratio of rice price and paddy price is nearly 2.25 in Indonesia (Octania, 2021). It reveals the farm gate price equal to LKR 57.66/kg and retail price of rice LKR 129.74/kg. Those prices are similar to the Sri Lankan paddy and rice prices during 2020 and when we build up an equation for Indonesia, Rice Retail Price = 2.25 * Farm gate price of Paddy (Octania, 2021)

2.7 Rice Sector in Vietnam

Vietnam has grown to become the second-biggest rice exporter in the world, particularly when the country started to introduce market economic reforms of the *Doi Moi* period in 1986 (Agrifood Consulting International, 2002). Vietnam also engages a parastatal agency in its rice marketing chain, namely the Vietnam Food Association (VFA). Unlike state-owned trading enterprises in other Asian countries, the VFA is not directly involved in the process of procuring rice from farmers and selling it to consumers. The rice procurement process is mainly executed through market players, such as middlemen, millers, and wholesalers (Dang and Tran, 2008). The intervention of the government in the domestic market is limited and VFA has conducted mostly rice exports purchased from domestic wholesalers.

A regulation in 2010 s permitted the involvement of the private sector in conducting rice exports providing they meet the minimum requirements of factory and storage capacities (Dao, Thai, & Nguyen, 2020). Interestingly, despite being one of the major rice exporters, rice consumed by Vietnamese is also sourced through imports, partly from rice farms in Cambodia that are being owned by Vietnamese farmers. Vietnam also imports rice from Lao PDR with no import duties on rice import quotas (Tobias et al., 2012).

Thanh and Nguyen (2013), work out the costs and margins of paddy/rice value chain in Mekong River Delta in Vietnam. The survey was carried out in 2010 and the results are in Table 2.4.

Table 2.4: Margin Analysis of Domestic Rice Value Chain in Mekong River Delta in Vietnam

Actor	Total Cost (USD/kg)	Price Received (USD/kg)	Unit Margin (USD/kg)
Farmer	0.27	0.30	0.031
Collector	0.31	0.31	0.002
Paddy Miller	0.36	0.37	0.008
Miller	0.417	0.420	0.003
Transporter	0.01	0.01	0.007
Wholesaler	0.49	0.53	0.044
Retailer	0.53	0.57	0.038

Exchange rate: 16,500VND/USD.

Source: Compiled by the Author, 2019

The study explained that the domestic chain is also a secondary market for rice products that are not meeting the quality, taste requirements and safety of the export markets. Quality and taste failures mainly consist of mixed varieties, seed degeneracy, damp and mould rice and worms while safety failures mainly include problems with antibiotic or probiotic contamination and mixture. There are many agents in the domestic rice value chain that result in high costs, low quality and weak supply chain management. In fact, value added of rice is low and distributed to many agents. The producers have the lowest income in the chain. In the domestic value chain, the wholesaler has the largest margin. Paddy and rice passed through local paddy millers, urban large rice millers, wholesalers and rice companies in major cities. The margin of urban rice millers also low. According to the above table Rice Retail Price/ Paddy farm gate Price ratio = 1.93

2.8 Rice Sector in Bhutan

Rice is the staple food commodity in Bhutan. The average yield of wetlands are 4 t/ha and the current self-sufficiency rate is 45 percent. Per capita consumption of rice in Bhutan is relatively high and is 140 kg per annum. Long term objective is to achieve self-sufficiency in rice within the country. Bhutan is a small landlocked mountainous country with an area of 38,394 km². Only one rice crop cycle is maintained per year. Main actors of the rice value chain are farmers, Agriculture Sales and Service Representatives (ASSR), Extension Supervisors (ES), National Seed Centre (NSC), Agriculture Machinery Centre (AMC), Farm Machinery Corporation Limited (FMCL) and Agriculture Research and Development Centers (ARDC). There are around approximately 28,988 paddy farmers in the country. Agricultural inputs are provided by Agriculture Sales and Service Representatives (ASSR), who were previously known as commission agents. However, it is reported that this is a less attractive dealership due to minimal commission and transport subsidy. Extension agents coordinate timely supply of agricultural inputs (Chog, 2018).

FMCL is a government owned business centre which provides farm machinery hiring services such as mini-power tiller, power tiller, tractor, reaper, power thresher, water pump, paddy trans planter and combined harvester. There are about 5,267 small scale mills or household mills around the country. Milling is done only in the production season and these mills are equipped with 7hp or 10hp electric motor engines. The government provides free transportation, installation and repair of milling machines. In addition, there are three commercial large-scale mills (0.5-5 t) located in the country which are run by the FMCL. Previously these large scale mills were operated by farm groups. However, due to inability of farmer groups to operate and maintain these mills, the result is the underutilization of the mills. Marketing channel comprises urban retailers, millers, farmers, FMCL, Food Corporation of Bhutan Limited (FCBL) and exporters. Farmers sold 14 percent of the total domestic rice production. FMCL also engages in procuring and processing of domestic rice. Urban rice retailers import 80 percent of the total rice imports mainly from India. The rest is imported by the FCBL and sold through fair price shops and farm shops spread across the country. Only a single private enterprise is engaged in rice exportation mainly to Singapore.

2.9 Rice Sector in Nepal

Rice is the staple crop of Nepal and yield productivity is 3.3 t/ha. Rice is cultivated in diverse ecosystems around the country and more than 75 percent of the total production is cultivated under irrigated schemes. Domestic production is not sufficient to cater to the demand hence, fine and aromatic rice is imported from India. Rice market is based on three rice types namely: fine, coarse and aromatic. The rice value chain in Nepal is characterized by informal and less developed market systems. A strong vertical and horizontal linkage among the key actors was not found mainly due to lack of mutual understanding and poor functional relationship. Farmers, rice collectors, millers and wholesalers are the dominant actors in the value chain. Links between paddy farmers are very weak. Both public and private entities are involved within the value chain. However, the main contribution is by the public sector in the country.

Agro-vets, agricultural tool dealers and fertilizer are the main input suppliers. Nepal Agricultural Research Council (NARC) and Department of Agriculture (DoA) are the major service providers. NARC provides technological support related to improved rice varieties. DoA provides improved rice cultivation methods. Furthermore, different Non-Governmental and International Non-Governmental Organizations are also providing technical support to farmers.

Credit facilities are mainly provided by the local level cooperatives and banks. In addition, seed and seed related technologies are provided by local seed producer groups and cooperatives. Both small and large scale collectors are present in the value chain. In addition to collection, small scale collectors also engage in drying and winnowing and thereafter selling paddy to the local millers and large scale collectors. Millers typically engage in collecting, de-husking, grading, packaging and labelling rice. Millers sell rice to wholesalers, retailers or in some cases directly to consumers. Hence, the rice value chain in Nepal is comparatively simple and narrow in terms of number of actors and service provision (Yadew, 2018).

2.10 Rice Sector in Pakistan

Rice is considered as the second most important food crop in Pakistan and the average yield of Basmati rice is 2.5 t/ha which is low compared to other rice producing countries. Pakistan is popular for Basmati with aroma and other kinds of long grain rice. The second most exportable commodity in the country is also rice. Hence, rice is an attractive cultivation for growers. All rice cultivation is done under irrigation schemes using transplanting of seedlings manually. Hence, the production is highly labour intensive. However, threshing is delayed due to use of manual methods and also the post-harvest loss is significant at this stage. Paddy cleaning is done in order to remove foreign matters but this is very inefficient method. From harvesting to drying is carried out by the farmers. The entire process is mainly done manually and therefore, it is highly labour intensive. Dry direct seeded rice technology is also an emerging technique in Pakistan.

Commission agent's act as brokers between the farmer and miller. In general, rice miller's store and mill rice. Storage is carried out in the open yards and physical (moisture and temperature), biological (insects, rodents, birds and microorganisms), and chemical (rancidity and mycotoxins) factors collectively are responsible for deterioration of the quality during storage. Thus, the condition of infrastructure, which is an important secondary activity, is very poor. It is evident that Pakistan is using by-products of rice milling such as rice bran, rice bran oil, rice husk and broken rice. Also, the country produces value-added products such as rice flour, rice milk, rice starch, rice straws, rice paper, fiber boards, and rice glue and rice vinegar. Pakistan exports rice mainly to United Arab Emirates, United Kingdom and European markets. It is highlighted that there is a high potential to export non-Basmati rice as well (Yousuf et al, 2018).

2.11 Rice Sector in Malaysia k

Rice trading in Malaysia is assigned to a state-owned trading enterprise called *Bernas*⁹. *Bernas* was officially privatized in 1994 to ease the fiscal burden of the government and with the notion that a private sector enterprise will be better equipped to ensure the efficiency of the operations (Fatimah, Arifin, and Tey, 2019). The three main responsibilities of *Bernas* is to stabilize consumer and producer prices, to determine rice trade volumes, and to act as a canalizing agency. The domestic rice supply chain in Malaysia mostly consists of wholesalers and retailers. Comparable to *Bulog* in Indonesia, *Bernas* also has a profit-maximizing goal and is entitled to run commercial activities (Fatimah, Arifin, and Tey, 2019).

Malaysians consume rice grain daily, either as cooked rice or indirectly in the form of rice flour and they have a lot of rice based traditional foods. *Nasi lemak* which is, a celebrated national dish in Malaysia primarily consists rice cooked in coconut milk and infused with *pandan* leaves. Like most Asian cultures the Malaysian culture is also embedded with rice. In year 2016, the country consumed 2.7m mt of rice of which 67 percent produced locally, and the rest was imported primarily from Thailand, Vietnam and Pakistan.

Sarena et al (2019), studied the status of paddy and rice industry in Malaysia. The study points out that the rice production in Malaysia has increased over the decades. Historically, Malaysia has always had production-driven agricultural targets. Measures were introduced in the 1940s to help increase national rice production and protect farmers' welfare. Indeed, in the last 30 years, the total production has increased, allowing the self-sufficiency level (SSL) to hover between 60 and 70%. However, paddy farmers remain in the B40¹⁰. In 2016, the household income of farmers in MADA was RM2, 527/month, while the national mean was at RM6, 958/month. This household income is derived from, but is not exclusive to, the net profit from paddy cultivation. In the same year the exchange rate was RM 4.14 equal to one USD and one RM equals

⁹ State Owned Grain Marketing Agency in Malaysia

¹⁰ B40: The first 40% of the households in the income distribution are considered as the Bottom 40%.

to SLR 43. In 2014, COP for a renter was RM3, 766/Ha/season and net profit was RM2, 892/Ha/season. The largest contributions to the COP are land rental and machinery, at 42% and 30% respectively. The country needs to feed 31 million consumers with the production of 0.2 Million paddy farmers.

The study stated that the Malaysia is far from achieving the maximum possible yield for the paddy plant. The average annual rate of yield in other South East Asian countries ranges between 1.1%/year (Indonesia) and 2.4%/year (Vietnam), higher than Malaysia's 0.8%/year from 1986 to 2016. Therefore, Malaysia may consider continuing its focus on improving average farm yields. In 2016, the total value of paddy subsidies was estimated to be equal to RM0.79 for each kilogram of rice sold and the average household in Malaysia spent 6.1% (RM44/month) of their monthly expenditure for food and non-alcoholic beverages on rice. The rural households spent 7.2% (RM51/month) of their monthly expenditure for F&B on rice, more than their urban counterparts (5.7%, RM42/month). The rural poor and non-citizens are the most vulnerable groups in the event of rice price volatility.

Sarena et al (2019), suggested moving away from a production-centric policy targets measured in volumes incorporating other performance indicators such as the adoption of Good Agricultural Practices (GAP), improving transparency and accessibility through digitalization of data and information across the supply chain such as the adoption of the Block chain technology. The country should encourage the private sector for breeding new varieties because there has been a slow release of new rice varieties, monitoring of food safety beyond the manufacturing stage, from the farm to the bin. The study also suggests the application of Block Chain Solution technology in agriculture especially for the paddy/rice industry in order to adopt data liberalization and transparency.

Literature of all the rice producing countries pay much attention on upgrading their rice value chain. This is caused by the growing demand for rice, ensuring food security and the specific contribution of farmers to the rural economy. The relationship between farm gate price and consumer price of rice in most of the countries were summarized and the results are presented in the table 5.17 in results chapter.

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CHAPTER THREE

Conceptual Framework and the Methodology

3.1 Introduction

This chapter demonstrates the conceptual framework constructed to analyse the rice value chain in Sri Lanka. Systematic view has been used for the study in order to elicit the deeper aspects within the value chain. Further, this chapter sheds light on the concepts of value chain mapping and approach describing the significance of both qualitative and quantitative data. Further, it discusses how the research design and the selected variety of actors in different settings to map the best possible value chain. Sampling and composition of the sample is also elaborated. Next, the description of the study areas is presented. The chapter concludes by describing the methods of data collection and data analysis.

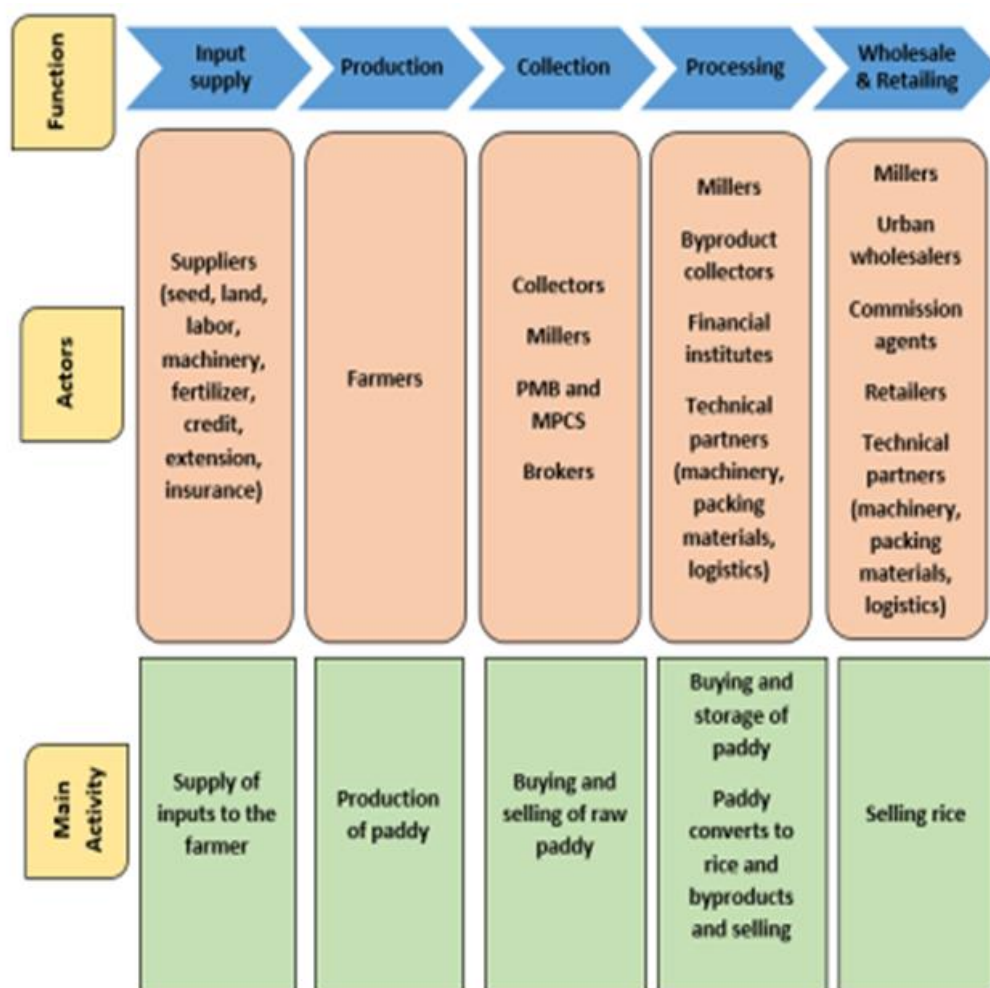
3.2 Conceptual Framework

An agricultural value chain concept explained as an economic unit of analysis of a particular commodity or group of commodities that encompasses a meaningful grouping of economic activities that are linked vertically by market relationships. The emphasis is on the relationships between networks of input suppliers, producers, traders, processors and distributors (UNCTAD, 2000). The conceptual framework of rice value chains in Sri Lanka views a network of horizontal and vertically integrated value chain actors that jointly aim to provide products to a market. The value chains include direct actors who are commercially involved in the chain (input suppliers, producers, traders, by product suppliers, by product manufacturers and exporters, retailers and consumers) and indirect actors who provide services or support the functioning of the value chain. These include financial or non-financial service providers such as bankers and credit agencies, transportation, machinery manufactures, extension agents and public services.

The study followed the classical value chain approach developed by Michel E. Porter in 1985. A value chain is a portion of a socio-economic system where upstream agents are linked to downstream partners by technical, economic, territorial, institutional and social relationships (Food and Agricultural Organization, 2013). Value chain consisted of a set of primary and secondary activities. Ultimate objective of studying the value chain is to identify value proportions generated through each activity by each actor. Several studies demonstrated that systematic view of the value chain illustrates the best possible and deeper understanding on the given agricultural context (Jaidaan, *et al.*, 2014; Roduner, 2007). Systematic value chain cascades into three counterparts namely; value chain function, actors and their influence or main activities. This allows us to analyse opportunities and bottlenecks within these counterparts as well as in the dynamic interactions between levels.

According to Figure 3.1, main functions of the rice value chain are identified as supplement of inputs, production, collection, processing paddy into rice and by-

products and wholesale and retailing the final product to the customer. Either a single or group of actors engage to execute each function. These players can be further categorized into primary actors who deliver primary activities and secondary actors who engage in supporting activities. Specific function of the secondary actors is to facilitate and maintain a seamless flow within the industry. It is important to understand, these players do not operate in isolation. Degree of facilitation services determines the boundary of the industry. For example, lack of storage availability has a direct impact on both production and marketing capacities. This determines the future orientation of the industry such as growth and expansion. The third layer is core activities each player does within the value chain. Increasing the efficiency and effectiveness of those core activities might result in an impartial value delivery to the final consumer.



Source: Compiled by the Author, 2019

Figure 3.1: Conceptual Framework for Rice Value Chain

3.3 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.

In agriculture, market power is often concentrated at the point a firm turns a commodity into a comestible good for e.g. 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).

3.4 Research Design

Since value chain analysis covers a wider area, there are no fixed rules on which research approach is better but there are strong grounds for recommending that a qualitative approach is used first, followed by a quantitative study (Food and Agricultural Organization, 2013). Hence, the study deployed a mixed method. Both qualitative and quantitative methods were used to gather data and information. Only rich information matters to understand the deeper contextual form of the scenario. Value chain mapping is an important analysis and the integral part of the value chain studies. Value chain mapping was carried on key prioritised product lines. The two major sub sectors will be selected as rice and rice bran. According to the (Food and Agricultural Organization, 2013) guidelines, value chains can be mapped and analysed using value chain analysis which can include qualitative and/or quantitative tools.

The channel mapping methodology was used to analyse the value chain because it is a process of tracing a product flow through an entire channel from the point of conception to the end market. The smooth functioning of interactions in the vertical linkages of an agricultural value chain depends to a large extent on the quality of the

products and services provided by horizontal linkages. Therefore, the study mapped all horizontal linkages like input supplies, extension, packing, transporting services of selected value chains. Study followed the UNIDO concepts of value chain analysis (Figure 3.2).

Step 1	Product/ subsector selection
Step 2	Review of existing literature and data
Step 3	Preliminary interviews/fieldwork
Step 4	Identification key issues & questionnaire design
Step 5	Drawing of preliminary (value-chain) map
Refine map and subsector understanding	
Step 6	Extensive fieldwork: interview of chain actors
Step 7	Visiting of physical facilities & institutions
Step 8	Quantification and refinement of map
Step 9	Re-assessment of results by actors and map finalization
Develop recommendations and policy	
Step 10	Group identification of potential points of leverage
Step 11	Group analysis of chain dynamics and major constraints
Step 12	Finding of group-based solutions

Source: United Nations Industrial Development Organisation, 2009

Figure 3.2: UNIDO Concepts of Value Chain Analysis

3.4.1 Sampling and Composition of the Sample

Multi-stage (initially the district level, then the DSD level and last GN Divisions) random sampling was used to select the paddy farmers for the study and purposive sampling for other stakeholders in order to ensure the information richness. Further, this enables it to include a variety of settings and situations and a variety of participants, including negative cases or extreme cases to obtain data (Moser & Korstjens, 2017). The sampling procedure is mainly determined by the conceptual requirements. Apart from the farmers, other key informants were selected carefully who hold special and

expert knowledge about the phenomenon to be studied and are willing to share information and insights. Sample size and the composition is shown in Table 3.1.

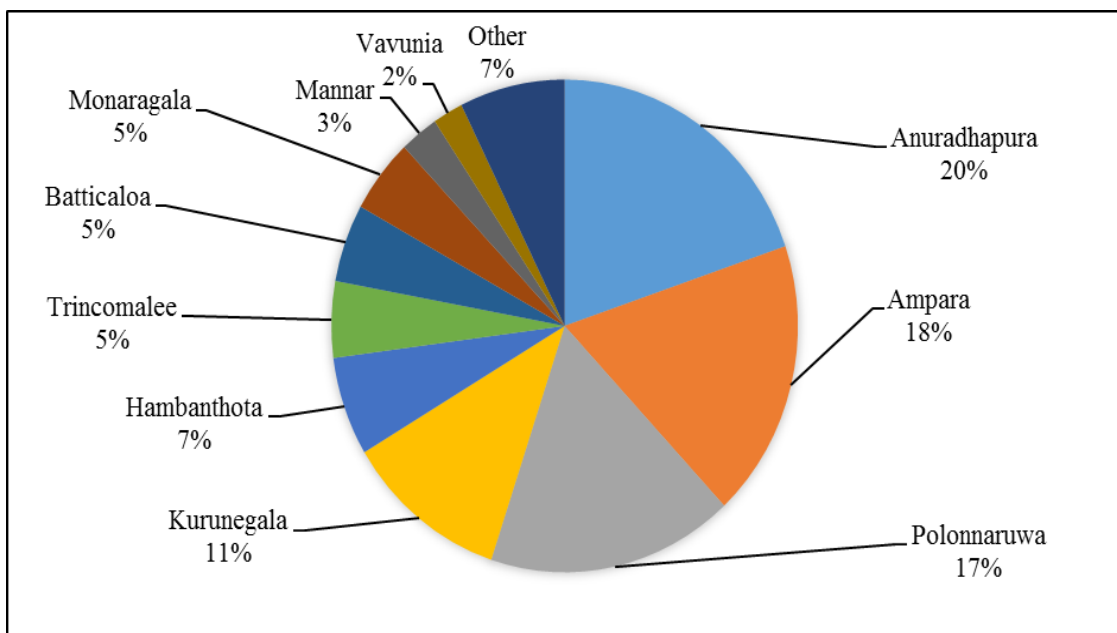
Table 3.1: Study Sample

Participants	Number
Farmers	105
Paddy Collectors	10
Rice Millers	12
By product Traders (includes Bran and Husk Collectors, Feed Manufacturers and Rice Oil Manufacturers)	15
Rice Wholesalers and Retailers	10
Other Key Informants (Government and Private Sector)	10

Source: HARTI Survey, 2019

3.4.2 Study Area

The main area of the study is the Polonnaruwa district. Polonnaruwa is the largest rice processing area in the country with 160 commercial rice mills. In terms of quantity of paddy milling per day 19 per cent of the mills belongs to greater than 20mt/day and 34 percent is 8-20mt/day (Wijesooriya & Priyadarshana, 2013). Also, Polonnaruwa is one of the major paddy producing areas. The paddy farmers in the district produce 17 percent of the total marketable surplus of paddy in the country (Figure 3.3). Hence, Polonnaruwa is the ideal study area to conduct a rice value chain analysis.



Source: Authors' Calculations Using the Data from Department of Census and Statistics

Figure 3.3: Annual Marketable Surplus of Paddy in Sri Lanka (%) in an Average Production Year, 2013

Farmers, assembly traders and rice miller were mainly selected within the Polonnaruwa district. In order to calculate the cost of production and returns, a paddy farmer survey was carried out by representing the rural DSDs in the district. Therefore, Medirigiriya and Dimbulagala DSDs were selected according to the highest number of farmers. (Table 3.2).

Table 3.2: Number of Paddy Farmers by DSDs in Polonnaruwa District

DS Division	Number of Paddy Farmers		
	Male	Female	Total
Thamankaduwa	5172	778	5950
Hingurakgoda	4210	814	5024
Medirigiriya	8356	1124	9480
Lankapura	4437	684	5121
Dimbulagala	9942	2001	11943
Elahera	5387	779	6166
Welikanda	4272	1049	5321
Total	41776	7229	49005

Source: Economic Census, 2014, DCS

Rice oil manufacturers, local dryer builders and packing material manufactures were also selected from Polonnaruwa district. Livestock feed manufacturers using rice bran, husk and dust were selected from Kuliypitiya and Bingiriya areas. Currently, the major rice supplying markets of rice millers in Polonnaruwa are located in the Colombo and suburban markets. Therefore, the main wholesale and retail market survey was carried out in selected suburban markets in Colombo. Rice bran exporters and machinery importers were also selected from Colombo and suburbs.

3.5 Methods of Data Collection and Data Analysis

Both primary and secondary data were gathered and used in the study. Primary data was gathered through key informant interviews using semi structured questionnaires, structured questionnaire surveys and focus group discussions. Secondary data was gathered through a review of existing literature.

To achieve the objectives 1 & 2

- Firstly, a review of existing literature on rice value chain studies in Sri Lanka and other countries were carried out.
- Secondly, key informant interviews using semi structured questionnaires for collectors (assembly traders), rice millers, bran collectors, feed manufacturers, wholesalers and retailers were carried out.
- Thirdly, structured questionnaire surveys and focus group discussions were conducted for farmers.

To achieve the objectives 3 & 4

- A SWOT analysis was carried out on rice and by-products value chains in order to find out the strengths, weaknesses, opportunities and threats throughout the chains.
- Value chain mapping and estimating value chain efficiencies

Both qualitative and quantitative data analysis tools and techniques were deployed to analyse gathered data. Accordingly, analysis of qualitative data was carried out with the identification of 'Critical' and 'Non-critical' issues existing with regard to study matter (Attaie & Fourcadet, 2003). Quantitative analysis such as gross margins, market margins and value addition percentage was calculated to find out the inefficiencies in each of the value chain actors.

3.5.1 Gross Margin Analysis (GMA)

GM is used to determine the returns realized by the farmers, processors and traders.

$$GM = TR_1 - TVC_1 \quad \text{Where,}$$

GM = Gross margin of framers, transporters, millers, wholesalers and retailers (Rs/kg)

TR = Average total revenue of farmers, transporters, millers, wholesalers and retailers (Rs/kg)

TVC = Average total variable cost of farmers, transporters, millers, wholesalers and retailers (Rs/kg)

i = 1-nth farmers, transporters, millers, wholesalers and retailers

3.5.2 Value Addition

Value Additions along the Paddy/Rice Value Chain: Value addition to agricultural products is the process of increasing the economic value and consumer appeal of an agricultural commodity. Value-added products are defined by USDA as having: A change in the physical state or form of the product.

$$\text{Value Addition (\%)} = \frac{\text{Marketing Magin}}{\text{Purchased Price}} * 100$$

3.5.3 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.

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, S_1 – market share of the industry

n – number of industries

$CR_4 \leq 33\%$ – competitive market structure

$33\% < CR_4 < 50\%$ – weak market structure

$CR_4 > 50\%$ – Oligopsony 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 (Tengku *et al.*, 2008).

3.6 Chapter Summary

A systematic view of the value chain: value chain function, actors and their influence or main activities is identified and broadly described in the chapter. The study followed the UNIDO approach to gather, analyse and interpret data. Further, value chain mapping is identified as a key aspect of the study. Gathered data were mainly of the qualitative nature. This has been practiced in order to seek rich information regarding the research matter. Quantitative data were also used to estimate value addition of the VC.

CHAPTER FOUR

Value Chain Mapping

4.1 Paddy/Rice Value Chain

This chapter presents different actors and their activities in the paddy/rice value chain. Theoretically value chain participants can be divided in three levels such as principle actor's supporters and facilitators. Studying the behaviour 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, producers, traders, processors, intermediaries, brokers, supporters, facilitators and policy makers are categorized under the above three broad actors. They fulfil various functions in the paddy rice value chain.

Value chain actors: The chain of actors who directly deal with the products by producing, processing or trading.

Value chain supporters: The services provided by various actors who never directly deal with the product, but whose services add value to the product.

Value chain influencers: The regulatory framework, policies, infrastructures, etc.

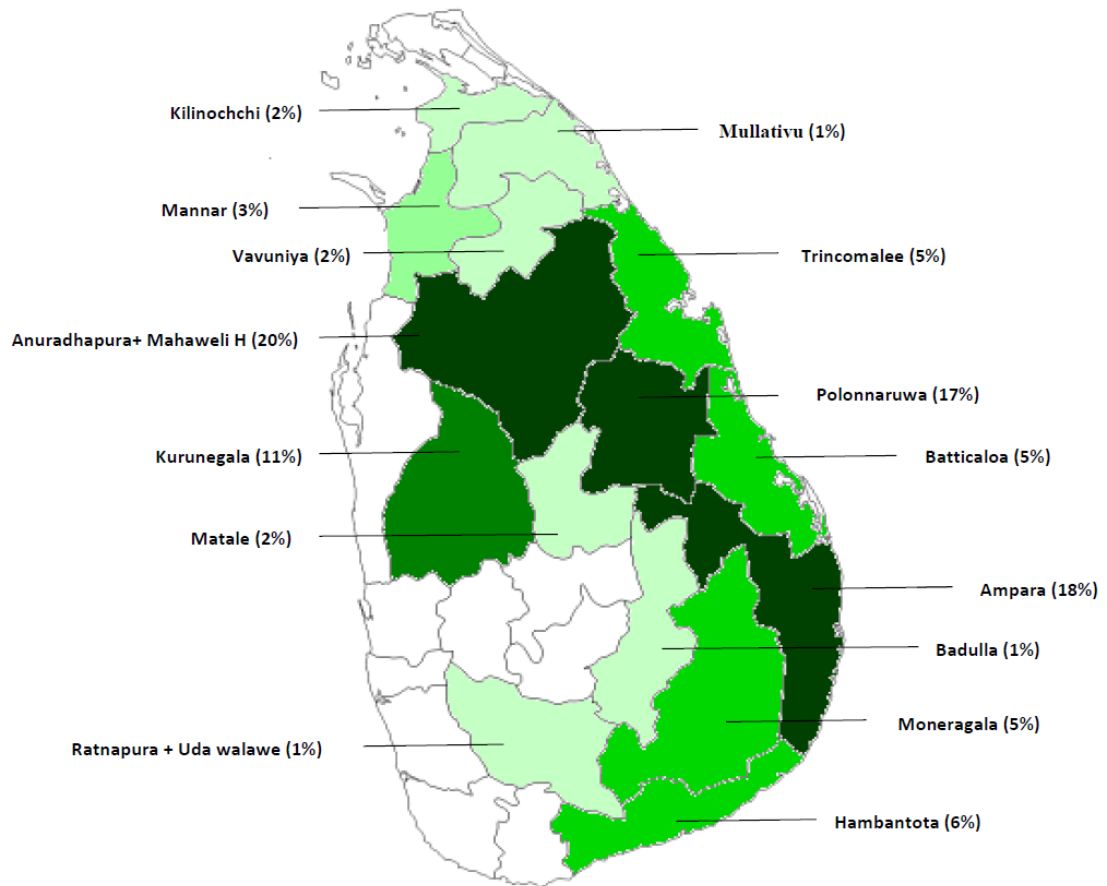
4.2 Production and Utilization of Paddy in Sri Lanka and the Study Area Polonnaruwa District

Prior to describing the nature and activities of the key actors involved in the paddy/rice value chain, in Polonnaruwa the study attempts to present the normal paddy/rice production situation in the country in a normal paddy production year by using the secondary data (Figure 4.1 & 4.2). It was clear that in an average production year the country produces 2.8 Million Metric tons of paddy in *Maha* season and 1.8 Million mt in *Yala* season and the total annual production is 4.6 Million mt. According to the production statistics 15 districts of the country create surplus of paddy after human consumption and other needs in the respective districts are taken into account. The following figures reveal the surplus districts and the percentage to the surplus. It was revealed that more than 75% of the surplus (S) is obtained from the North Central & Eastern Provinces and Kurunegala district.

The equation of the S is as follows.

$$S = \text{Net Production} - (\text{Wastage} + \text{Consumption} + \text{Seed requirement for next season})$$

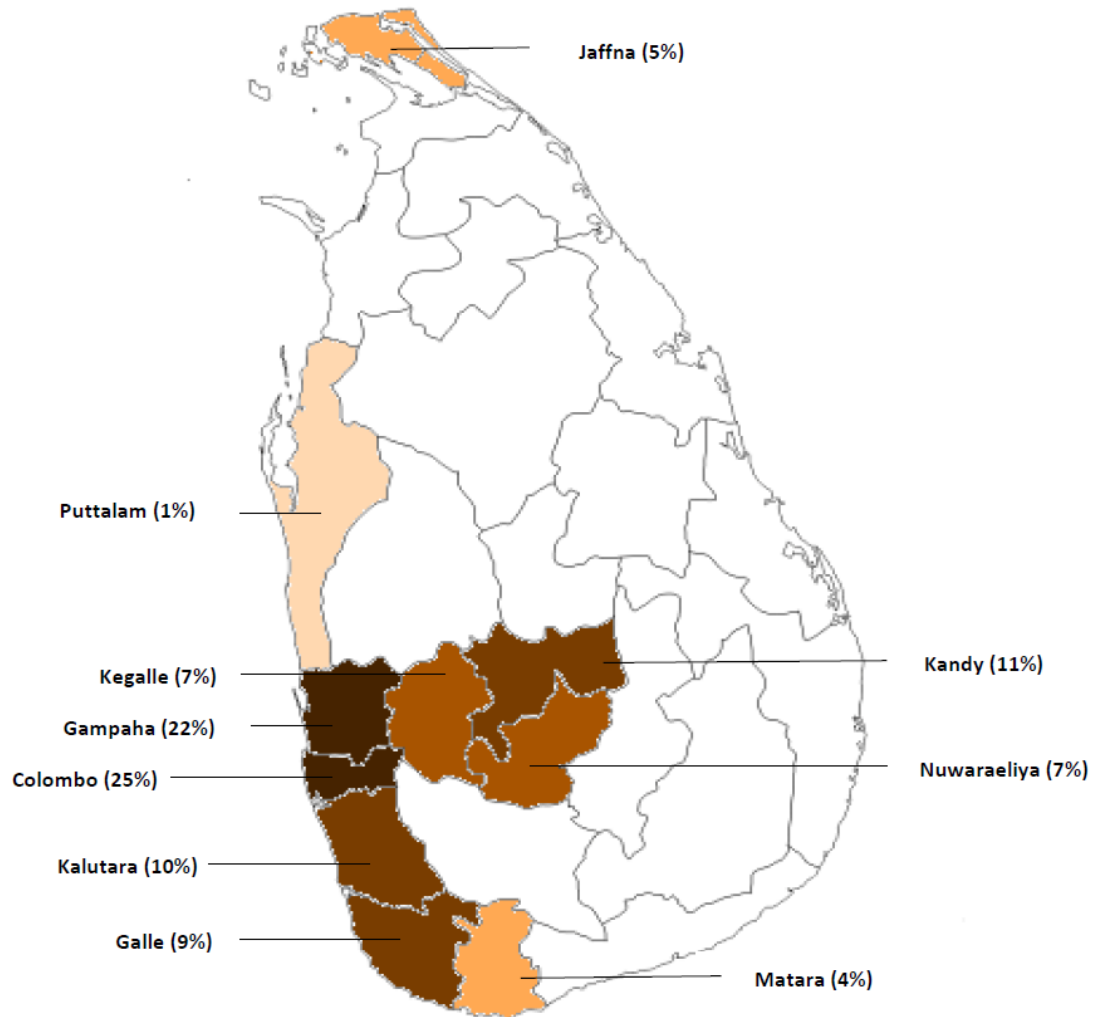
Paddy/Rice Surplus Districts in Sri Lanka



Source: DCS, Average Producing Year, 2013

Figure 4.1: Paddy/Rice Surplus Districts

Paddy/Rice Deficit Districts in Sri Lanka



Source: DCS, Average Producing Year, 2013

Figure 4.2: Paddy/Rice Deficit Districts

The following Table 4.1 also describes the paddy production and surplus of Sri Lanka and the Polonnaruwa district in a normal production year. In an average production year the country produces nearly 4.6 Million mt of paddy from *Maha* season 2.8 Million mt and from *Yala* season 1.8 Million mt.

Table 4.1: The Paddy Surplus Production in Sri Lanka and Polonnaruwa District

	Item	Units	Quantity
	Sri Lanka		
1	Paddy Production in <i>Maha</i> Season	mt	2846276
2	Paddy Production in <i>Yala</i> Season	mt	1774451
3	Annual Production in an Average Production Year	mt	4620727
4	Marketable Surplus (MS) in <i>Maha</i> Season	mt	1832429
5	Marketable Surplus in <i>Yala</i> Season	mt	930,910
6	Total Annual MS	mt	2763339
7	MS As a % of Total Paddy Production = $(6/3)*100$	%	60
	Polonnaruwa District		
8	Paddy Production in <i>Maha</i> Season	mt	277045
9	Paddy Production in <i>Yala</i> Season	mt	261263
10	Annual Production	mt	538308
11	Total Annual MS in the District	mt	471868
12	MS As a % of Paddy Production in Polonnaruwa	%	88
13	Utilization of Paddy by the Polonnaruwa Millers	mt/Annum	832200
14	Deficit Quantity of Paddy in the District = $(11-13)$	mt	-360332
15	As a % of the Annual MS of the Country = $(13/6)*100$	%	30.12

Source: Authors Calculations using the data of Department of Census and Statistics

The surplus quantity of paddy is the amount that remained after the removal of post-harvest losses, requirement of domestic consumption and the seed requirement of next season. The above Table reveals that in a normal production year nearly 2.76 Million mt of paddy is released to the market as surplus. Polonnaruwa district annually produced nearly 472000 mt of surplus paddy. However, the total requirement of Polonnaruwa rice millers is nearly 832000 mt and the deficit is nearly 360332 mt which is bought from the Eastern and North Central Provinces.

From the survey information an attempt was made to categorize the rice mills functioning in the Polonnaruwa district. The following table depicts the utilization of paddy by different categories of rice mills (Table 4.2).

Table 4.2: Annual Paddy Utilization of Rice Mills in Polonnaruwa

Mill Category	No of Mills	Per Day (mt)	Days/Month	Months	mt/Year	%
Largest Group 1	3	400	25	12	360000	43
Largest Group 2	3	150	25	12	135000	16
Largest Group 3	4	75	25	12	90000	11
Medium	9	40	25	12	144000	17
Small	86	10	10	12	103200	13
Total	105				832200	100

Source: HARTI Survey, 2019

4.3 The Key Actors Involved in Paddy/Rice Value Chain in Polonnaruwa

This sub chapter describes some key actors and their activities in the paddy/rice value chain in Polonnaruwa.

Table 4.3: Different Participants in Paddy/Rice Value Chain in Polonnaruwa

VC Stage	VC Supporters	VC Influencers
Farm Level Farmers	Inputs providers, Agriculture research and extension officers, RRDI, GA's, DOA, DOAD, AIB Machineries suppliers, Banks, Procurement	Policies (Seed, Fertilizer, Irrigation, Agrarian, Land)
		Research, New Varieties
		Import regulations
		FMRC Guidelines
		Credit Schemes, CBSL
		Guaranteed Price (GP) Policy
Paddy Collecting Collectors	Transport Credit Brokers	Purchasing policy, PMB, AMIS
Processing Rice Millers	Machinery importers, Local machinery Builders, Banks, Government institutions, Logistics, Storage, Packing and Marketing, Brokers	Machinery import policy, Environmental laws, GP & Rice price ceiling policies, COL regulations, MPCs, IPHT, Service organizations, Local authorities, CWE, Food commissioner
		Consumer protection laws, Quality standards Banks, Credit schemes, CBSL

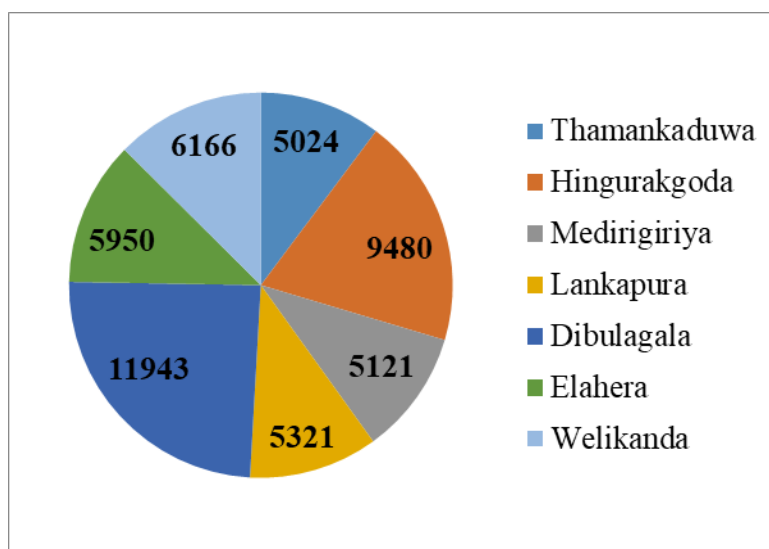
By-product Trading Traders	Collectors, Traders, Manufactures of feed, bran, bran oil, Husk & RHA, exporters	Feed manufacturing regulations, Cement industry
Rice Trading Wholesalers	FC, CWE, DEC's, Super market chains, Petah market traders, Private wholesalers.	Ceiling Price Law, Consumer Laws
Rice Retailing Retailers	Retailers, MPCS network	
Consumer	SLSI, CPA, AMIS providers like HARTI	Consumer Protection Laws, Quality Standards

Note: RHA: Rice Husk Ash, AMIS: Agriculture Market Information Services, DOA: Department of Agriculture, RRD: Rice Research and Development Institute, FMRC: Farm Machinery Research Centre, DAD: Department of Agrarian Development GA: Government Agent, FC: Food Commissioner, PMB: Paddy Marketing Board, DEC: Dedicated Economic Centers.

Source: Compiled by the Author, 2019

4.4 Farmers

Farmers are the first and the most important link in the marketing chain. Farmers produce and sell their paddy through different channels. The main channels are, rural paddy collectors, large scale millers, rice wholesalers in major cities and consumers in major deficit areas. Also the farmer is the first actor of the value chain in rice marketing. Using secondary data, the number of farmers and their land distribution was highlighted for the Polonnaruwa district. The main channel is collectors, large scale millers, urban wholesalers, and consumers. There is a separate chapter describing farmers with field survey results (Chapter 5).



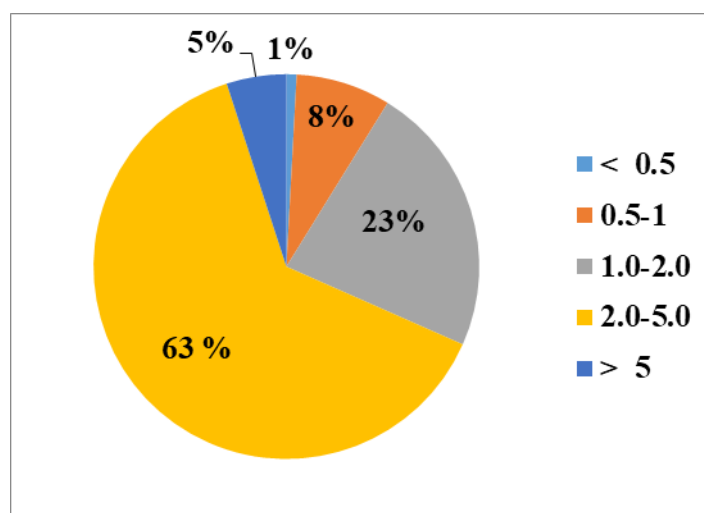
Source: Economic Census, 2014, DCS, Sri Lanka

Figure 4.3: Distribution of Paddy Farmers by DSD in Polonnaruwa

Table 4.4: Number of Paddy Farmers by DSD in Polonnaruwa District

DSD	Number of Paddy Farmers		
	Male	Female	Total
Thamankaduwa	4210	814	5024
Hingurakgoda	8356	1124	9480
Medirigiriya	4437	684	5121
Lankapura	4272	1049	5321
Dibulagala	9942	2001	11943
Elahera	5172	778	5950
Welikanda	5387	779	6166
Total	41776	7229	49005

Source: Economic Census, 2014, DCS, Sri Lanka



Source: Economic Census, 2014, DCS, Sri Lanka

Figure 4.4: Distribution of Paddy Farmers by Land Size (Acres) in Polonnaruwa District

4.5 Paddy Collectors (Assembly Traders)

There are a number of traders involved in paddy purchasing in Polonnaruwa as the first link of the paddy/Rice value chain. They are collectors, local millers, large scale millers, Paddy Marketing Board (PMB). In addition, sometimes Multi-Purpose Cooperative Societies of the respective producing areas also purchased paddy for producing rice for their retail outlets. However, the most prominent channel in Polonnaruwa is the purchasing of paddy by the collectors. Therefore, the paddy collectors are the second value chain actors in the paddy/rice value chain in Polonnaruwa. In other words, they are the first link between the farmer and other middleman. A previous study conducted in 2011, in Polonnaruwa district revealed that

collector who are known as ¹¹Assemblers operate at village level and normally there are about three collectors in a village and each has a collecting centre to which he collects several smaller lots of the village paddy production spending his money and combines them into a single load (Wijesooriya, 2013).

The present study reveals that these village-based small scale paddy collectors have transformed into one or two large collecting centers covering more than one village. A Divisional Secretariat Division (DSD) has about 20-25 large collecting centres. These centres sell agro chemicals, fertilizers in addition to purchasing of paddy (Figure 4.5). In some instances, these collectors provide tractors for land preparation and combined harvesters for harvesting on a credit basis. These collectors possess a lorry to transport paddy to the rice mills in addition they are the suppliers of paddy to large scale millers. Sometimes they obtain the service of brokers when paddy is purchased from remote areas in the district itself or in nearby districts. The collector sells his paddy stocks directly to the millers in nearby areas and to the outside millers through brokers. Hence, they fulfil an exchanging function in VC. A collector normally deals with about 50 -100 paddy farmers in the area. He has a farmer base in the village and nearby villages in the DS Division. The collector's role is predominant in areas where the mills are less concentrated.

The main reason for the services of the small-scale collectors to be weakened at village level is the gradual increase in wet paddy reaching the markets soon after harvesting. Wet paddy or paddy that has a high content of moisture has to be directly and quickly transported to the rice mills where dryers are available. However, the small-scale collectors at village level are not able since large or medium trucks or lorry are required for transportation.



¹¹ Village level Paddy Collection Centers



Source; Compiled by the Author, 2019

Figure 4.5: Paddy Collecting Centers in Polonnaruwa

4.6 Millers

In the paddy rice marketing channel, the millers fulfil the processing function which is one of the most important stages. They change the form of the product: paddy into brown/polished rice. The quality of rice in the market mostly depends on the quality of rice processing. Wijesooriya and Priyadarshana (2013) found that there are nearly 160 mills functioning in the district. The study also revealed that 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. There were a considerable number of small-scale rice mills in Kaduruwela in 2011, but at present they are not operational or operate in other related businesses such as paddy drying, rice bran and husk collecting. In 2011, mills in which the per day milling quantity exceeded 20 mt of paddy were classified as large scale mills. But now the situation has changed and a new classification is in use (Table 4.5).

It was revealed by the present study that the number of small scale rice mills has decreased whereas the number of large scale mills has increased. According to the above table, the production of the Polonnaruwa district cannot cater to the requirement of the rice mills in that district. That requirement is fulfilled through the large scale rice mills purchasing paddy from the producing areas from Northern and Eastern Provinces and Anuradhapura district. Study obtained the two millers lists from Government Agents Office and United Rice Producers Association, in Polonnaruwa. According to that records, the number of functioning mills ranged from 90 to 110 in the district.

The following tables' shows the classification of rice mills according to the per day milling quantity of paddy found in the study (Table 4.5.).

Table 4.5: Classification of Rice Mills

Per Day Milling Quantity of Paddy(mt)	Scale
Less than 20	Small
20 -50	Medium
More than 50	Large

Source: HARTI Survey, 2019

The capacity of four largest mills in Polonnaruwa district ranged between 50-200mt of paddy per day in 2011, however at present the capacity of four largest mills ranges between 100 and 400 mt of paddy per day. It was also noticed that the medium millers at that time have upgraded to large scale level. It was also noted that a certain number of small scale mills have left the industry. It can be observed that the four largest mills in 2011, have doubled their capacity at present as a result of establishing their rice brands successfully in all major consuming areas using marketing strategies. They in turn have doubled their production to cater the increased demand in return.

The study found that the two largest millers have modern Silo for storage of paddy for which they have made huge investments. One miller has 20 Silos and the other has 6 Silos and each Silo can store more than 3000 mt of paddy. The grain loss and weight loss of these modern Silo storages are minimum and the quality of paddy being assured.

According to the Table, the four largest rice millers in the Polonnaruwa district currently utilize nearly 405, 000 mt of paddy annually (Table 4.3). All the 105 mills annually utilize 803, 400 mt of paddy. Accordingly, the calculated value of CR4 of four largest rice mills is 50 (Table 4.6).

4.7 Paddy Stockist

There are some stockists in the districts who purchase paddy from farmers and collectors and maintain paddy stocks in their own warehouses. They maintain their paddy warehouses in areas like Aralaganwila, Welikanda and Dehiattakandiya maintaining the paddy stocks purchased in the harvesting period using credit facilities provided by the banks. They have facilities like container vehicles and weighing bridges. They retain their paddy stocks for a short time and sell them to rice millers at a higher price on a later date. However, in proper records are not available with regard to paddy stockists or collecting centres due to absence of a monitoring process. Therefore, it is recommended that information of all the actors included in the paddy/rice value chain should be regularly updated. Further there collecting and storage processes should be monitored.

4.8 Degree of Millers Concentration and Market Power in Polonnaruwa District

Table 4.6: The Values of Concentration Indices on Milled Rice Production in Polonnaruwa District

Year	Measure	Polonnaruwa
2011	CR4	30
2019/20	CR4	50

Source: HARTI Survey, 2019

The most important issue is whether some millers are able to dominate the industry. 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). In order to have a clear view on this, it is useful to compute the four firms "Concentration Ratio (CR4). Concentration ratio (CR) is the cumulative share of the "k" 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. 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). However, still, the CR does provide a useful, though rough, measure.

Therefore, it is clear that the four largest rice mills, in 2011, have doubled their capacity and the CR4 value and increased from 30 to 50. This means nearly half of the rice production in Polonnaruwa district is controlled by the four largest millers and the situation can be explained as the rice milling is concentrated among the four millers.

4.9 Brokers in the Paddy Buying System

These agents work for a commission on behalf of other participants by operating between the paddy collector and the miller. Brokers generally have a long standing relationship with millers and make purchases for them but they do not invest in paddy trade and do not take any price risks. Brokers bring buyers and sellers together and assist in negotiations on a more ad hoc basis.

The study identified a decrease in the functioning of brokers within the district due to a number of large collectors found in large scale mills. However, the paddy supplies from other districts which are rice producing areas in Eastern and North Central provinces like Ampara and Anuradhapura seek the assistance of brokers to sell their paddy to large scale mills.

Typically, they work for a flat rate of around Rs. 1000/= per lorry load paid by the miller (Buyer). It is equal to Rs. 10 per 64 kg paddy bag. It is observed that this broker charge has not changed for a long time. The most popular way of purchasing paddy mainly from the suppliers from outside the district is through brokers. 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, North central and Northern Provinces. 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 doorstep of their mill thus saving time. Therefore, many of the medium and large scale millers get the service of a broker.

In 2011, there were 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 Marandagahamula, and Kurunegala areas. However, now with the declining milling industry in Maradagahamula area, the number of brokers functioning in Polonnaruwa also decreased. 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. Therefore, the number of brokers has reduced now.

4.10 By-Product Collectors

There is a group of traders who organize purchasing of rice bran, rice polish, paddy husk and broken rice from mills. There are nearly 20 such traders operating in the Polonnaruwa district for paddy husk trading. There are nearly 20 traders in the parboiled rice bran and polish collection and trading and they supply bran mainly to the RICO rice oil manufacturer in the Polonnaruwa industrial zone and manufacturers in the Dankotuwa area. All raw rice bran is supplied to the animal feed manufacturing industry in Kuliypitiya, Udubaddawa and Bingiriya areas in the North Western Province. After the extraction of rice oil from the bran the remaining residues are transported to Colombo and exported to India. In India the parboiled rice bran is used to manufacture rice oil and the residues for feed manufacturing. During the study period, the price of rice bran and rice polish in Polonnaruwa was Rs 35/kg and Rs 32.00/kg respectively. It is observed that the price of raw rice bran was higher than parboiled rice bran due to its superiority in terms of nutrition.

4.11 VC Supporters at Different Levels of the Paddy/Rice Value Chain

The main input of the paddy rice value chain is paddy seeds. Providing seed paddy to the farmers in the district is mainly done by the Department of Agriculture (DOA) and the private sector companies. Seed and Planting materials Development Centre and Seed Certification Service (SCS), and Rice Research and Development Institute of DOA are the key institutions in the seed paddy production process. Seed Certification Service of the DOA monitors the whole seed production programme of the private sector.

Hayley's, Agstar, CIC, Araliya and Parakum are some of the private sector companies involved in seed paddy production and marketing in Polonnaruwa district. In addition,

Dimbulagala MPCS and *Mahaweli* Seeds Company are also engaged in seed paddy production. Each of these private sector companies possesses a registered farmer base. These companies provide farmers the necessary assistance and credits and this assistance is given through their extension officers. The companies purchase the seed paddy harvest of the farmers at an agreed price. Accordingly, the excess seed paddy produced in the district is provided to other districts too. It was observed in the study that the above process goes on smoothly without any problems.

The study also found that a particular large scale rice miller has established a plant to manufacture paddy/rice packing materials. In addition to the rice packing materials they also provide packing for some other food manufactures in the country.

Large scale rice millers have entered the seed paddy manufacturing, fertilizer trading and paddy/rice packing material manufacturing businesses and they contributed the chain development as well. In the meantime, they penetrate their market power both up and down stream of the paddy to rice value chain.

Extension services are provided by the extension staff of the DOA and this is given to the entire farming community. Agricultural machinery is also extended as another important support service and this is mainly fulfilled by the private sector. This machinery includes tractors for land preparation and combined harvesters which come at a cost to the farmer. Credit facilities for paddy farming are mostly provided by government banks while private banks are also involved in providing these facilities. The government intervenes in paddy marketing by purchasing at a guaranteed price through Paddy Marketing Board. However, the major portion of the harvest is purchased by the private sector.

When rice milling is considered most of the modern machinery is imported. Such machinery was imported mainly from Japan in the past. However, the situation has changed and most of the machinery at a lower cost is imported from China and India. According to the rice millers there are about ten importing companies. However, few local manufactures have evolved in this machinery industry for e.g. in the past paddy dryers were mainly assembled in Sri Lanka by Indian companies however at present this is mostly done by local manufactures. Therefore, special attention should be given to upgrade these local manufactures.

Research on machinery is carried out by the Institute of Post-Harvest Technology and Farm Machinery Research Centre of DOA. Policies, Regulations and Acts with regard to paddy rice value chain can be considered as influencing mechanisms such as Seed Paddy Policy, Fertilizer subsidy policy, guaranteed price policy, Sri Lanka standards related to the paddy and rice and manufacturing, and Rice Ceiling Price Policy.

4.12 Facilitating Functions in the Paddy/Rice Value Chain

Traders not only use brokers but also facilitate 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, and 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 agent and market authority. In sum, the above classification of marketing agents is useful for this study. They will be applied for analysing all types of actors/agents that perform different marketing functions in the rice marketing channels in Sri Lanka in more detail. The study identified that at the production stage, input providers (seed, machinery, labour, credit), agriculture extension staff of DOA, Agrarian Services Department, and Irrigation Department are the major facilitators. During the post-production stages the Paddy Marketing Board, IPHT, Development Banks, Consumer Protection Authority, Sri Lanka Standards Institution, are some of the important facilitators.

4.13 Paddy Marketing Board (PMB)

Government intervention in the 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 the other government marketing institutions in their respective countries. 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.

Governments may keep different types of storage reserves, depending on the extent 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 the Government's overriding concern for national food security, which is fundamental to political stability. Government, therefore, uses 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 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 fulfil the activities of PMB. However, the PMB was re-established in 2010 to achieve the objectives of purchasing agro production and their supply and distribution, encouraging producers 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 the government's guaranteed price scheme for paddy, introduced through the Paddy Marketing Board.

The paddy production in the war affected areas like Batticaloa, Trincomalee, 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 prominent to stabilize the market. The PMB continued purchasing paddy, increasing the amount gradually every season and reached the highest in 2015.

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 the rising population in the world, domestic prices and escalating cost of paddy production have made us wiser on how to handle this valuable commodity.

4.14 The National Institute of Post-Harvest Management (NIPHM)

The institute operates under the Ministry of Agriculture. Previously it was known as the Institute of Post-Harvest Technology (IPHT), which is responsible for the development of post-harvest technology for rice, other grains, and other agricultural commodities like field crops, fruits, vegetables and spices. The institute is engaged in research, training & extension, consultancy, advisory and other activities in order to improve the post-harvest technology. The Institute has taken over the functions of the Rice Processing Research & Development Centre (RPRDC) of the Paddy Marketing Board, which was set up with the assistance of FAO/United Nations Development Programme (UNDP) in 1976. IPHT implemented a project called Modernization of Rice

Mills in 2001 to increase rice output and to improve rice quality up to international standards. The Treasury introduced a loan scheme with concessionary interest rates through the Bank of Ceylon to rice processors to modernize their rice mills with the recommendation of the IPHT during the project. 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.

Currently the institute is planning to commercialize the technologies like processed fruit and vegetable based products, rice cream, vegetable cake, soup cube, instant mung kiribath mix, and bio wax. In addition, currently the institute is engaged in research, design and development and evaluation of railway for fruits and vegetable transportation.

4.15 Banks

The role of state and private banks is vital as a facilitator in the rice milling industry. The banks fulfil 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 the paddy/rice value chain. The study has found that the state banks is the leading bank in Polonnaruwa. The banks prefer to arrange ¹²pledge 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.

4.16 Value Chain Influencers: Policies and Institutions

Laws, regulations, policies, international trade agreements, social norms and public goods, all contribute to the agribusiness' milieu (Haggblade, Theriault, Staatz, Dembele & Diallo, 2012). Consequently, there is an environment that comprises economic, political, cultural and demographic factors that shape the development goals and strategies of a country. These tactics are expressed through national policies implemented by several policy instruments (i.e. taxes, credits, subsidies) and institutions, which, at the same time, create an impact on agro-industries and farms. In order to adjust to these policies, the production chain and agroindustry encounter difficulties due to the changes, which consequently force the national goals and strategies to adapt to these new challenges and demands (Austin, 1992). In concordance with the policies, there are also institutional linkages. These relationships, among the different types of organizations that operate and interact with the agroindustry production chain, tend to affect the dynamics of the production

¹² Paddy pledging scheme for millers

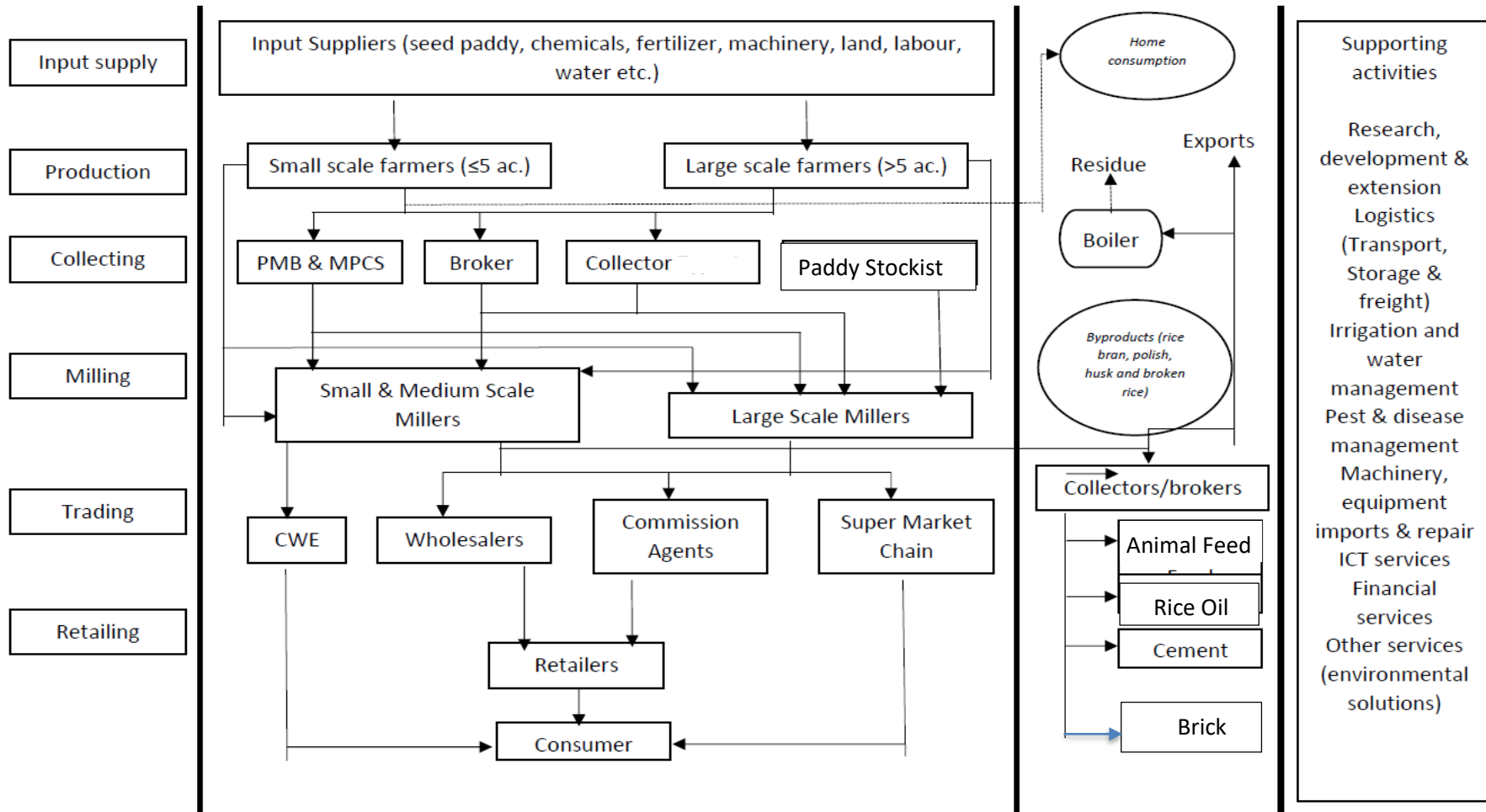
chain, the access to international markets, and even the instauration of certain policies (Austin, 1992).

When we consider the paddy/rice sector in Sri Lanka, the legislations related to the agrarian services acts, paddy land ordinance, fixing of minimum support price, rice ceiling price, commercial storage, lending principles and paddy rice standards are important.

4.17 Paddy/Rice Value Chain Map

By considering all of the above-mentioned different actors and their functions in the paddy/rice value chain, the study attempts to construct a Value Chain Map as follows (Figure 4.6).

The VC map was drawn after studying all the functions related to each point of the entire value chain.



Source: Compiled by the Author, 2019/20

Figure 4.6: Paddy/Rice Value Chain-Polonnaruwa

Paddy/Rice Value Chain in Polonnaruwa and Porters Five Forces model (Box 1)

To provide a common thread for the analysis, the study attempted to describe the paddy/rice value chain in Polonnaruwa district according to the Michael Porters Five Forces Model. Porter identifies five forces that shape an industry: (1) rivalry among existing competitors, (2) threat of new entrants (3) bargaining power of suppliers (4) bargaining power of buyers and (5) the threat of substitute products (Porter, 2008).

The paddy/rice value chain in Polonnaruwa district mainly consists of a large number of small scale paddy farmers, few paddy collectors, very few large scale rice millers, few medium scale rice millers, number of small scale rice millers, number of rice wholesalers in main cities, and large number of retailers spread all over the country. The rice miller is the key actor between the paddy producing farmer and the rice consumer of the paddy/rice value chain. And the rice miller plays a dual role – as the buyer when purchasing paddy and the seller when selling rice to the wholesalers and retailers. However, literature in countries like Bangladesh reveals that there are number of middle actors functioned between rice millers and rice retailers. In such contexts there are no direct links between rice millers and rice wholesale or retail traders. This method is similar to that practiced in the manning market based commission selling system some decades ago. At present the rice millers in Polonnaruwa get directly connected with the wholesalers and in some instances with retailers in major consumer areas too.

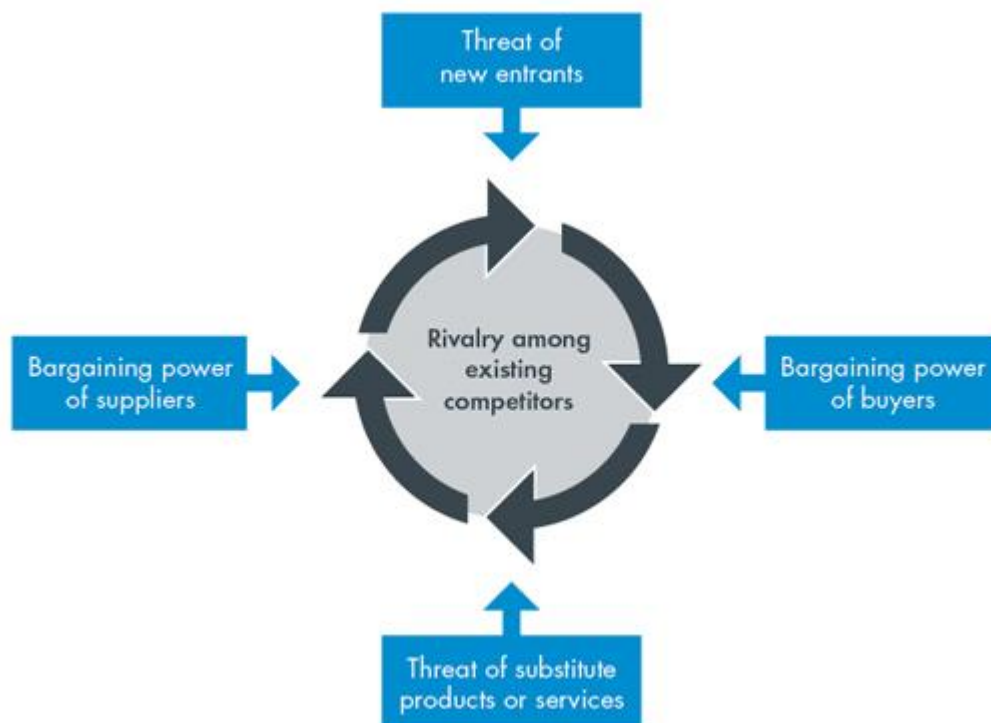


Figure 4.7: Porter's Five Forces of Competitive Position Analysis

The five forces are:

1. Supplier power.

An assessment of how easy it is for suppliers to drive up prices. This is driven by the: number of suppliers of each essential input; uniqueness of their product or service; relative size and strength of the supplier; and cost of switching from one supplier to another.

The rice millers in Polonnaruwa district mainly purchase paddy from large number of small scale farmers scattered in Polonnaruwa, Anuradhapura, Eastern and Northern Provinces. Approximately 0.3 Million small scale farmers provide paddy from those areas. Among these farmers a few percentage of large scale farmers are found in Batticaloe district whereas the majority who cultivate less than two acres are found from all other areas. As the majority of farmer population who provide paddy are small scale farmers, they have a less bargaining power on determination of farm gate price.

2. Buyer power.

An assessment of how easy it is for buyers to drive prices down. This is driven by the: number of buyers in the market; importance of each individual buyer to the organization; and cost to the buyer of switching from one supplier to another. If a business has just a few powerful buyers, they are often able to dictate terms.

The most prominent channel in Polonnaruwa district is purchasing paddy by the collectors. Therefore, the paddy collectors are the second value chain actors in the paddy/rice value chain in Polonnaruwa. According to a previous study there are about three collectors in a village and each has a collecting centre to which he collects several smaller lots of the village paddy production spending his money and combines them into a single load (Wijesooriya, 2013). The present study reveals that those village based small scale paddy collectors have transformed in to one or two large collecting centres covering more than one village. A Divisional Secretariat Division (DSD) has about 20-25 such type of large collecting centres. These centres sell agro chemicals, fertilizers in addition to purchasing of paddy. Some instances these collectors provide tractors for land preparation and combined harvesters for harvesting on credit basis. Those collectors possess a lorry to transport paddy to the rice mills. They collect mostly supply paddy to large scale millers. Sometimes they get the service of brokers when paddy is purchased from far remote places in the district itself or in districts nearby. The collector sells his paddy stocks directly to the millers in nearby areas and the outside millers through brokers. Hence, he fulfils an exchanging function in VC. A collector normally deals with about 50 -100 paddy farmers in the area. This collector has a farmer base in the village and nearby villages in the DS Division. The collector's role is predominant in areas where the mills are less concentrated.

It was revealed by the present study that the number of small scale rice mills has decreased where as the number of large scale mills has increased. According to the above table, the production of the Polonnaruwa district cannot cater the requirement of the rice mills in that district. That requirement is fulfilled through the large scale rice mills purchasing paddy from the producing areas from Northern and Eastern Provinces and Anuradhapura district.

According to the records number of functioning mills ranged 90 to 110 in the district. The capacity of four largest mills in Polonnaruwa district ranged between mt of paddy per day 50-200 in 2011, but by now the situation has rapidly changed. And at present the capacity of four largest mills ranges mt of paddy per day 100 - 400. It was also noticed that the medium millers at that time have upgraded in to large scale level. However, a certain number of small scale mills has left the industry. It can be observed that the four largest mills in 2011, have made their capacity double by now. This situation is a result of establishing their branding successfully in all major consuming areas using marketing strategies. And they had to double their production to cater the increased demand in return.

When buyer power is considered the collector who purchased paddy from farmers is identified as the first buyer in the value chain. Rice miller who purchases paddy from the collectors and directly from the farmers is the second buyer in the paddy purchasing of the value chain. The miller produces rice from the purchased paddy and supplied that rice to wholesale and retail traders in major cities. Accordingly, the rice millers play a dual role as a buyer in buying paddy from farmers and a seller in selling rice. This situation especially allows major rice millers to exercise both buyer power and seller power.

3. Competitive rivalry.

The main driver is the number and capability of competitors in the market. The marketable surplus of paddy produce in a normal producing year in Polonnaruwa district is approximately sufficient to fulfil the annual paddy requirement of the six largest millers in that district. It is revealed by the previous table. However more than 100 rice mills functioned in the district. Therefore, the major rice millers tend to purchased paddy from other districts with major paddy surplus. Here the large millers purchased paddy mainly from the producing areas in the Eastern Province where there are relatively few rice mills are available. This situation gives them an opportunity to purchased paddy at low prices with low competition.

However higher exit barriers can increase rivalry and competitive pressures. This can happen when profitability is low for an industry, but firms are unable to exit—or exit quickly—due to investments in specialized assets, high exit/shut-down costs, emotional attachments to an industry, or contractual or other relationships between firms.

4. Threat of substitution.

Where close substitute products exist in a market, it increases the likelihood of customers switching to alternatives in response to price increases. This reduces both the power of suppliers and the attractiveness of the market. According to the Household Income and Expenditure Surveys, the annual per capita rice consumption was 103.7kg, 107.9 kg, 108.8 kg, 107.8kg, and 107Kg in 1986/87, 2006/07, 2009/10, 2012/13 and 2016 respectively. It is clear that during the recent past, per capita consumption shows a degree of stability.

Wijewardana and Rupasena (2016), studied the Price and Income Elasticity's of Demand for Rice in Sri Lanka and study indicated that consumer response for rice to change either price or income is limited. Inelastic price demand means availability of limited substitutes for rice. This study found that bread is not the substitute for rice. Due to the nature of inelastic price demand, increased rice prices lead to increase rice expenditure and country's inflation.

And also the demand for imported rice varieties was limited and this was experienced during the periods with heavy rice imports.

5. Threat of new entrants

The threat of entry depends on the height of barriers to entry. These barriers include: the extent to which established firms have scale economies, the extent to which established firms enjoy a market or cost advantage over potential entrants, high capital requirements for new entrants, the extent to which established firms have better access to distribution channels for inputs and outputs, the extent to which government regulations restrict entry, and the extent to which established firms have brand name loyalty with customers.

New entrants result in higher competition for existing rice millers and collectors. The present study reveals that those village-based small scale paddy collectors have transformed in to one or two large collecting centres covering more than one village. A Divisional Secretariat Division (DSD) has about 20-25 such type of large collecting centres.

The capacity of four largest mills in Polonnaruwa district ranged between mt of paddy per day 50-200 in 2011, but by now the situation has rapidly changed. And at present the capacity of four largest mills ranges mt of paddy per day 100- 400. It was also noticed that the medium millers at that time have upgraded in to large scale level. However, a certain number of small scale mills has left the industry. It can be observed that the four largest mills in 2011, have made their capacity double by now. This situation is a result of establishing their branding successfully in all major consuming areas using marketing strategies. And they had to double their production to cater the increased demand in return. When new entrants is considered in rice milling it is quite low.

Chapter Five

Results and Discussion

This chapter deals with the socio economic profile of the sample paddy farmers in the study areas. The descriptive analysis also explained the variables like age, gender, land size, occupation, experience, paddy production and marketing, marketing channels, rice processing, value addition and different margins in paddy/rice value chain. Further, chapter describes paddy land usage, water usage and seed usage by farmers. Chapter also provides the process of by-products production and utilization.

5.1 Farmer Characteristics

Total of 105 farmers from two DSDs (Medirigiriya, n=62 & Dimbulagala, n=43) covering five ASCs (Medirigiriya, Kaudulla, Galamuna, Manampitiya and Dimbulagala) were selected for the study. Table 5.1 represents some of the selected demographic characteristics of the sample. Out of the total sample majority (96%) of respondents were males. Most of the farmers (73%) were in the age of 41 years to 65 years. Only seven percent were below the age of 40 years which indicates a lesser number of younger generation participation in paddy farming. More than 90 percent of the farmers were married and nearly half (49%) of the farmers have more than four family members within the household (Table 5.1).

Table 5.1: Demographic Characteristics of the Sample

Characteristic	Category	Frequency	Percentage
Gender	Male	101	96
	Female	4	4
Age	Below 40 years	7	7
	41-65 years	77	73
	Above 66	21	20
Marital Status	Unmarried	2	2
	Married	103	98
Education Level	No Schooling	2	2
	Grade 1-5	25	23
	Grade 6-9	21	20
	Up to G.C.E. O/L	46	44
	Up to G.C.E. A/L	10	10
	Diploma/Vocational Training	1	1
Family Size	Below 4	56	53
	Above 4	49	47

Sources: HARTI Survey, 2019

Interestingly, the majority (44%) were educated to G.C.E. O/L while 20 percent were educated up to grade six to nine. Only 10 percent had higher education qualifications. Only two percent (2%) were characterized under no schooling category Hence, one can deduce that the sample has reasonable education qualifications.

Table 5.2: Types of Occupation

Main Occupation	Frequency	Percentage	Secondary Occupation	Frequency	Percentage
Farmer	94	90	Farmer	9	9
Pensioner	9	8	Animal Husbandry	2	2
Government Employee	1	1	Self-Employed	6	6
Skilled Employee	1	1	Agricultural Labour	4	4
			Non Agricultural Labour	1	1
			Skilled Employee	3	3
			Business	1	1
			Agri-Business	1	1
			Private Sector Employee	2	2
			No Secondary Occupation	76	72
Total	105	100	Total	105	100

Sources: HARTI Survey, 2019

Main occupation of 90 percent of the respondents was farming (Table 5.2). Main income source of another eight percent was pension received from the government. Nearly three fourth of the sample did not have any sort of secondary income source. However, nine percent engaged in farming as their secondary occupation. Another six percent were self-employed. The rest were engaged in agricultural, non-agricultural, skilled employment, business and private sector employment as their secondary occupation.

Table 5.3: Experience in Farming

Category (Years)	Frequency	Percent
<15	7	7
16-30	49	47
31-45	38	36
46-60	10	10
60<	1	1
Total	105	100

Sources: HARTI Survey, 2019

When referring to the farming experience, the majority (47%) had 16 years to 30 years of experience on paddy farming activities which is a considerable amount of tacit knowledge (Table 5.3). Another 36 percent had 31 years to 45 years of experience. Only a few (7%) had less than 15 years of experience related to the subject. This clearly

demonstrates the sample is adequately knowledgeable to assess value chain elements.

Table 5.4: Land Extent (ac)

Land Category (ac)	Lowland		Highland	
	Frequency	Percentage	Frequency	Percentage
Below 1.0	10	10	58	63
1.0-1.9	6	6	10	11
2.0-2.9	51	49	16	17
3.0-3.9	20	18	7	8
4.0-4.9	5	5	1	1
Equal or above 5.0	13	12	0	0
Total	105	100	92	100

Sources: HARTI Survey, 2019

All farmers possessed lowlands for the cultivation purposes, whereas only 92 farmers possessed highlands. Average lowland extent is 3.071 acres. Nearly half of the sample had land extent ranging from 2.0 to 2.9 acres (Table 5.4). Another 18 percent had 3.0 to 3.9 acres of land extent. Interestingly, 12 percent had an extent of five acres or above of lowland. On the contrary, more than half of the sample had less than one acre of land extent as lowland. None of the farmers had five acres or above land extent as highlands. Average highland extent is 1.182 acres. Soil testing was not a popular practice among farmers with only 30 percent engaged in the soil testing of their fields.

Table 5.5: Land Ownership

Land Ownership Type	Lowland		Highland	
	Frequency	Percentage	Frequency	Percentage
Singly Owned	83	71	79	86
Jointly Owned	16	14	12	13
Tenant	11	9	0	0
Mortgaged	3	3	0	0
Leased	2	2	0	0
Permits	1	1	1	1
Encroached	1	1	0	0
Total	117	100	92	100

Sources: HARTI Survey, 2019

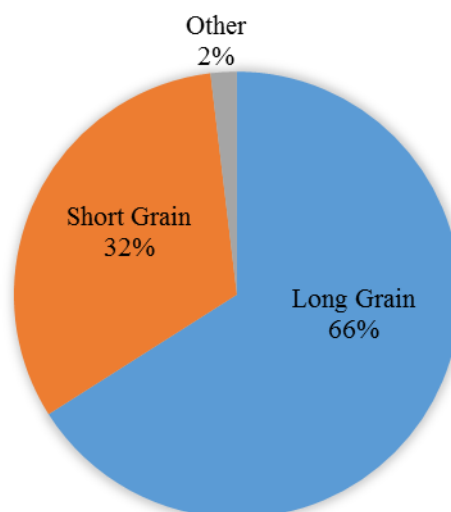
Taking into account the land ownership pattern of the sample 117 had individual lowland plots and 92 highland plots (Table 5.5). Majority (71%) of lowland plots had single ownership while and 86 percent of highlands also had single owners. However, 14 percent of lowlands had joint owners, while another nine percent s were cultivated on a tenant basis. Apart from this few lowlands were mortgaged, leased and permitted for farming activities.

Water is one of the important inputs in agriculture. Major irrigation scheme was the main water source in the area. Farmers received water through mini-canals. Majority lowland plots received satisfactory levels of water in both *Yala* (71%) and *Maha* (91%) seasons. This was also observed in highland plots as well. All farmers have participated in cleaning water channels prior to initiating the cultivation. This has been done in a scheduled way through farmer organizations. In general, farmers spend nearly two and a half days cleaning and clearing due to this there is no additional costs incurred for the maintenance process.

Table 5.6: Satisfactory Level with Irrigation Schemes

Level of Satisfaction	Lowland				Highland			
	<i>Yala</i>		<i>Maha</i>		<i>Yala</i>		<i>Maha</i>	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Satisfied	83	71	106	91	64	70	70	76
Not Satisfied	34	29	11	9	28	30	22	24
Total	117	100	117	100	92	100	92	100

Sources: HARTI Survey, 2019

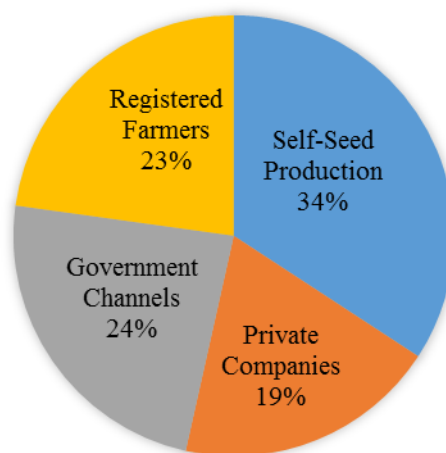


Sources: HARTI Survey, 2019

Figure 5.1: Cultivated Varieties by Farmers

Majority of the farmers (66%) cultivated long grain paddy varieties (Bg366 and Bg352) indicating the popularity of that variety in the area. Another 32 percent cultivated

short grain varieties (Bg360, BW367 and *Pokuru Samba*). Furthermore, more than 90 percent have practiced broadcasting as the main planting method and the rest adopted transplanting and parachute methods. Awareness regarding the parachute method among farmers was at a reasonable level (64%). However, more than three quarters of the sample are not aware that seeders can be used which illustrates the lack of technological adaptation in the seeding stage.



Sources: HARTI Survey, 2019

Figure 5.2: Seed Source

Farmers used self-seeds (34%) as their main seed source. Of the self-seed farmers more than 70 percent procure new seeds once in every two seasons and another 21 percent procure new seeds once in every three seasons. Another 24 percent purchased seeds from the government channels and 23 percent from registered farmers. However, private companies are not the prominent players of supplying seed for paddy cultivation like in vegetable and other commercial cultivations. Interestingly, farmers (74%) purchasing preference for seed paddy is the government seed paddy.

5.2 Main Cultural Practices

More than 85 percent of the farmers have received the fertilizer subsidy without any delay on the part of the government. However, 62 percent of the farmers stated that the given fertilizer subsidy was insufficient for the cultivation. Interestingly, 77 percent farmers have used organic manure for the paddy cultivation which is one of the requirements to be eligible for the fertilizer subsidy. Most of the farmers used plant based manure (73%) and the rest used animal based manure.

i. Land Preparation

Labour availability (59%) for cultivation purposes was at a reasonable level according to the farmers' point of view. However, farmers stressed that labour availability in the region is decreasing at an increasing rate since the younger

generation is moving towards non-agricultural activities. This is well-depicted in the farmer demographics.

ii. **Application of Chemicals for Weeds, Pest & Diseases**

Majority of the farmers adopted chemicals as the primary methods for weed control (95%) while the rest used manual methods.

iii. **Harvesting**

Harvesting is mainly done using mechanical methods (96%). Combined harvester is the most popular machinery (91%) used by the farmers in the area. This is due to the relative easiness and availability of combined harvesters in the region.

5.3 Paddy Production and Utilization

Table 5.7: Paddy Production & Utilization

Criteria	Long Grain White (Nadu)		
	Mean	Min.	Max.
Yield (Bu/ac)	115	89	138
Yield (kg/ac)	2,395	1857	2,880
Extent (ac)	3	1	25
FGP (Dried paddy)	49	47	52

Note: OC – Own Consumption, FGP – Farm gate Price

Source: HARTI Survey, 2019

Farmers have cultivated mainly three varieties namely *Nadu*, *Samba* and *Keeri Samba*. From the average yield of *Nadu* and *Keeri Samba* 76 percent and 70 percent has been kept aside for selling purposes respectively. While in the case of *Samba* nearly, 90 percent of the yield has been kept for selling purposes. Moisture content for all three varieties of paddy was at the given requirement when they were marketed.

Table 5.8: Methods of Paddy Marketing

Methods	2018/19 Maha		2019 Yala	
	Frequency	Percentage	Frequency	Percentage
Selling wet paddy just after harvesting (at the field)	26	25	24	23
Selling wet paddy to brokers (at home)	12	11	13	12
Selling dry paddy to collectors (at home)	37	35	35	33
Selling dry paddy to paddy purchasing centers	5	5	6	6
Drying and selling paddy after storage (at home)	24	23	25	24
Other	1	1	2	2
Total	105	100	105	100

Sources: HARTI Survey, 2019

Interestingly, the majority of the farmers (35% in 2018/19 *Maha* and 33% in 2019 *Yala*) sold their paddy output to the sellers after drying in both seasons. Sellers bore the transportation cost of the transaction. Other two popular paddy selling methods were selling wet paddy just after harvesting at the paddy field and selling paddy after drying and storing at home. However, only a limited number of farmers sold their well-dried paddy output to the purchasing centres.

Table 5.9: Major Reasons for Selling Wet Paddy

Reason	Frequency	Percentage
To settle the loan/s	16	20
Quick credit requirements	24	32
Lack of facilities to dry the paddy	13	17
Insufficient storage	5	7
No additional transportation costs	11	15
Other	7	9
Total	76	100

Sources: HARTI Survey, 2019

The main reason for selling wet paddy was due to the need for quick credit (32%) of farmers for consumption and other economic activities. The other reason was due to the requirement of settling loans (20%) which was obtained during the previous season. Lack of facilities to dry wet paddy (17%) was identified as the third reason followed by no need of incurring additional costs for transportation (15%).

Table 5.10: Major Paddy Purchasing Actors

Actor/s	At the Paddy Field or at Homestead		Transporting and Selling	
	Frequency	Percentage	Frequency	Percentage
Village Collectors	51	49	\	29
Local Millers	38	36	8	57
Outside Millers	5	5	-	-
Stores under WRS	-	-	1	7
Other	11	11	1	7
Total	105	100	14	100

Sources: HARTI Survey, 2019

Majority of the farmers (88%) sell their produce in the paddy field or in homesteads. Only a small percentage transport and sell their harvest bearing an additional cost. In both cases, village collectors and local millers are the central actors who purchased paddy from the farmers. Interestingly, other entities such as private companies are also engaged in the paddy purchasing. Involvement of outside collectors and millers are minimum in both scenarios therefore there is a lack of competition in paddy purchasing.

Table 5.11: Reasons for Selling to a Particular Actor

Reason/s	Frequency	Percentage
Getting a high FGP	57	38
No transportation cost incurred	40	26
No need to maintain the standard wetness	21	14
Due to quick credit requirements	15	10
Nearest vendor	3	2
Can obtain cash soon after harvest	14	9
Other	2	1
Total	152	100

Note: Multiple responses were recorded

Sources: HARTI Survey, 2019

Major determinant for the selection of the particular actor was due to a relatively higher FGP for paddy (38%) in the given season. Transporting paddy stocks to the selling point is an additional cost to the farmer hence, most farmers tended to avoid this additional cost (26%). Another aspect farmers also considered was the wetness of the paddy (14%). Drying paddy is seen as an extra burden for 14% of farmers. Also, lack of drying facilities act as a further constraint for this process.

Table 5.12: Major Problems Faced by the Farmers

Problem	Frequency	Percentage
Lack of irrigation water	26	19
Lack of agricultural equipment	11	8
Lack of threshing floors for drying paddy	22	16
Low selling price (High cost of production)	12	9
Insufficient fertilizer or fertilizer not available in time, less quality	9	7
Agricultural inputs are too expensive	8	6
Weedicide, pesticide and seed paddy are low in quality	12	9
Damages from wild or Stray animals	18	13
Other (Insufficient or damaged irrigation infrastructure, Lack of storing facility , Less knowledge about weedicide, pesticide among farmers, Agricultural labourers are not available, Pest attack, Lack of involvement agricultural officers)	18	13
Total	136	100

Note: Multiple responses were recorded

Sources: HARTI Survey, 2019

The main issue of concern faced by the farmers who cultivated under major irrigation schemes was scarcity of water (19%) followed by the lack of threshing floors (16%) in the area to dry paddy. As a result, many farmers tend to sell their produce soon after harvesting at low FGP. Next prominent issue was damages from wild and stray animals (13%). Those were the main three issues faced by the farmers in the area. Apart from that, low FGPs and quality and information lapses related to agrochemicals were also highlighted as concerns among farmers.

5.4 Economic Analysis

As shown in Figure 5.4, paddy and milled rice pass through several hands from the farmers to consumers involving a set of interconnected chain actors: farmers, paddy traders, miller-traders, wholesalers, and retailers, who each adds economic value to rice as it moves through the chain. These values then add up to the final price of rice in the final market. As a result, the purchased price of milled rice increases as it journeys toward the consumers. In assessing the value addition in the entire paddy rice VC, cost and return by segment in the chain was analysed. Tables 5.13 to 5.19 show the estimated costs and returns of paddy production, paddy trading, rice milling, rice wholesaling and retailing.

Table 5.13: Cost of Cultivation per Acre of Paddy (Irrigated) – Polonnaruwa

	Labour	Machinery	Input	Total
General Land Preparation	1762.50			1762.50
1 st & 2 nd Ploughing, Levelling with 4W	1410.00	9000.00		10410.00
Plastering Bunds	4935.00			4935.00
Levelling & Broadcasting	4582.50		3200.00	7782.50
Fertilizer Application	1057.50		1280.00	2337.50
Weeding with Weedicides	1762.50		2950.00	4712.50
Pest & Disease Control	2115.00		1400.00	3515.00
Water Management	4230.00			4230.00
Harvesting & Processing with CH	3525.00	9000.00		12525.00
Drying	4230.00	1000.00		5230.00
Transport		800.00		800.00
Total Including Family Labour	29610.00	19800.00	8830.00	58240.00
Related Information				
Input	Unit	Quantity	Unit Price (Rs)	
Seed	kg	42	76.19	
Labour				
Hired	Md	7.5	1410.00	
Family	Md	13.5		
Total		21.0		
Returns		Per Acre	Per Hectare	
Average Yield	kg	2395	5915	
Farm Gate Price Range	Rs/kg	47.00-52.00		
Average Farm Gate Price	Rs/kg	49.00	49.00	
Gross Income	Rs	117,355.00	289866.85	
Profit including Family Labour	Rs	56,720.00	146014.05	
Unit Cost including Family Labour	Rs/kg	24.32	24.32	

Source: HARTI Survey, 2019

CH: Combined Harvester

5.4.1 Cost of Cultivation Related to Agronomic Information

The price of seed paddy ranged from Rs 1500 - 1650/Bushel and seed paddy was also traded by the paddy collectors. The fertilizer recommendation is 86 kg of Urea, 20 kg of Triple Superphosphate (TSP) and 22kg of Muriate of Potash (MOP). The cost of subsidised fertilizer was Rs 1280.00 per acre. Majority of the farmers use 4W tractors for basic land preparation activities and the average cost is Rs 9000.00 per Acre.

Majority of the farmers adopted chemicals as the primary methods for weed control (95%) and the rest used manual methods. Harvesting is mainly done using mechanical methods (96%) where the combined harvester is the most popular machinery (91%) used by the farmers in the area. This due to the relative easiness and availability of combined harvesters in the region.

Total man days used under the major irrigation was 21Man days per acre and it consisted of 64 percent of family labour. Mainly hired labour is used for the pesticides and weedicides application and harvesting. The female participation was very limited and in some instances it was observed in practices like water management.

5.4.2 The Yield, Unit Cost and Farm Gate Price

The average yield of paddy under major irrigation in Polonnaruwa district is often six to eight per cent higher than the normal average yield under major irrigations in the whole country. Further, the average yield of Medirigiriya and Dimbulagala indicates a higher amount than that of Polonnaruwa district. Those areas are mainly known as high yielding areas. The study shows that the average yield ranged between 89- 138 Bu/ac in the above producing areas under the major irrigation schemes. Farmers engaged in seed paddy production programmes with DOA and the private companies. This was mainly due to the experience of farmers, in addition to a good extension package, and excellent agro climatic settings like soil, rainfall, daytime length in the crop zone. Due to the higher yield the average cost of production was low compared to the other normal producing areas. The average cost of production of a kg of paddy was approximately Rs. 24.50 in the producing areas in the year 2019 *Yala* season. However, all major irrigation areas in the district are considered the average yield is around 100Bu/ac and under this situation the unit cost rose up to Rs. 27.90/kg.

The farm gate price of quality paddy ranged between Rs. 47.00 - 52.00, which showed an increase of nearly 30% compared to the same period of 2018. This was due to the decision to increase the guaranteed price of paddy to Rs. 50.00/kg from the *Maha* season 2019/20.

Activity	Detailed Cost (Rs/kg)	Cumulative Cost	Share %
Land Preparation	Labour	3.39	
	Machinery	3.76	
	Sub Total	7.14	29.4
Planting	Labour	1.91	
	Seeds	1.34	
	Sub Total	3.25 (10.39)	13.4
Crop Maintenance	Labour	3.83	
	Fertilizer	0.53	
	Weedicides	1.23	
	Pesticides	0.58	
	Sub Total	6.18 (16.57)	25.4
Harvesting	Labour	1.47	
	Machinery	3.76	
	Sub Total	5.23 (21.80)	21.5
Drying & Transporting	Labour	1.77	
	Machinery	0.75	
	Sub Total	2.52	10.3
	Total Unit Cost (Rs/kg)	(24.32)	100

Source: HARTI Survey, 2019

Figure 5.3: Pre-Production Value Chain I for Paddy (*Nadu* Variety) - Cost of Production in Polonnaruwa

The Figure 5.3 gives the formation of unit cost of one kg of paddy. It also reveals the share of each cost component to the total unit cost. Nearly 10.3% goes to the value addition of raw paddy which means drying of wet paddy up to the standard moisture level (14%).

The most popular paddy/rice marketing channel in the surveyed producing areas is,
Farmer ➡ Collector ➡ Rice Miller ➡ Wholesaler ➡ Retailer ➡ Consumer

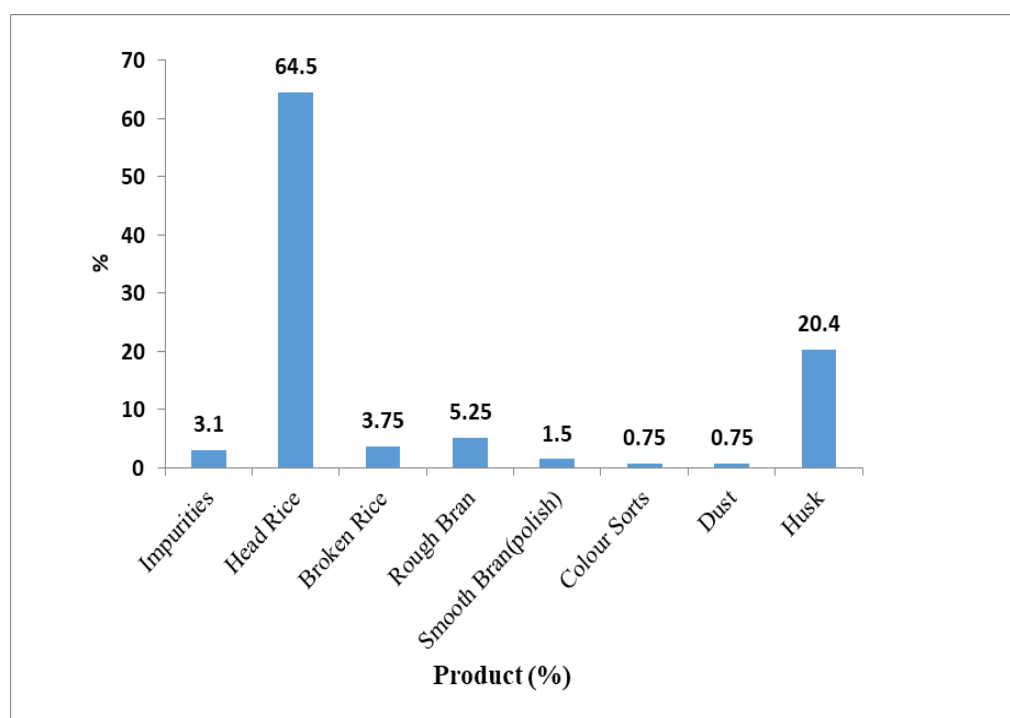
Sometimes brokers function between collectors and millers. The role of brokers becomes prominent in the time when paddy stocks are scarce.

Majority of the farmers received farm gate price and the guaranteed price for long grain white paddy of Rs 50.00/kg considered as the collectors buying price at the farm gate.

Table 5.14: Milling Outturn of 100 kg of Long Grain White Paddy in Parboiled Processing

Item	Quantity per 100 kg of Paddy
Impurities, Empty Seeds & Dry Weight	3.10
Head Rice	64.50
Broken Rice	3.75
Rough Bran	5.25
Smooth Bran (polish)	1.50
Colour Sorts	0.75
Dust	0.75
Husk	20.40
Total	100

Source: HARTI Survey, 2019



Source: HARTI Survey, 2019

Figure 5.4: Milling Outturn of 100 kg of Long Grain White Paddy in Parboiled Processing

Table 5.15: Millers Earnings from By Products

By Product	Quantity	Price (Rs/kg)	Quantity/ 1kg Rice	Value (Rs)
Rice Bran + Rice Polish (6.75 kg for 64.5 Head rice)	6.75	32.00	0.10	3.40
Broken Rice(3.75 kg for 64.5 Head rice)	3.75	58.00	0.06	3.37
Discoloured Grains(0.75/64.5 Head Rice)	0.75	45.00	0.01	0.52
Husk (20.4 kg for 64.5 Head rice)	20.75			
By product income from every 1kg of Rice				7.29

Source: HARTI Survey, 2019

**Table 5.16: Rice Value Chain Analysis (VCA): Post Harvest VCA (Post Production)
Parboiled Nadu Rice from Farm Gate at Polonnaruwa to Consumer in Colombo**

Actor	Activity	Units	*Price Flow & MM	
				%
	Collectors Buying Price of Paddy at Farm gate	Rs/kg	50.00	
	Paddy equal to 1 kg of Rice = 1.55kgs	Rs/1.55kg	77.50	76
	Handling	Rs/kg	0.39	
Collector	Transport (from Farm gate to the Mills)	Rs/kg	0.84	
	Brokerage Received	Rs/kg	0.15	
	Collectors Gross Margin with Brokerage	Rs/kg	2.50	4
	Collectors Selling Price	Rs/kg	52.50	
	Collectors Net Margin	Rs/kg	1.27	
	Millers Buying Price at Mill gate	Rs/kg	52.50	
	Milling Ratio (64.5%)	64.50%	1.55	
	Cost of 1.55 kg of Paddy at the Mill	Rs/kg	81.38	
	Milling Cost for 1 kg of Rice	Rs/kg Rice	13.02	
Miller	Breakeven Price at the Mill Gate (MGP)	Rs/kg Rice	94.40	
	Revenue from by Products(every 1 kg of Rice)			
	Rice Bran	Rs/0.10kg	3.40	12
	Broken Rice	Rs/0.06kg	3.37	
	Discoloured Grains	Rs/0.01kg	0.52	
	Sub total		7.29	
	MGP - By Products Income -@		87.11	
	Transport to Colombo	Rs/kg	2.00	
	Millers Net Profit Margin	Rs/kg	4.89	
	Millers Selling Price at Colombo	Rs/kg	94.00	
Wholesaler	Wholesalers Buying Price	Rs/kg	94.00	
	Wholesalers Gross Margin	Rs/kg	3.00	
	Wholesalers Cost	Rs/kg	0.50	3
	Wholesalers Net Margin	Rs/kg	2.50	
	Wholesalers Selling Price	Rs/kg	97.00	
Retailer	Retailers Buying Price	Rs/kg	97.00	
	Retailers Gross Margin	Rs/kg	5.00	5
	Retailers Cost	Rs/kg	1.00	
	Retailers Net Margin	Rs/kg	4.00	
Consumer	Retail Price at Colombo (RP)	Rs/kg	102.00	100
	Retail Price/ Paddy Price	Ratio	2.04	

Source: HARTI Survey, 2019

*MM- Marketing Margin

5.4.3 Paddy to Rice Formula

Paddy to Rice Formula: The following formulas describe the relationship between the farm gate price in Polonnaruwa and the retail price of rice in Colombo for parboiled Nadu rice which was the most widely consumed rice variety.

According to the above scenario the relationship of the Paddy price and the respective rice price can be presented as a formula for the long grain white (Nadu) as follows,

$$RP = FGP \times 2.04$$

Note: RP: Retail Price of Rice

FGP: Farm Gate Price of Paddy

The Maximum Retail Price (MRP) was active during the survey period of December, 2019 to early January, 2020 and the MRP for long grain white (Nadu) rice was Rs. 98.00/kg. The rice prices recorded during the period ranged from Rs. 98.00/kg to Rs. 110.00/kg in Colombo and suburban markets. The Nadu rice was available in bulk in shops for MRP and it was weighed and sold. The price of rice varieties' mostly available at Rs. 102.00/kg was considered as the average retail price. The prices of rice which exceeded the above average up to Rs. 110.00/kg were due to high margins kept by the all actors (millers, wholesalers and retailers) of the VC, brand loyalty and the degree of polishing of rice etc. If the retail price becomes Rs. 105.00/kg the ratio will become 2:1 and if the retail price becomes Rs. 110.00/kg the ratio will be 2:2. However, the study revealed the possibility of selling quality rice with reasonable margins for each actor as indicated in the VC.

The study attempted to explore the paddy and rice price relationship in other major rice producing countries. According to the review of literature in other rice producing countries, the study summarized the relationship between the farm gate price and the retail price of rice (Table 5.17). However, the information such as rice types, rice quality and time periods were some of the limitations that were encountered.

Table 5.17: Summary of the Ratio of Rice Retail and Paddy Farm gate Price in Different Countries

Country	Period	Rice Retail/Paddy FG Price
Bangladesh	Early, 2019	2.50
Philippines	2015	2.49
Myanmar	2017	2.30
Indonesia	2017	2.25
India	2017	2.08
Vietnam	2009	1.93
Sri Lanka	Early, 2019	2.27
Sri Lanka	Late , 2019	2.04

Source: Compiled by the Author

5.4.4 Paddy to Rice Processing Cost

The processing cost of rice milling consists of fixed and variable costs. An attempt was made to calculate the rice processing cost during the study. In this study, under the fixed cost, depreciation charges, insurance and administrative expenses are included. The administrative cost included building maintenance, rates and taxes, environmental license fees, mill license, weighing bridge maintenance, auditors' remuneration, travelling charges, and charity and donation. Fixed cost estimation excludes investment on machines. The variable cost consists of labour cost, electricity, packing charges, storage, maintenance charges, loan interests etc. The rice processing cost basically depends on milling outturn and type of machinery in use. In all major rice mills and some medium scale rice mills fully automated paddy to rice milling process is carried out by using modern machinery. The labourers are normally paid the E.P.F and E.T.F allowances in rice mills.

The fully automated major rice mills are most energy consuming. Various types of energy pattern used in rice milling industries viz., thermal energy, mechanical energy, electrical energy and human energy. The important utilities in a rice mill are water, air, steam, electricity and labour. Water issued for soaking and steam generation. The major energy consuming equipment in the rice milling units are; boilers and steam distribution, blowers, pumps, conveyors, elevators, motors, transmission systems, weighing, etc. A boiler is used to produce the steam for parboiling and drying of the paddy in the rice mill. The boiler is operated on firing of paddy husk in the boiler furnace. Conveyors are used to transfer the paddy/ rice from one operation to another, and this needs electrical energy and is also a major energy consuming operation in the rice mills. Electricity is the main energy source for these rice mills and is imported from the state electricity board grids. Electricity is used to run motors, pumps, blowers, conveyors, fans, lights, etc.

Wijesooriya and Priyadarshana (2013) studied the behaviour of the rice milling industry in Polonnaruwa district in 2011. According to the study the processing cost of parboiled *Nadu* rice was Rs. 4.72/kg. The current study attempts to compare the findings of the previous study (Table 5.18). However, it should be noted that impurities, empty seeds & dry weight were not considered when calculating the paddy to rice processing cost in the previous study. However, those aspects were taken into consideration in the current study. Accordingly, 2.0 kg of paddy loss for impurities, empty seeds & dry weight was considered for 64kg of paddy bag. That value is Rs 2.52 when it is calculated for the processing cost of one kg of rice.

Table 5.18: Comparison of Farm gate Price of Paddy, Rice Processing Cost and Rice Retail Price

Item	Unit	2011	2019	Change (%)
Farm gate Price	Rs/1kg Paddy	27.32	50.00	83
Paddy to Rice Processing Cost	Rs/1 kg Rice	4.72	13.02	175
Retail Price (Nadu)	Rs/kg	59.70	102.00	71

Source: HARTI Survey, 2019

Table 5.19: Cost of Paddy Processing to Rice in Automated Modern Rice Mill, Polonnaruwa (Average 50 mt of Paddy Milled per Day, Rice Variety: Nadu Parboiled)

Item	Units	Unit Cost	Cost for 100 Kgs of Paddy
Cost for Paddy Bag	Rs/64 kg Bag	40.00	62.50
Unloading Paddy Bag & Storage	Rs/64 kg	20.00	31.25
After 3 Months Paddy Unloading for Milling	Rs/100kg	15.00	23.44
Impurities, Empty Seeds & Dry Weight	2.0Kgs/64kg	103.90	162.34
Put into Paddy to Processing Point	Rs/100kg	20.00	20.00
Cleaning, Removing Empty Seeds and Washing	Rs/100kg	10.00	10.00
Parboiling	Rs/100kg	10.00	10.00
Drying	Rs/100kg	2.50	2.50
Operating Boiler	Rs/100kg	7.50	7.50
Milling	Rs/100kg	10.00	10.00
Rice Outturn from Quality 100 Kgs of Paddy	64.5 kg of Rice		
Processing Cost of 64.5Kgs of Rice	64.5 kg of Rice		339.53
Cost for 1 Kg of Rice	Rs/kg of Rice		5.26
Electricity Cost	Rs/kg of Rice		1.62
Machinery Cost	Rs/kg of Rice		0.40
Depreciation	Rs/kg of Rice		0.18
Insurance	Rs/kg of Rice		0.06
Staff Salaries & Administrative Expenses	Rs/kg of Rice		0.75
Bank Interest	Rs/kg of Rice		2.25
Total Processing Cost of Rice at Mill Gate	Rs/Kg of Rice		10.52
Rice Bag (10ks Pack)	Rs/kg of Rice		2.00
Packing Cost	Rs/kg of Rice		0.50
Total Cost for Packed Rice at Mill Gate	Rs/kg of Rice		13.02
Transport to Colombo	Rs/kg of Rice		2.00
			15.02

Source: HARTI Survey, 2019

The paddy purchased by the collectors is transported to rice mills in poly-sack bags by tractors, trucks and lorries. Some farmers also directly take their paddy to rice mills in poly-sack bags. Almost all the value chain actors like farmers, collectors and millers used poly-sack bags for storing paddy. The study found a large scale rice miller who owns a poly-sack bag manufacturing plant. Further one large scale miller stores paddy in gunny bags in order to assure the quality of rice. All the major rice millers use non-woven eco-friendly fabric bags for rice packing. However, some small scale rice millers used low cost poly-sack bags for packaging rice. And all the large scale millers use their paddy three to six months before it is used for producing rice. They practiced this method to maintain their quality of rice. Some large scale use some sophisticated fabric bags to pack rice so as to maintain their brand name and rice quality. In such instances the bag cost for one kg of rice is nearly Rs 3.00. Those who used 50 kg large poly-sack packs can minimize their packing cost considerably.

In most of the large scale rice mills the process of paddy being converted to rice is fully automated. The process is monitored at particular points using human labour. There are two large scale mills with Silo storage facilities. Paddy can be directly sent to the milling plant through elevators when Silo is used. In addition to that when these modern machines are used the weight and quality loss of grains is minimum. Paddy cleaning, removing empty seeds, washing, parboiling, drying, milling and packing are monitored by workers. These workers are paid either on a quantity or daily basis.

Some rice mills practised paddy cleaning, soaking, parboiling and drying on contract labour basis while practising rice milling, polishing and packing on daily wages basis. The cost is decided per one dryer load. The capacity of dryers depends on the scale of the mill. There are dryers with the capacity of 16,000kg, 24,000kg and 32,000kg of paddy. Automated large and medium scale rice mills mostly used stainless steel dryers for which the investment cost is high. These dryers are installed by Indian companies. Annual licensing fees of weighing bridges, measuring devices, boilers, all other machinery and vehicles, environmental levies, taxes to local authorities, building maintenance expenses are included in the administrative costs. Regular machinery like rubber rollers, polisher screens, bearings etc., need replacements and other machines, vehicles need regular maintenance. Pledge loan interests and other machinery loan interests are also included in rice processing cost.

Almost all the medium scale and all large scale mills use a transformer of their own. Otherwise, modern machinery like polishers and colour sorters cannot be operated. These mills get to separate electricity bills; one according to the transformer KV value and another normal according to use. The millers emphasized that the electricity cost based on the KV value is favourable for the large scale mills operated the whole day to full capacity, whereas it is not beneficial for the small and some 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 automated, the electricity cost is higher. During the study period the electricity charges are as follows: the charge for a KWH in peak hours (5.30 p.m to 10.30 p.m) is Rs 20.50, in the day time (5.30 a.m -5.30 p.m) it is Rs 11.00 and in the off peak (10.30 p.m-5.30 a.m) it is Rs 6.85.

Table 5.20: Relative Financial Position of Actors in the Paddy/Rice Value Chain

VC Actor	Product	Total Unit Cost (Rs/kg)	Added Unit Cost (Rs/kg)	% to Added Unit Cost	Selling Price (Rs/kg)	Unit Margin (Rs/kg)	% to Price
Farmer	Dry Paddy	24.32	24.32	58	50.00	50.00	49
Collector	Dry Paddy	51.28	1.28	3	52.50	2.50	2.5
Miller	Milled Rice	66.30	15.02	36	94.00	41.50	40.5
Wholesaler	Milled Rice	66.80	0.50	1	97.00	3.00	3
Retailer	Milled Rice	67.80	1.00	2	102.00	5.00	5
Total			42.12	100		102.00	100

Source: HARTI Survey, 2019

Farmers produce fresh paddy and add value by drying in open spaces like concrete yards, tarpaulins and carpeted road sides. They spend Rs. 24 - 32/kg average cost for producing 1 kg of paddy. Their selling price ranged between Rs. 48.00/kg to Rs. 52.00/kg during the study period and the average is Rs. 50.00/kg. Paddy traders, the second actor in the chain who incurred an added cost of Rs. 1.28/kg for weighing, handling and transporting dry paddy to the mills. Rice millers, the next stage in the chain, spend an added cost of Rs. 15.02/kg of rice for carrying out the processing of stored paddy into milled rice and handling, packing, storing and transporting milled rice to wholesalers or directly to retailers. The next stage in the chain is the rice wholesalers whose main function is marketing or distributing rice to retailers. In carrying out this function, they spend the smallest added cost of 0.50/kg cents owing to marketing cost. Retailers, the last actors in the chain, incurred added cost amounting to Rs. 1.00/kg due to marketing cost.

5.5 Value Additions along the Paddy/Rice Value Chain

Value addition to agricultural products is the process of increasing the economic value and consumer appeal of an agricultural commodity. Value-added products are defined by USDA as having: a change in the physical state or form of the product.

$$\text{Value Addition (\%)} = \frac{\text{Marketing Margin}}{\text{Purchased Price}} * 100$$

5.5.1 Value Addition at the Farm Level

Study identified the value addition occurs in two points of the paddy rice value chain. The first one is by the farmer; who adds value by drying soon after harvesting high moisture raw paddy. He changes the physical state of the raw paddy by adding value through proper drying.

The analysis found that value addition takes place only in two points in the entire value chain: farmer and the miller levels. In all the other points only a buying and selling process takes place. However, the transport function was visible.

In recent years combined harvesters are the most popular harvesting method in almost all major producing areas like Polonnaruwa, Ampara and Batticaloa districts in the Eastern Province. Farmers tend to use the combined harvesters mainly due to the low cost compared to the other methods. However, the combined harvester's threshed paddy has high moisture content (nearly 20%) and needs to dry out to maintain the standard moisture level. At present most of the major producing areas lack drying areas due to which farmers are unable to dry paddy. During the peak harvesting season, the available public and private drying concrete beds are overloaded in study areas. However, in this situation millers offer low prices according to the moisture level. In this situation farmers tend to use one side of a carpeted road for this purpose. After the proper drying of wet paddy has reached to the 14% standard moisture level, paddy can be sold to the government purchasing centres as well as to the private millers at a higher price. Now there is a tendency of farmers to sell paddy after properly drying mainly due to the high farm gate price as a result of the new increased support prices.

Value addition by the farmers at farm gate level was nearly 14% (Table 5.18) of the cost of production which is the cost for drying paddy up to the standard quality (14% moisture).

Table 5.21: Value Addition by the Farmers

Item	Price (Rs/kg)
Wet Paddy Price	44.00
Drying Cost	2.52
Dry Paddy Price	50.00
Marketing Margin (Value Addition)	6.00
Net Marketing Margin	3.48
Value Addition by the Farmer (%)	13.60

Source: HARTI Survey, 2019

Rice millers are the next important player in the rice value chain by adding value to the paddy. They add the most value to the rice value chain. The main part of the rice value chain work takes place in rice mills only by converting paddy into rice. Millers add a higher percentage in the paddy/rice value chain. In present study it was observed that rice millers were adding value to rice in nearly six different steps in the value chain. Value is added for cleaning paddy stocks, storing, processing, grading and packing rice and transportation of rice and it's by-products like bran, husk and broken rice to the major cities and this value addition is nearly 25% (Table 5.19) of the cost of production of rice.

There are about 100 -110 functioning rice mills in the district which need about 869400 mt of annual supply of paddy. The marketable surplus of paddy in the district in a normal producing year is 471,000 mt and nearly 50,000 farmers throughout the Polonnaruwa district annually release this quantity to the market.

Table 5.22: Value Addition by the Miller

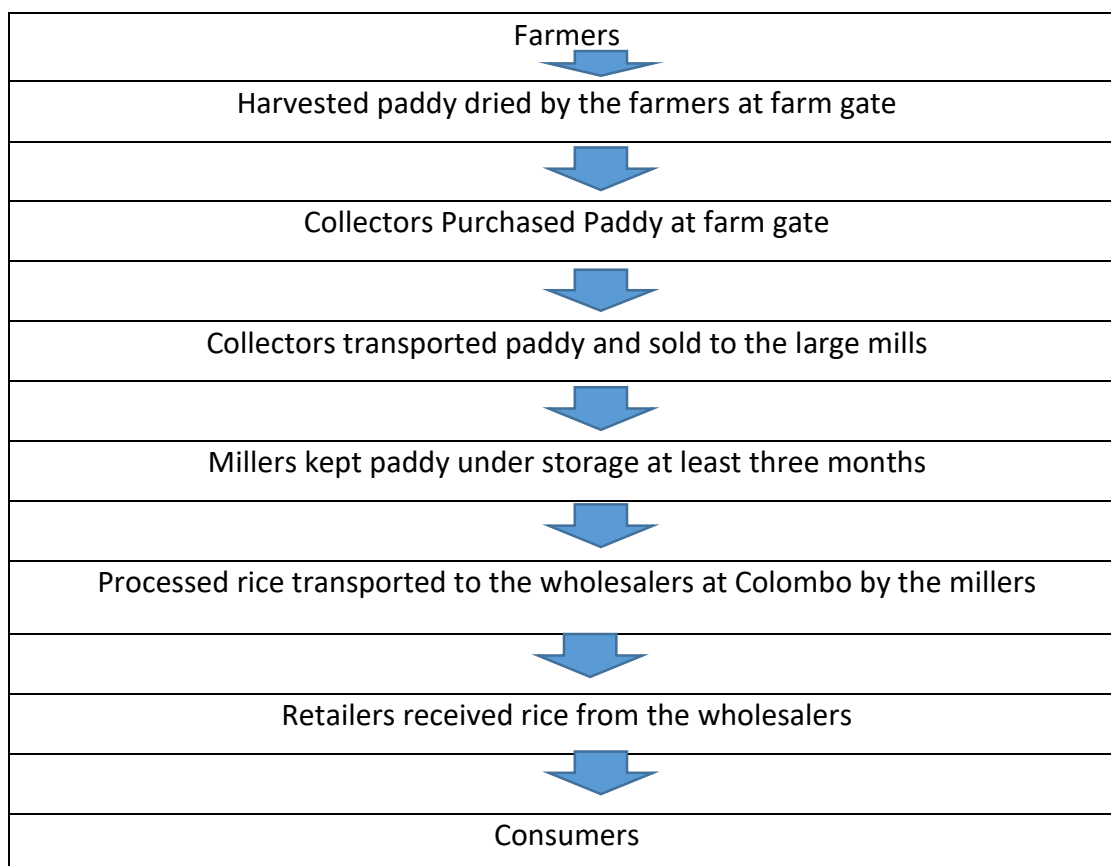
Item	Value (Rs/kg equalling of 1 kg of Rice)
Purchase price of paddy	81.38
Milling cost of paddy	13.02
Selling cost of rice	2.00
Return from rice	94.00
Return from by products	7.29
Total Return	101.29
Value Addition by the Miller	19.91
Value Addition by the Miller (%)	24.46 %

Source: HARTI Survey, 2019

5.6 Marketing Channels

The study has identified different marketing channels of paddy, rice and associated by-products. Two different marketing channels were found in the study areas. First, paddy marketing channel which was farmers, Collectors, Large Mills, Wholesalers in Colombo and Retailers. The major two types of marketing channels are shown in the Figure 5.5.

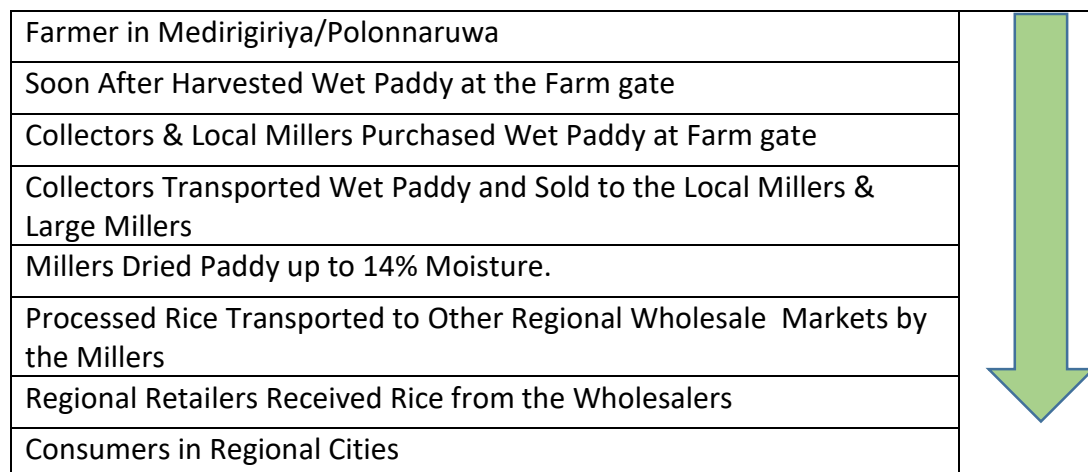
The channels identified are shown below:



Source: HARTI Survey, 2019

Figure 5.5: Channel One

Figure 5.5 and 5.6 show the main paddy/rice marketing channels in Polonnaruwa. The large Millers in the district have major rice selling markets in Colombo and suburbs. The large and some medium scale millers, who require a large amount of paddy for their daily processing, purchase paddy through their regular collectors and the paddy received from outside the district through brokers. In addition, during the off season farmers take small amounts of stored paddy to the local mills.



Source: HARTI Survey, 2019

Figure 5.6: Channel Two

This study was conducted in the last quarter of 2019 and the early 2020. There was a rumour that the Guaranteed Price of paddy (GP) would increase to Rs 50.00/kg in this season, 2019, *Yala* season or at the beginning of next 2019/20 *Maha* season. According to this, farmers as well as buyers anticipated an increase in paddy price in near future. Therefore, there was a competitive buying behaviour by the large scale millers practised during the *Yala* season harvesting period. As a result of this situation the farm gate prices of paddy for 2019 *Yala* harvested paddy were relatively higher than compared to the same period of last year. The prices of dried paddy ranged between Rs 45.00 - 50.00/kg during that period in producing areas in Polonnaruwa. However, the paddy prices in other districts remained relatively low in that period. It was observed that the large scale rice millers had an opportunity to purchase Long grain white (*Nadu*) at a range of Rs 42.00 - 45.00/kg at that time from the other major producing areas such as Anuradhapura, Dehiattakandiya and Ampara. Further, a retail price ceiling prevailed for rice in that period.

As the production of large and medium scale mills takes a greater share in main markets, the VC analysis was done relevant to it. According to that analysis these millers stock the purchased paddy for 3 to 4 months before producing rice. Therefore, usually the paddy purchased in September in *Yala* season is used to produce rice at the end December. The VC analysis was done on the long grain white parboiled paddy and *Nadu* rice which is the mainly produced rice variety. The price of dried long grain white paddy ranged between Rs 45.00 - 50.00/kg during September. In the analysis the guaranteed price Rs/kg 50.00 was used as the farm gate price and that price also prevailed in September for well dried paddy. Therefore, the paddy stocks purchased

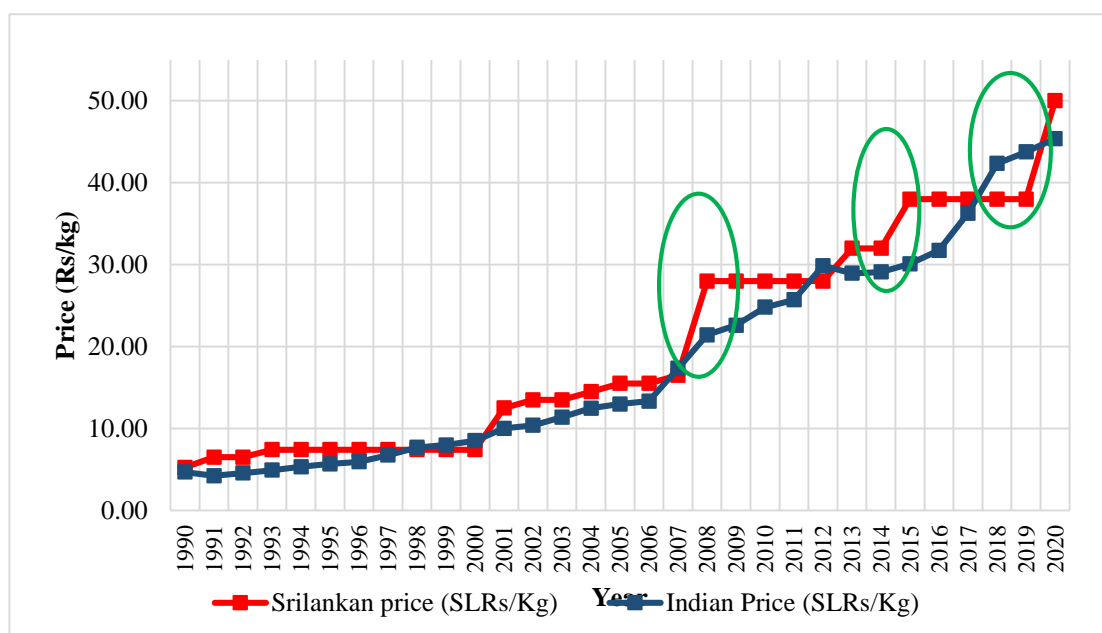
less than Rs. 50.00/ kg gave the opportunity to millers to earn extra profits. The study attempts to describe herewith a note on how the local Guaranteed Price (GP) of paddy is determined as it is relevant to this value chain analysis. It is also vital in a situation when a new GP is going to be introduced. The need of a systematic mechanism in determining the GP is also emphasized. A comparison of the local GP with that of India is also mentioned.

5.7 Determination of Guaranteed Price for Paddy and Maximum Retail Price of Rice

It is noted that the determination of Guaranteed Prices (GP) for especially paddy and Ceiling Prices for rice occurs in an ad hoc system which has created certain problems. There is a lack of a proper mechanism or proper time for the announcement of the Guaranteed Price for paddy and fixing GP is episodic. After 1977 the guaranteed price for paddy remained unchanged for long periods as in 1993-1999, 2008-2012.

When examining the Indian mechanism in this regard it is very systematic in comparison. The Commission of Agricultural Costs & Prices (CACP) of India announces the Minimum Support Prices (MSP) prior to every paddy cultivation season. The MSP is determined by the CACP using a clear methodology by an expert panel consisting of eminent agricultural economists. There are many variables considered in calculating the MSP such as demand and supply, cost of production, price trends in the market (both domestic and international), inter-crop price parity, terms of trade between agriculture and non-agriculture, and likely implications of MSP on consumers of the particular product. Figure 5.7 reveals the nature of the support price determination process of two countries.

Therefore, establish a proper mechanism for fixing Guaranteed Prices for the staple crops and a Price Ceilings for food commodities. A formal mechanism with the participation of HARTI, CBSL, DOA, and Universities & Consumer Authority is recommended in this regard. This will lead to the smooth functioning of the paddy/rice market.



Source: HARTI Survey, 2019

Figure 5.7: The Guaranteed Price of Paddy in India and Sri Lanka

5.8 By-products Process of Paddy/Rice Value Chain

By-products of rice such as paddy husk, bran and polish are mainly used in the production of animal feed, rice oil, cement manufacturing, brick industry and as a fuel source for boiler operations. The study found that when the milling of 100 kg of Long Grain White Paddy in Parboiled Processing nearly 6 -7 kg of rice bran and 20-21 kg of paddy husk was created as the main by-products.

5.8.1 The Main Paddy Husk Supply Chain

The traders collect paddy husk from rice mills in Polonnaruwa and bagging, loading and transporting to the Mitsui Cement Factory, in Trincomalee. There are nearly 20 such traders operating in the Polonnaruwa district for paddy husk trading. Two-way transport mode is used to convey these husks, cement bags to the Polonnaruwa hardware traders and husk from paddy mills to cement manufacturers.

Activity	Detailed Cost (Rs/Kg)	Cumulative Cost (Rs/Kg)
Husk Handling (Bagging & Loading)	Price of Husk at Mill	0.50
	Labour Cost	0.60
	Transport Cost	1.12
	Traders Total Cost	2.22
Transporting to Trincomalie	Price Received at Mitsui	4.00
	Traders Net Margin per kg of Husk (Rs)	1.78

Source: HARTI Survey, 2019

Figure 5.8: Main Paddy Husk Supply Chain

5.8.2 Rice Bran

Parboil rice bran is the main by-product created from the rice milling industry in Polonnaruwa. Almost all parboil rice bran are being used as a raw material in rice oil production. Rice oil production is carried out by RICE-O (Indian based company) located in the industrial zone at Polonnaruwa and another private company located at Dankotuwa. RICE-O produces nearly 700 mt of rice oil per month. Rice oil is supplied to the local biscuit and food industry through traders in Pettah market. In addition, rice oil is used as a cooking and frying oil in the local hotel industry. Residue after oil extraction (de-oil rice bran) is supplied to Pelawatta Dairy Company as a food source for cattle and buffalo in Buttala and Apollo Marine company as a raw material for fish meal production. A certain amount of parboil rice bran is also exported to India for rice oil production as a result of high demand. Rice oil manufacturing companies are expecting to introduce rice oil to the local market.

Recently rice bran and polish have been a popular raw material in animal feed. Animal feed mills are located in Bingiriya and Kuliyaipitiya areas. Raw white and red polish are mainly supplied from Ampara, Muthur, Kalmunai, Samanthurei, Nindavur, Dambulla and Hambantota whereas bran is supplied from Valachchenai and Polonnaruwa. Raw red is barely used as a raw material due to high density and fibre content. By-products derived from parboil are better due to the presence of a high amount of protein. Rice polish can be kept for a maximum of one to two weeks due to the issue that it turns rancid. Rice bran can be stored for a considerable duration.

Two-way transport mode is used to convey these by-products, poultry manure to the respective paddy fields and by-products from paddy mills to feed mills. This process has been carried out through a middleman. Total of 16-17mt of rice polish per truck (six-wheel) and 20-21mt of broken rice per truck are supplied per trip and two to three trips are conducted per week. Final price of polish ranged between Rs.32.00 - 35.00/kg and the price of bran ranged between Rs.35.00 - Rs 40.00/kg. Brokerage fee ranged between 0.50-1.00/kg. Price of the raw materials may be affected by seasonality, substitutes and number of intermediaries. Furthermore, paddy husk is also used in certain instances. The price of paddy husk is Cents 0.50/kg to Rs 1.00/kg and packed as 20kg bags.

Moisture level (<13%), protein level, fibre content and fat are the quality criteria when selecting a good quality rice polish. Most feed mills do not possess laboratories to check the quality of raw materials which are supplied by the middlemen. Hence, quality assessment is done through manual methods including experience and trustworthiness of the middlemen. Testing is carried out bag by bag and this is a time consuming process. Therefore, adulterations are frequent in this industry. This is especially observed for rice polish. Mixing rice bran into rice polish is a common adulteration. Mixing of Calcite powder is also common in the industry. In addition, mixing of broken rice and husk dust with good quality polish is also reported.

Maize is the ideal raw material to produce animal feed (5% -75% of protein and energy). However, maize shortage is the main issue in the industry. Animal feed should contain 55% of maize however, current usage is only 35% due to the shortage. The price of imported maize is Rs.64.00/kg and high compared to rice polish. Maize importation process may take up to one month and mainly imported from Ukraine and Pakistan (Applied tax is nearly Rs.10.00/kg). Farm gate price of local produce is Rs.54.00/kg. Another highlighted issue is the import restriction of maize and bias quota system for selected importers. Soya extracts are also used as animal feed. This is directly imported from the USA. Usage of soya extracts is very much limited in Sri Lanka. Rice bran is used to extract rice oil. Certain quantities are imported to India for this purpose. Residue after oil extraction is also used to produce animal feed. In addition, broken rice in seasons where there is an oversupply are used as animal feed. This is commonly termed as "Peacock Rice".

It is important to highlight that residue of burned husk from boilers are mainly underutilized. This residue is termed as Rice Husk Ash (RHA). This is mainly disposed of to the bare lands by the millers and in some cases dumped into paddy fields as a Potassium supplement. However, this residue can be utilized in industrial purposes such as Silica production. This practice has been observed in many other countries.

5.9 SWOT Analysis for Paddy/Rice VC

The paddy/rice value chain study attempts to summarize the facts and construct SWOT analysis when considering all the accumulated information throughout the study as follows (Figure 5.9).

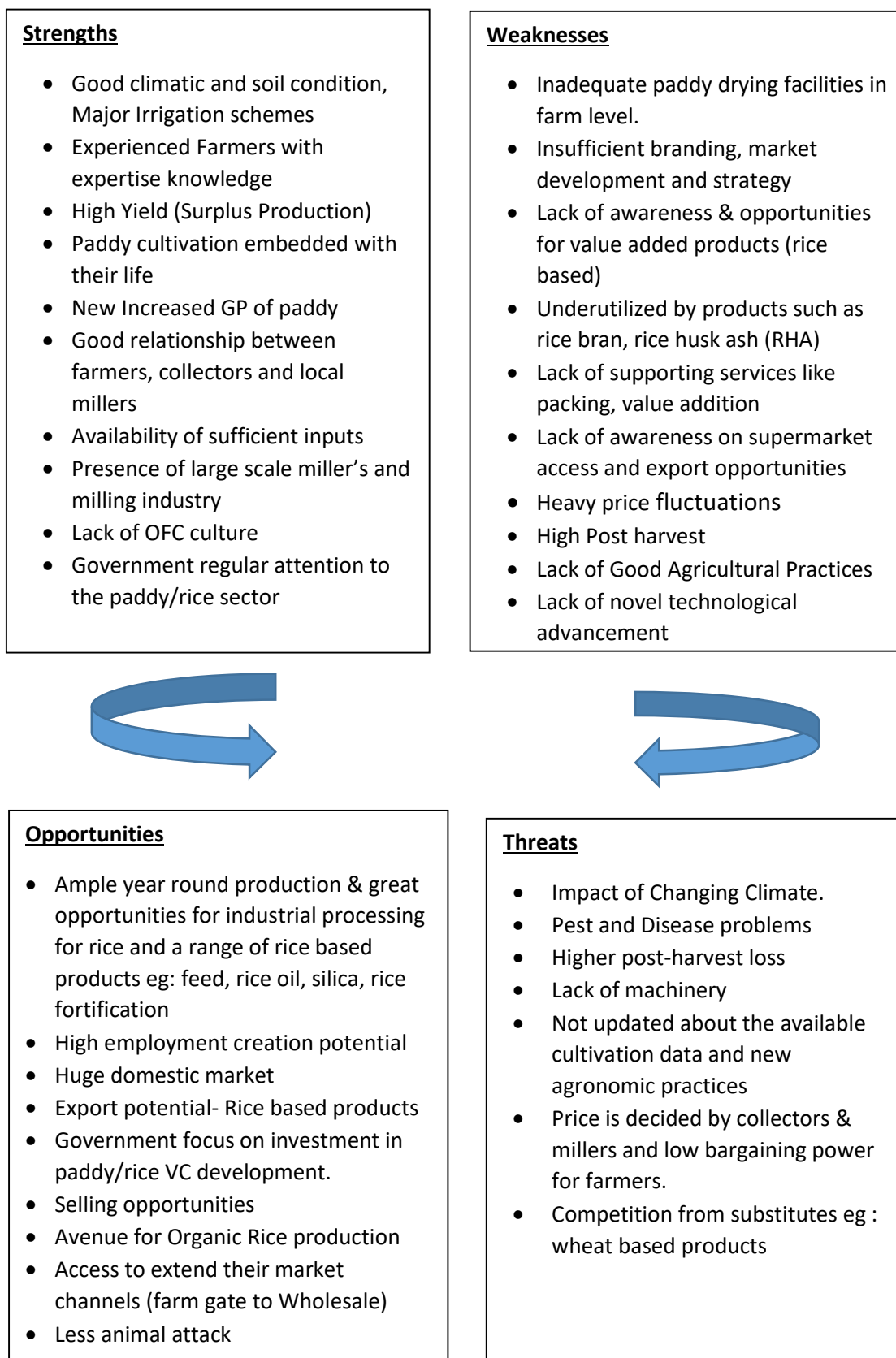


Figure 5.9: SWOT Analysis for the Paddy/Rice Industry

CHAPTER SIX

Findings, Conclusion and Recommendations

6.1 Findings of the Study

In general, the average yield of paddy under major irrigation in Polonnaruwa district is often 6% - 8% higher than the normal average yield under major irrigations in the whole country. Further, the average yield of Medirigiriya and Dimbulagala indicates a higher yield than that of Polonnaruwa district. The study shows that the average yield ranged between 89 - 138 Bu/ac in the above producing areas under the major irrigation schemes. The average cost of production of a kg of paddy was approximately Rs 24.50 in the producing areas in the year 2019. The farm gate price for a kilogram of quality paddy ranged between Rs 48.00 - 52.00, which showed an increase of 25% compared to that of 2018. This was due to the decision to increase the guaranteed price of paddy up to Rs 50.00/kg from the *Maha* season 2019/20.

The most popular paddy/rice marketing channel in the surveyed producing areas is,

Farmer → Collector → Rice Miller → Wholesaler → Retailer → Consumer

Sometimes brokers function between collectors and millers. The role of brokers becomes prominent in the time when paddy stocks are scarce. The analysis found that value addition takes place only in two points in the entire value chain at the farmer and the miller levels.

Value addition by the farmers at farm gate level was about 13% of the cost of production which is the cost for drying paddy to the standard quality (14% moisture). A major problem faced by farmers is the lack of an appropriate way to dry paddy. At present, carpeted roads are used for this purpose.

Millers add a higher percentage in value chains. Value is added for cleaning paddy stocks, storing and packing rice and transportation of rice to the major cities and this value addition is 24% of the cost of production of rice. There are about 100-110 functioning rice mills in the district which need about 832400 mt of annual supply of paddy. The marketable surplus of paddy in the district in a normal producing year is 471,000mt and nearly 50,000 farmers throughout the Polonnaruwa district annually release this quantity to the market. Thus the shortage quantity which is about 360,000 mt is obtained mainly from the Ampara, Batticaloa and Anuradhapura districts by the large scale millers in Polonnaruwa.

Hayley's, Agstar, CIC, Araliya and Parakum are some of the private sector companies involved in seed paddy production and marketing in Polonnaruwa district. In addition, Dimbulagala MPCs and Mahaweli Seeds Company are also engaged in seed paddy production. Each of these private sector companies possesses a registered farmer base. These companies provide farmers the necessary assistance and credits and this assistance is given through their extension officers. The companies purchase the seed

paddy harvest of the farmers at an agreed price. Accordingly, the excess seed paddy produced in the district is provided to other districts too. It was observed in the study that the above process goes on smoothly without any problems.

Large scale rice millers have entered the seed paddy manufacturing, fertilizer trading and paddy/rice packing material manufacturing businesses and they contributed the chain development as well. In the meantime, they penetrate their market power both up and down stream of the paddy to rice value chain.

Rice mills annually produce 44,000mt of rice bran and nearly 13,000 mt of rice polish as major by-products in the process of rice production. Rice bran is provided to RICE-O Company, an Indian processing company, which produces rice oil in “Laxa Uyana” Industrial park in Polonnaruwa . The rice polish supplies to animal feed producing industries in Bingiriya, Kuliyaipitiya, Udubaddawa in North Western Province. The major problem faced by animal feed manufacturers is suppliers adulterating rice polish.

The husk is mainly used in boilers to produce the steam for parboiling and drying of the paddy in the rice mill. The boiler is operated using paddy husk in the rice mills. The excess is provided to cement factories in Trincomalee and Puttalam as a raw material. There are about 20 collectors each for collecting rice bran and polish and husk connected to the rice mills in Polonnaruwa.

It was found that in 2011, there were three paddy collecting centres in one village. However, at present these collecting centres at village level have reduced giving way to about nearly 20 multipurpose purchasing and selling centres in one Divisional Secretariat for purchasing paddy, selling agro chemicals, fertilizers, seeds and sometimes hardware items. Further, according to the study in 2011, there were 160 rice mills in the district but now it has decreased to nearly 110. A certain number of small scale rice mills have left the industry. Further, the capacities of major scale rice mills have increased. Medium scale rice mills have also increased their capacity.

The largest four rice miller’s concentration ratio equals 50% that means four largest millers control half of the rice production in Polonnaruwa district. The study found that the most reasonable formula for parboiled *Nadu* rice, which was the most consumed rice variety, was produced from long grain paddy. The mostly prevailed price ratio was 2.04 and the relationship of the farm gate price and the retail price as follows,

$$RP= FGP \times 2.04$$

6.2 Leveraging Points of Paddy/Rice Value Chain, Need Interventions (Policy Issues)

According to the identified constraints through the value chain analysis some leveraging points which are helpful to VC development, creating business models by focusing special emphasis for small holder paddy farmers, identifying the

interventions, investment opportunities and VC financing needed to strengthen the chain.

6.2.1 Pre-Production and Production of Paddy

Segment	Intervention and Investment Opportunity
High production cost due to high cost of machineries	Establish farm machinery hubs which will provide custom services to farmers, with an appropriate public private partnership strategy (PPP).
Limited drying and storage facilities resulting in low quality and low price for fresh paddy.	Provided mechanical dryers and multipurpose drying pavements to farmers, farmers' associations, paddy collectors under the PPP strategy. Introduce credit schemes to encourage the private sector.
Farm level storage difficulties	Establishment of systems like warehouse receipt marketing (WHRM) which are familiar to the farmer.

6.2.2 Rice Processing and Distribution

Segment	Investment Opportunity
Almost all large scale rice mills in the country are concentrated in Polonnaruwa District.	Establishment of modern automated private sector mills in high surplus producing rural areas especially in the Eastern and North Central Provinces.
High cost for establishing rice mill machineries	Promote local engineering companies for manufacturing rice milling equipment's
Rice bran is still underutilized	Rice bran oil industry can be encouraged with investments
Rice Husk Ash which is a by-product of burning paddy husk gets wasted.	It is a very good source for Silica industry, which is practiced in other countries
Lack of Rice based on other food manufacturing industries.	Encourage the private sector for rice based other foods like rice biscuits, rice snacks which are popular in all other rice producing countries.

6.3 Conclusion

Being the staple food of the country, the Paddy/Rice value chain in Sri Lanka links urban consumption with rural production. Gradual, increment of the dynamism of paddy processing in the country is a great display of the development of the paddy/rice industry in the country. Rice milling industry has undergone vast structural changes with a concentrated market power. This is mainly because of the high degree of credit affordability, large quantity of paddy storage ability during the harvesting season and established brand loyalty. In comparison to 2011, by 2019 the production of four largest millers in major milling zone Polonnaruwa has been doubled while their market power too has significantly increased. Simultaneously, five forces in the industry are also favouring the millers providing more market power. The four largest millers in Polonnaruwa are the four largest millers in the country too. Their share of the total rice production in Polonnaruwa is nearly 50 percent. In calculating these concentration values, inadequacy of proper updated information about the number of rice millers in the country and their capacity is a limitation.

The rice millers could be identified as the major actor in the paddy/rice value chain in Sri Lanka. More importantly, millers exercise dual roles as the buyer when purchasing paddy and the seller when selling rice to the wholesalers and retailers. The large scale millers as the most specific actor in the middle of the paddy rice value chain has the ability to impose market power either upstream or downstream. This is specific when compared with most of the rice producing countries. In addition to that there are less number of actors in value chain in Sri Lanka than that of other countries. In other words the length of value chain are comparatively short. In addition, a certain number of small scale rice mills have left the industry. The capacities of major and medium scale rice mills have increased. This strongly justified the oligopolistic/oligopsony nature of the paddy/rice milling industry in Polonnaruwa.

The ceiling price law was active for rice during the study period. The rice prices become stable for a certain extent when the ceiling is implemented. During that period, the ratio between the farm gate price of paddy and the retail price of *Nadu* rice ranged between 1.97 -2.2. The mostly prevailed price ratio was 2.04. When consider the absence of price ceilings the ratio between the farm gate price of paddy and the rice retail price tends to exceed the above value. Accordingly, it is necessary to increase the number of the largest millers which will result in an increase competition. For this purpose, investments should be made to establish large automated rice mills in major producing areas with few mills at present and allow to value chain development. It will upgrade value chain and increase the competition causing equal opportunities for all the actors.

The four largest millers in Polonnaruwa are the four largest millers in the country too. Their share of the total rice production in Polonnaruwa is nearly 50 percent. In calculating these concentration values, inadequacy of proper updated information about the number of rice millers in the

country and their capacity is a limitation. When the above concentration values are considered the rice milling industry is characteristics by oligopsony power.

The analysis found that value addition takes place only in two points in the entire value chain farmer and the miller levels. Value addition by the farmers at farm gate level was about 13% of the cost of production which is the cost for drying paddy up to the standard quality (14% moisture). A major problem faced by farmers is the lack of an appropriate way to dry paddy. At present, one side of the carpeted road is used for this purpose. Millers add a higher percentage in value chains. Value is added for cleaning paddy stocks, storing, packing, and transportation of rice to the major cities, releasing by products to other industries and this value addition is 24% of the cost of production of rice.

As a suggestion, the government should encourage medium scale millers to establish modern automated private sector mills in high surplus producing rural areas especially in the Eastern and North Central Provinces. Study recommends the need of a detailed rice mill and stakeholder survey covering the whole country including capacity, machineries, storages, rice types etc. Therefore, the need for a detailed census and Information & communication Technology based regular updating database is vital. It can be suggested to conduct a collaborative study with Hector Kobbekaduwa Agrarian Research and Training Institute, Institute of Post-Harvest Technology, PMB, Department of Census and Statistics and the Ministry of Finance.

Study found that the important by-products such as rice bran and paddy husk ash are underutilized. Need to identify the potential and strategies to popularize the rice oil among the local community. Many of the research literature provides that rice bran oil is a healthy oil for food and other specific uses. Further, a detailed study of paddy/rice based by-products and a comprehensive value chain is recommended in order to utilize those in an efficient and effective manner.

In addition, rice quality improvement will become even more important in the future in Sri Lanka, like in most other countries, entering into international as well as regional trade agreements and thereby opening its market to the outside world. This would create a situation where the country will have to compete with other rice producing countries in the sale of locally produced rice. Therefore, an updated and dynamic paddy/rice milling industry without market manipulations must be needed.

6.4 Policy Recommendations for Paddy/Rice Value Chain Development

6.4.1 Farm Level

Designing strategic programmes to replicate the agronomic practices that produce high yield in producing areas like Medirigiriya among the other farmers to increase their average yields.

Farmers need infrastructure facilities to dry paddy in order to add value to their harvest. For this purpose, standard concrete threshing floors are needed. Programmes

should be designed at public and private level to impress the private sector to provide such quality threshing floors so as to increase the efficiency of the value chain. Establishing machinery hubs as a public private partnership to enable farmers to access to farm machinery at low cost is vital.

Establishing a proper mechanism for fixing Minimum Support Prices or Guaranteed Prices for the staple crops and a Price Ceilings for food commodities is essential. A formal mechanism with the participation of HARTI, CBSL, DOA, and Universities & Consumer Authority is recommended in this regard.

Further, facilities should be provided to farmers to feed information about their stocks to a digital platform, through which a programme can be implemented to link buyers. It is needed to Introduce an electronic trading portal for paddy rice marketing. India's National Agriculture Market (eNAM¹³) is a good example.

Study recommends developing horizontal linkages (farmer-farmer) and vertical linkage (farmer- large scale milling company) for reducing marketing costs.

The government should intervene by encouraging the establishment of farm level drying facilities and at the same time introducing systems like warehouse receipt marketing (WHRM) which are familiar to the farmer. Warehouses should offer the price, supply and demand information to the market users so as to develop selling and buying strategies.

6.4.2 Collector and Rice Miller Level

Traders who are engaged in collecting paddy can contribute towards the process of drying paddy. Programmes to encourage the traders to invest in mini dryers and concrete floors are needed.

That is the miller who adds the highest amount of value into the value chain. Successful innovative small and medium scale millers who maintain good relationship with financial institutions should be encouraged to upgrade their milling industry. Similarly, the government should encourage the successful medium scale millers to establish modern automated private sector mills in high surplus producing rural areas especially in the Eastern and North Central Provinces. And the private sector should be encouraged to establish rice based and by-product based industries in rural producing areas like Dimbulagala, Padaviya, Kebithigoleewa, Ampara, Lahugala, Pottuvil, Elehera, Vilacchiya, Mannar, Mulativu, Kilinochchi and Batticaloa strengthening small scale rice millers for collective actions.

Large food companies should be encouraged to establish modern rice mills in above mentioned remote producing areas. Food security issue obviously relates to national security and human security. In addition, it is necessary to investigate into the

¹³ India's electronic trading portal for paddy rice marketing.

possibility of establishing large rice mills through agricultural and engineering divisions of the security forces.

Study recommends the need of a detailed survey on rice mills and stakeholder survey covering the whole country including capacity, machineries, storages, rice types etc. Therefore, the need for a detailed census and ICT based regular updating database is vital. It is suggested to collaborate a study through HARTI, IPHT, PMB and the Ministry of Finance.

Study also recommends enhancing transparency, traceability and trust between stakeholders across the supply chain and avoiding delayed data release and inconsistent data among different sources through collecting the data diligently for the paddy/rice industry. For this purpose, possibility of introducing the Block Chain Solution Technology to the paddy/rice industry should be examined.

Establishing a task force is recommended to examine and coordinate the issues related to the entire paddy and rice industry. Promotion of the use of solar energy and establishing paddy husk powered plants to reduce dependence on electricity to minimize the milling cost is vital.

A detailed study needs to be conducted on the Rice Oil industry. It is needed to identify the potential and strategies to popularize rice oil among the local community. The quantity exported to India as raw rice bran must be investigated. It is recommended to investigate the large quantity of by-product released by the industry. Strategies for making Silica from RHA and underutilization of rice husk ash should be investigated.

Future rice value chains will tap into growing market opportunities by adding value to products through processing, quality upgrading, and through diversification of rice varieties, products and by-products, and new market channels. Innovative millers involved in preparing value added novel rice based food products (eg: fortified rice products, organic and traditional rice products, rice *Kottu*, cooked rice, biscuits, bread) from rice need to be encouraged by providing finance, technology, research facilities, market and export assistance. Product upgrading must be facilitated through grading, labelling and certification.

Poor and the poorest people in urban, rural and estate sectors need to be correctly identified and their data bases should be digitised. During the high rice price periods, targeted safety net programmes need to be implemented to distribute rice in order to protect poor people. Better targeting the poor can be done through Smart cards or Biometric cards. Indonesia's *Raskin*¹⁴ rice distribution programme for vulnerable groups is an example.

¹⁴ Indonesia's subsidized rice programme

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