MARKETING PERFORMANCE AND DETERMINANTS OF RICE INCOME OF THE SELECTED FARMERS IN WAW TOWNSHIP (BAGO EAST REGION)

YEE MON AUNG

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MARKETING PERFORMANCE AND DETERMINANTS OF RICE INCOME OF THE SELECTED FARMERS IN WAW TOWNSHIP (BAGO EAST REGION)

YEE MON AUNG

A Thesis Submitted to the Post-Graduate Committee of the Yezin Agricultural University in Partial Fulfillment of the Requirements for the Degree of Master of Agricultural Science (Agricultural Economics)

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Yezin Agricultural University

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The thesis attached hereto, entitled "**MARKETING PERFORMANCE AND DETERMINANTS OF RICE INCOME OF THE SELECTED FARMERS IN WAW TOWNSHIP (BAGO EAST REGION)**" was prepared and submitted by Yee Mon Aung under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee and board of examiners as a partial fulfillment of the requirements for the degree of **MASTER OF AGRICULTURAL SCIENCE (AGRICULTURAL ECONOMICS)**.

……	**……**
Dr. Dolly Kyaw	**Dr. Thanda Kyi**
Chairperson	**External Examiner**
Supervisory Committee	**Supervisory Committee**
Professor and Head (Retd.)	**Deputy Director**
Department of Agricultural Economics	**Department of Agricultural Planning**
Yezin Agricultural University	**Nay Pyi Taw**

.....	**.....**
Dr. Cho Cho San	**U Thet Lin**
Member	**Member**
Supervisory Committee	**Supervisory Committee**
Associate Professor and Head	**Lecturer**
Department of Agricultural Economics	**Department of Agronomy**
Yezin Agricultural University	**Yezin Agricultural University**

……..

Dr. Cho Cho San

Associate Professor and Head

Department of Agricultural Economics

Yezin Agricultural University

Yezin, Nay Pyi Taw

This thesis was submitted to the Rector of the Yezin Agricultural University and was accepted as partial fulfillment of the requirements for the degree of **MASTER OF AGRICULTURAL SCIENCE (AGRICULTURAL ECONOMICS).**

Dr. Tin Htut

Rector

Yezin Agricultural University

Yezin, Nay Pyi Taw

Date ----------

DECLARATION OF ORIGINALITY

This thesis represents the original work of the author, except where otherwise stated. It has not been submitted previously for a degree at any other University.

Yee Mon Aung

Date ----------

DEDICATED TO MY BELOVED PARENTS

U AUNG WIN AND DAW MYINT MYINT OO

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MARKETING PERFORMANCE AND DETERMINANTS OF RICE INCOME OF THE SELECTED FARMRES IN WAW TOWNSHIP (BAGO EAST REGION)

ABSTRACT

The objectives of the study were to analyze the profitability of rice production for different rice varieties and cultivation methods, to investigate the market performance, to assess the constraints of rice production and marketing and to examine the determinants of rice income and yield of rice farmers. The survey was conducted at 3 villages (Win Ka Dark, Hmone Ka Tone, and Oak Pho) in Waw Township in December 2011 to January 2012. The selected sample sizes were 94 farmers, 7 people who work as both milling and wholesaling, 4 wholesalers, and 5 retailers.

Among the sample farm households, the number of small farm household was 14, medium farm household was 36 and large farm household was 44. Large farm households owned more productive and households' assets. Majority of sample farm households grew Shwewarhtun rice variety by using broadcasting and transplanting cultivation methods. The average sown area of Shwewarhtun rice variety for small, medium and large farm households was 1.61 ha, 2.87 ha and 5.33 ha, respectively.

For overall households, the gross margin per unit of land received from growing Shwewarhtun variety by broadcasting and transplanting methods were 138,375 kyats per hectare and 236,502 kyats per hectare respectively, Manawthukha variety by broadcasting and transplanting methods were 180,932 kyats per hectare and 293,061 kyats per hectare, Shwetasope variety by broadcasting was 118,040 kyats per hectare and other rice varieties (Sinthiri, Sinthukha and Baykyarlay) by broadcasting and transplanting methods were 140,069.96 kyats per hectare and 248,593.26 kyats per hectare.

The marketing channels of rice production in Waw Township were Mawlamyine, Hpa-an, Kyaikhto, Theinzayat and Myingyan markets. Miller/wholesalers and wholesalers were the most important buyers of rice from producers, about 83.73%, 92.76% and 94.19% respectively for Shwewarhtun, Manawthukha and Shwetasope varieties.

Marketing margin of local wholesalers was narrow but for Myingyan market was the largest. The marketing margins, costs and profits of wholesalers who traded to Mawlamyine, Hpa-an and Myingyan markets were the highest in Shwewarhtun, Manawthukha and Shwetasope rice varieties. The highest profit (22041.37 Ks/ton) of

retailers in Waw Township was received from Manawthukha rice variety. The highest profit percentage of consumer paid price (35.55%, 42% and 33.89%) was obtained by farmers in Shwewarhtun, Manawthukha and Shwetasope rice varieties. The marketing concentration of the top three millers/wholesalers and wholesalers was 54.86%.

The most serious problems of sample farm households were high fertilizer price, low technology for production and low farm gate price of paddy for marketing. The major constraints for the millers were high tax rate and low quality of milled rice due to lack of modernized machinery and huller.

Based on the regression result, yield and farm size positively and significantly influenced on the rice income at 1% significant level. Marketing margin, home consumption and reserved seed negatively and significantly influenced on the rice income at 5%, 1% and 5% level, respectively. The yield was positively and significantly influenced by total labor quantity, urea quantity and farm yard manure quantity at 1%, 5% and 5% respectively. Sown area of paddy grown by using broadcasting method and suffered from floods in rice field negatively and significantly influenced on rice yield at 5% level. The F value shows that the selected regression model was significant at 1% level.

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LIST OF ABBREVIATIONS

ac	Acre
ha	Hectare
MT	Metric ton
Bsk	Basket
Amd	Animal man day
md	Man day
Ks	Kyats
MAS	Myanmar Agriculture Service
MIS	Market Information Service
MOAI	Ministry of Agriculture and Irrigation
N	Number of respondents
kg	Kilogram
DAP	Department of Agricultural Planning
MRIA	Myanmar Rice Industry Association
FAO	Food and Agriculture Organization
CSO	Central Statistical Organization
GDP	Gross Domestic Product
SLRD	Settlement and Land Resource Department

LIST OF CONVERSION FACTORS

1 basket of paddy	=	20.86 Kg
1 basket of paddy	=	46 pounds
1ton of paddy	=	48.75 basket
1 basket of rice	=	34.01 Kg
1 ton of rice	=	29.39 basket
1 hectare	=	2.47 acre
1 metric ton	=	2204.623 pounds
1 basket of paddy	=	0.02086 ton
1 ton of rice	=	73 basket of paddy

CHAPTER 1
INTRODUCTION

1.1 Background

The agriculture sector is essential for providing food for increasing population and for earning foreign exchange. Rice is the most important food crop or major staple food of Myanmar and it remains a strategic sector in terms of its significance in the country's socio-economic development. On the supply side, rice is cultivated about 17 million acres in monsoon season and 3 million acres in summer season. Hence, rice occupies 34% of the total agricultural area in the farm economy and employs around 5 million farmers and family members (MOAI 2011). Rice also contributes 9.3% to the agricultural export in Myanmar in 2010-2011. The agriculture sector contributes 30% of the country's Gross Domestic Product (GDP). The estimated total population in Myanmar was 59.13 million with population density of 87 per square kilometer in 2009-2010 (MOAI 2011).

Rice is not only a staple food but also used for making different varieties of snack such as vermicelli, rice noodle, rice cake, etc. On the demand side, rice carries the largest weight in the Consumer Price Index. The consumer price index was changes from 23% in 2008 to 7.3% in 2010(ADB, 2010). This suggests that a major percentage of the budget for low income families constitutes rice expenditure. Therefore, the successive government has intervened in the rice market using various productions and marketing programs in pursuit of its self-sufficiency and food security objectives. It is noted that Myanmar has the highest per capita milled rice consumption (196 kg/person/year) among the neighboring Asian countries (FAO 2008). The sustainable growths in production and appropriate profit shares for paddy farmers are crucial for increasing income and alleviating rural poverty. Due to important role in terms of creating employment and income, the government has always given high priority to increasing its productivity.

1.2 Sown area, Yield and Production of Rice in Myanmar

According to (DOA 2011), Ayeyarwady, Bago, Yangon, Sagaing Regions and Mon and Shan States are the paddy surplus production areas of the country and Magway, Mandalay Regions and Chin State are the paddy deficit production areas of the country. The total sown area of paddy was increasing from 6.55 million ha in 2003-2004 to 8.05 million ha in 2010-2011. Average yield of the paddy was increasing at a low rate from 60

to 80 baskets per acre during the period of 2003-2004 to 2010-2011. The annual growth rates of total yield were fluctuated**.** The average annual growth rate of paddy yield from 2003 to 2010 was 1.9%. There has been tremendous increase in total production from 22,770,000 MT in 2003-2004 to 32,579,000 MT in 2010-2011 in Table1.1. Annual growth rates of total rice production were fluctuated from 2003-2004 to 2010-2011. The total annual growth rate of total rice production from 2003 to 2010 was 5.38 % (MOAI 2011).

1.3 Sown Area, Yield and Production of Rice in Bago (East) Region

Bago Region is one of the main-surplus rice producing areas where ecological environment is favorable for rice production and main supplies not only to the domestic but also to the international markets. In this region, total rice sown areas increased from 1.09 million hectares in 2003-2004 to 1.43 million hectares in 2009-2010 that comprised of 1.23 million hectares of monsoon paddy and 0.2 million hectares of summer paddy respectively. Yield per hectare also increased from 3.45 MT/ha in 2003-2004 to 3.98 MT/ha in 2009-2010. The annual growth rate of yield in Bago region was fluctuated from 2003-2004 to 2009-2010 (CSO 2010).

The average annual growth rate of yield in Bago (East) Region from 2005 to 2010 was 1.4%. The annual growth rates on yield in Bago (East) Region from 2005 to 2010 were fluctuated. The average annual growth rate of rice production in Bago (East) Region from 2005 to 2010 was 3.17 %.The annual growth rates of rice production in Bago (East) Region from 2005 to 2010 were fluctuated in Table 1.2. In general, most farmers practise the improved high yielding varieties. The farmers in Bago (East) region practise monocrop. They only grow monsoon rice. After monsoon rice, they grow pulses. Farmers usually suffer from floods every year. They have to grow rice twice in the monsoon season and therefore the production cost of paddy was higher than the costs in other regions.

Table1.1 Paddy sown area, yield, production and export in Myanmar from 2003-2004 to 2010-2011

Year	Sown area (million ha)	Yield (MT/ha)	Production (000' MT)	Exports (000'MT)
2003-2004	6.55	3.54	22770.0	169.00
2004-2005	6.86	3.63	24359.9	182.00
2005-2006	7.58	3.74	27245.8	180.00
2006-2007	8.13	3.84	30435.0	14.50
2007-2008	8.09	3.93	30954.1	358.50
2008-2009	8.10	4.03	32058.5	666.40
2009-2010	8.08	4.06	32165.8	818.10
2010-2011	8.05	4.07	32579.0	536.40

Source: CSO (2011), MOAI (2011)

Table 1.2 Paddy sown area, harvested area, yield, production and annual growth rate in yield and production in Bago (East) region from 2005-2006 to 2010-2011

Year	Sown area (million ha)	Yield (MT/ ha)	Annual growth rate in average yield (%)	Production (000' MT)	Annual growth rate in production (%)	Share in total production (%)
2005-2006	0.66	3.67		2406		8.8
2006-2007	0.72	3.43	-0.07	2407	0.0004	7.9
2007-2008	0.72	3.88	0.13	2776	0.15	8.96
2008-2009	0.72	3.96	0.02	2845	0.03	8.88
2009-2010	0.72	3.97	0.002	2856	0.043	8.88
2010-2011	0.72	3.98	0.002	2863	0.003	8.79

Source: DOA, Township Office, Bago (East) Region (2011)

1.4 Supply Chain Management and Profit Shares of Various Stakeholders in Myanmar

Myanmar has adopted a series of policy reforms to liberalize its economy since the late 1980s. As the country changed from a centrally planned economy to a market-oriented economy, a remarkable growth has been achieved in agricultural sector and also in economy of the country. For example, the contribution of the agriculture sector to the country's GDP has increased from 44% in 2002-2003 to 30% in 2010-2011. Not only increased in sown area, yield and total production of paddy but also rice export clearly increased from 354,000MT in 1995-1996 to 536,000MT in 2010-2011(MOAI 2011).

Rice is the staple food of the country and therefore successive government has intervened in both input and output markets with the aim of food security. The rice sector was experienced a relatively free domestic trade regime starting from the mid of 2003. Rice export was again permitted to a few companies in 2007. Because of permission for rice export licenses are granted to few numbers of traders; price incentive for producers was unstable. Although regional market price showed increasing trend starting from 2001, the farm gate prices for producers are still low due to low quality of paddy caused by inadequate, insufficient, and inefficient supply chain management.

Farmers generally sell their paddy to primary collectors or village millers. Besides, they sell rice to local traders after milling for their home consumption. The private marketing system has the main role of transferring rice from producers to consumers through transport, storage, and processing services. According to (Thakur et al. 1997), farmers in developing countries are not getting the right share of consumer price due to excessive margin mainly because of inefficient and costly transport. Similarly, paddy farmers in Myanmar are getting the low prices and receiving lower profit share. For example, farmers received about 19% of total profit which was lower than the profit of trader and exporter in Figure 1.1 (DAP, MIS 2008). If the whole supply chain is efficient, then the marketing margin for farmer will be declined and they will receive higher paddy price and thus high profit share.

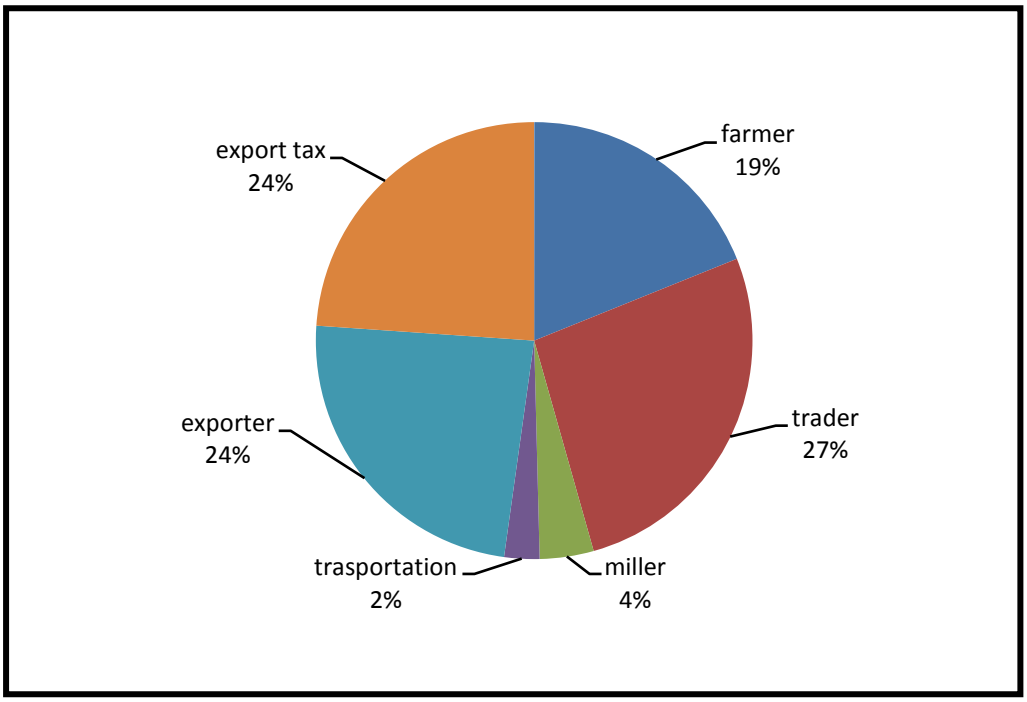

Figure 1.1 Percentage profit shares of various stakeholders' in Myanmar

Source: DAP, MIS (2008)

1.5 Problem Statement of the Study

Rice supply chain management is the main driving force for economic development of the country. The increased population in more urban centers and rising level of income require more organized channels for processing and distributing agricultural products (Takele 2010). Bago (East) region is one of the major rice production regions in Myanmar. The contribution of paddy production in Bago (East) region to the total paddy production was 8.79 % in 2010-2011. Among the Townships in Bago (East) Region, Waw Township produced 9.2% of the paddy production in 2010-2011.

In rice marketing system of Waw Township, primary collectors usually purchase paddy directly from farmers and sell to millers and wholesalers. Most of the large millers buy paddy from farmers/collectors through the commission and sell the milled rice to wholesalers and retailers. In Bago (East) region, farmers select the rice varieties depending on the cost of production and price of rice. The production costs and product prices are not equal for different varieties and qualities. There are many differences between productions of Pawsan and Manawthukha rice varieties regarding with capital investment, use of labor, use of fertilizer, water and weed management, insect and pest control, etc. Farmers use rice varieties such as Manawthukha, Shwewartun, Shwetasope, Thukhatun, Baykyarlay and Sinthiri in monsoon season and pulses in winter season.

Rain water is more than enough for rainy paddy cultivation in this area. The rainy paddy often suffers from inundation of rain. Because the rice is transplanted during the high rainfall period, thus the young nurseries are sometime submerged under increased water level in the paddy fields after heavy rain. The farmers have to replant two or three times per year, especially in lower and depression areas. Rice plants cannot survive more than four days under water; we need more seeds to start a new rice plantation to replace those destroyed by the flood. Therefore, production cost increased and profit is uncertain especially in risk prone area.

Most of the previous studies have focused on paddy production and marketing. Currently, the performance of agricultural marketing system in Myanmar might be constraints in many factors such as poor quality of agricultural produce, weak extension service, lack of market facilities, weak marketing information, limited access to credit and inefficient handling such as transportation, packaging and storage, etc. Waw is a leading township with respect to paddy growing and processing. Therefore, it is essential to study the market performance by classification of marketing channel and by estimation of

marketing margin, cost and profit of various stakeholders (farmers, wholesalers, millers, and retailers).

1.6 Objectives

The overall objective of the study is to understand the market performance in terms of marketing margin, cost and profit shares of various stakeholders (farmers, millers, wholesalers, and retailers) and to investigate the rice distribution system in the Waw Township, Bago (East) region.

- To analyze the profitability of the rice production for different rice varieties and different cultivation practices;
- To investigate the marketing costs and margins of various stakeholders along the rice marketing channels (concentration ratio and percentage of market share);
- To assess the major constraints of rice production and marketing in the Waw Township; and
- To examine the determinants of rice income and yield of the selected farmers.

CHAPTER 2
LITERATURE REVIEW

2.1 Concept of Marketing and Supply Chain

Marketing is a kind system in order to accelerate the moving of goods from the producers to the consumers. Marketing is getting the right goods and services to the right people at the right places at the right time at the right price (Timmer 1989). On the other hand, supply chain is a sequence of (decision and execution) processes and (material, information and money) flows that aim to meet final customer requirements, that take place within and between stages along a continuum, from production to final consumption (Flordeliza) . The goal of supply chain management is to reduce uncertainty and risks in the supply chain, thereby positively affecting inventory levels, cycle time, business processes, and customer service, which contribute to increased profitability and competitiveness.

By improving supply chain, the following positive effects would be received;

(1) Reduction in product losses in transportation and storage;
(2) Increase in sales;
(3) Dissemination of technology, advanced techniques, capital and knowledge among the chain partners;
(4) Better information on the flow of products, markets and technologies;
(5) Transparency of the supply chain;
(6) Tracking and tracing of the source;
(7) Better control of product safety and quality, and
(8) Large investments and risks are shared among partners in the chain.

2.2 The Rice Marketing Channel/Chain

According to Stern et.al (1996), marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use. The complexity of these channels depends upon the distance between the producers and the consumers, the availability of marketing facilities, the size of farms, and the time available for the farmer to do the marketing.

Kohls and Uhl (2002), define marketing channels as alternative routes of product flows from producers to consumers. They focus on the marketing of agricultural products, as does this study. Their marketing channel starts at the farm’s gate and ends at the

consumer's front door. The marketing channel approach focuses on firm's selling strategies to satisfy consumer preferences.

A general knowledge of the commonly used marketing channel is valuable to understand the marketing system, and the correlation between markets and market agencies. Market performance is a function of the number of scale and role of market intermediaries who provide services involving the transfer of producer to end user. The marketing channel showed the flow of pulses from the production site (producer) to intermediaries and on to the exporters. To understand how the commodities move through the various channels, it is necessary to identify the role of various market places and marketing agents involved. By knowing the marketing channel one can estimate where the deficit area or surplus area is. Traders can realize the channel and they can choose the appropriate markets and analysis will make the different shares of specific intermediaries who participates in the marketing channels.

The performance of a marketing channel is related with the composition of its structure and the behavior of the intermediaries conducting in these channels. To consider the link between intermediaries and the movement of the product from producer to consumer, the concept of marketing channels or channels of distribution need to be analyzed. In the case of Myanmar's rice market all important intermediaries, institutions will be focused on analyzing that operate in different channels of distribution as well as the availability of marketing facilities such as infrastructure, transportation, storage and market information etc.

2.2.1 The rice marketing channel in Myanmar

The unique situation in Myanmar is that the marketing of certain crops is completely handled by the open market. In the case of rice, the domestic marketing and export are now liberalized. Marketing covers a wide range of activities which include processing of goods, packaging, storing, transportation and the actual buying and selling of a product (Akinbode 2003). These are operational sub-systems of the marketing system which provide frameworks of participation by the marketers at designated places and at definite time periods (Basorun 2003).

Rice marketing in Myanmar is operated by several intermediaries for moving paddy from farmer to ultimate rice consumer. For transferring agricultural produce from farmers to consumers, various intermediaries play important role in domestic marketing system. The private marketing system has the main role of transferring rice from producers to consumers through transport, storage, and processing activities.

The overall conceptual framework of the study can be laid out as the Figure 2.1.In general, marketing intermediaries in marketing channel of Myanmar can be distinguished into five groups: farmer, primary collector, rice miller, rice wholesaler and rice retailer.

(a)Farmers

Farmers in this country can be grouped into three: small, medium and large farmers depending on land holding size and working capital. Most farmers have surplus of sale and store for family consumption and seed for next planting season. With regard to farmer marketing, the major key points are mentioned as follows:

- Some of the small farmers immediately part their crops after harvesting. The reason is that they need working capital to grow second crop in time before losses of soil residual moisture. In domestic market, newly harvested crops enter the market and prices start to decline.
- Most of the large farmers store marketable surplus with the expectation of higher price in later season.
- As regards to sale, it is found out that some farmers sell their crop at farm, and some deliver their crop to the nearest town.

(b) Primary collector

Primary collector usually purchase paddy directly from farmers for millers and wholesalers with basket, the volume of which varies from region to region. Some collectors play as the brokers with their own capital and some are commission agents of big millers and town wholesalers. During transaction time, farmer and broker used to negotiate the price of paddy depending on the advance payment, quality, variety, moisture content, and size of the basket and so on. The primary collectors have opportunity to easily enter into and exit out of the rice marketing depending upon market condition. Their working capital is small and it is partly provided by millers or wholesalers.

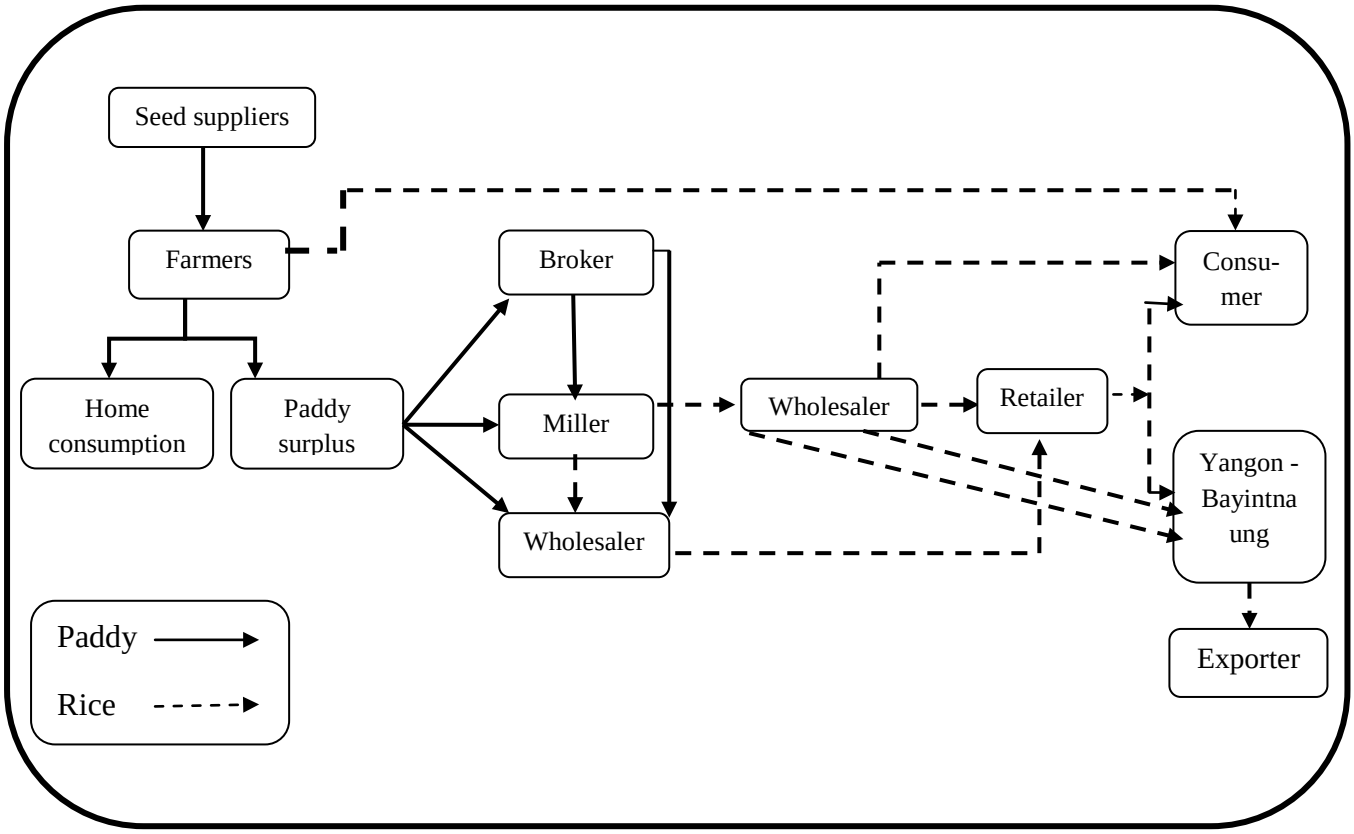

Figure 2.1 Schematic diagram of the rice marketing channel in Myanmar

(c) Rice Miller

In Myanmar, there were many state owned and private owned rice mills. The new rice marketing policy has been laid down in April 2003. The government has not generated rice processing. The private sector was allowed to access rice marketing. The total number of private owned rice mills are increased from 1005 mills in 2003-2004 to 1211 mill in 2010-2011. There are 10469 huller mills in 2003-04 , increasing 15392 mills in 2010-2011.Rice leading companies and private companies in Ayeyarwaddy region have been milling qualified rice, established the following 15 new modern rice mills(above 50 ton) during 2009-2010 and 2010-2011. Rice leading companies and private companies in Yangon region have been milling rice, established the 7 new modern rice mills (above 50 ton) during 2009-2010 and 2010-2011(Nay San 2011).

Myanmar milling sector has not yet been blessed with favorable environment for high milling standard and performance (San Thein 2006). Rice milling in the country is carried out in three categories: large-sized, medium-sized and small-sized rice mills though the milling capacity varies among the categories. Huller mills have the advantage of being cheap and simple to operate but are very inefficient in converting paddy into rice. The rice recovery from huller is less than 50 percent while it is more than 60 percent in medium-sized and large-sized mills with high quality of rice. The modern medium and large-sized mills return higher yield of rice output with least broken and better quality of by-products.

The owners of the small rice mills are often farmer because they have no sufficient capital to invest for medium or large mill. They milled their marketable surplus paddy and home consumption as well. Most of the large millers bought paddy from farmers/collectors through the commission and sold the milled rice to wholesalers and retailers. The large millers in surplus area played as wholesalers, and they sold their milled rice to wholesalers in the central markets in other regions.

(d) Rice Wholesaler

Wholesalers play an important role in the rice marketing channel in Myanmar. They operate rice marketing with much more capital than other participants. They conduct their business in local market and inter-State/ Division trade. For crop collection, some town wholesalers in major producing areas employ with agents and pay commission to agents for purchasing. Mostly, they are also rice millers especially in surplus regions.

They operate as the center point of the rice marketing in Myanmar. The market price information from the nearest market, supply/demand situation from focal point, and policy environment are important factors for wholesaler's decision making process.

At this stage of rice marketing, 'Myanmar Rice Wholesaler Association' was formed consisting of almost all of the wholesalers in each region. After abolishing the procurement system in 2003, rice wholesaler association became more organized under the guidance of government authorities and Myanmar rice Trading Leading Committee in all regions. This organization was much more active especially in rice surplus regions and in Yangon rice market.

(e) Rice retailer

Retailer is the last layers of the direct link to consumer in rice marketing channel. Of course, retailers of rice market are tightly close to consumers who have to buy rice everyday for their daily consumption. The relationship between retailer and consumer is much more complex compared to the relationship between the market participants. Because of the majority of consumers are low income consumers, and a large portion of their budget is used for rice. Therefore, rice retailers understand well the customer budget and they adjust the time of payment for buying rice later on. Most of retailers purchased rice from wholesalers.

A few retailers bought rice from millers and directly from farmers. They mainly sold to consumers in retail markets which are the nearest to consumer. It is evident that rice retailers had no organizational action in all rice markets. They had much more freedom to enter into and exit out of the rice marketing system. Moreover, they represent a layer which has much more competitive structure in the rice marketing in Myanmar.

2.3 Marketing Costs and Margins

Marketing costs and margins are required to understand for all stakeholders' value addition who is participating in rice supply chain. Farmers, who seek to produce a crop need to be aware not only the production costs but also the cost of marketing and demand condition. Wholesalers, retailers and processors must be fully aware of their costs if they want to trade profitably.

FAO (1993) assumes that harvesting of the crop and movement of that produce to the farm gate is part of the production cost. The first marketing cost is produce preparation including cleaning, sorting and grading. The second cost usually faced by

farmers or traders is packaging. Types of packaging may be different depending on the product types and market condition. Then, handling cost in all stages of marketing chain should be taken into account that will have the labor cost of packing, unpacking, loading, and unloading. Transportation cost will vary with distance between farmer or seller and market that will also depend on the quality of roads and mode of transport.

The assumption behind all commercial storage is that the price will rise sufficiently while the crop is in store to cover the cost of storage. Processing is important item for paddy that has to be milled; in working out total marketing costs, it is necessary to consider the conversion factor from paddy to miller grain.

Next invisible cost is capital cost, but it is very important to count for the interest rate if traders run the business with loan money, if not, the opportunity cost should be taken into account. Finally, fees, taxes, commissions are faced in agricultural marketing that all these costs have to be built into the calculations. Price incentives which is with marketing costs, affect the profits of marketing participants and their decision making. The analyzing costs are useful to compare the relative efficiency of various marketing agents.

Marketing margin is examined for a common means of measuring market efficiency. The overall marketing margin is simply the difference between the farm-gate price and the price received on retail sale. That difference can then be considered to be the cost of marketing and all that is entailed in getting the product from the producer to the consumer in the desired form. Therefore, marketing margins are differences between different levels of marketing channels. They capture the proportion of final selling price that marketing agent provides services for getting the added value in various levels. Response of marketing margins to price changes at any level is also indicative of the efficiency of the channel or supply chain (Guvheya 1998).

2.4 Market Structure

Bain (1968) as cited in Duc Hai (2003) says market structure is defined as “the characteristics of the organization of a market which seem to influence strategically the nature of the competition and pricing within the market. In general, market structure can be studied in terms of the degree of seller and buyer concentration, the degree of product differentiation, the existence of entry and exit barriers, and the power distribution (Scott 1995; Duc Hai 2003). A market concentration refers to the number and relative sizes of

buyers /sellers in a market. Many studies indicate the existence of some degree of positive relation between market concentration and gross marketing margins **(**Takele 2010).

2.5 Production Challenges and Opportunities

Rice production has increased substantially throughout the years according to government published data. Annual production increase was contributed by land area expansion and yield increase. Area expansion took place around the country where fallow lands are exit. Starting from 1992, government introduced summer paddy production program. It increased crop production intensification for farmers. Farmers who relied on rainy season can now grow second rice with irrigation within a year. Department of Agricultural Research (DAR), which maintains contact with international research institutes, is producing new improved high yielding varieties. DAR was to systematically conduct research activities that would suit to the needs of all stakeholders which include producers, distributors and consumers in developing and dissemination of regionally adapted crop varieties and crop protection technologies (DAR 2009)

Commercial farming system

– Introduced in 2000-01,

- incentive of 30 years land lease
- provision of technical and financial supports
- 50% of production for exports

– 1.67 million acres in 2009-10.

2.5.1 Increasing prices of fertilizer

The efficient utilization of modern inputs (quality seed, chemical fertilizer, etc) is essential to increase the productivity of crops. Compared to the neighboring Asian countries where chemical fertilizers and pesticides are in excessive use on the farm lands, agricultural chemicals were utilized at a relatively low level by farmer in Myanmar. Fertilizer is an imported commodity in Myanmar/ Distribution of fertilizers has declined substantially from 215,176 MT in 2000-2001 to 10,959 MT in 2010-2011 (CSO 2009). At present; the supply of fertilizer is quite limited compared to demand. The domestic prices of fertilizers are increasing in 2007-2008 to 2011-2012 except in 2010-2011 in both Yangon Market and Mandalay Market.

Table2.1 Average price of fertilizers in Yangon market

(kyats/ 50kg)

Items	Content(%)	2007	2008	2010	2011
Urea					
-from China	46%	22,510	28,939	19,271	21757
-Myanmar(MPE)	46%	22,535	24,219	NA	NA
Potash Fertilizer		26,478	44,005	23,789	27915
T-super fertilizer					
(1)GTSP	46%	21,506	34,543	19,446	24881
(2)GSSP	16%	NA	11,984	9,135	10615
(3)GSSP	12%	9,276	12,434	8,372	10568
Compound fertilizer					
(1)Armo	16:16:8:13	30,176	42,541	35,487	34764
(2)Armo	15:15:15	30,842	45,644	40,063	39073
(3)Armo	16:16:8	24,000	NA	14,238	14275
(4)Golden Lion	10:10:5	NA	16,000	18,137	18134
(5)Golden Lion	16:16:8	19,467	24,000	25,700	25776
(6) Golden Lion	15:7:8	16,000	19,300	21,900	21714
(7)Kimeya	15:15:15	33,167	33,500	40,946	42950

Source:MIS,DAP (montly data) NA= Not Available

Table2.2 Average price of fertilizers in Mandalay market

(kyats/50Kg)

Items	Content(%)	2007	2008	2010	2011
Urea					
-from China	46%	22,266	25,145	18,493	20295
-Myanmar(MPE)	46%	20,603	22,915	20,000	NA
Potash Fertilizer		24,356	43,470	24,959	26000
T-super fertilizer					
(1)GTSP	46%	19,992	33,137	18,752	24562
(2)GSSP	16%	8,369	11,079	8,369	10139
(3)GSSP	12%	NA	10,487	9,033	9544
(4)Arrow (orange)		10,150	11,100	8,376	9496
(5)Golden Elephant		19,683	28,891	NA	NA
Compound fertilizer					
(1)Armo	16:16:8:13	30,248	47,021	36,645	36677
(2)Armo	15:15:15	31,737	49,312	41,478	40478
(3)Golden Lion	10:10:5	16,038	15,959	18,005	16913
(4)Golden Lion	15:7:8	19,375	19,500	20,725	19785

Source:MIS,DAP (montly data) NA= Not Available

2.5.2 Stability in rice price

The rice varieties sown in Myanmar consist of Ngasein, Medone, Emata and Ngakywe. The year rice price was shown in Figure 2.2. Among these varieties, Medone and Ngakywe varieties are known as quality rice variety and it receives the highest price while Ngasein is the cheapest variety in the markets. It is noted that all of the rice prices increased starting from 2005 in all markets. In 2005, the price of Medone variety was Ks 10,000 and it become nearly Ks 30,000 in 2010. The production costs and product prices are not equal between varieties, qualities and also among regions. There are many differences between productions of Medone and Emata rice varieties regarding with capital investment, use of labor, use of fertilizer, water and weed management, insect and pest control, etc. Regarding with domestic rice marketing, Emata has strong and high domestic and international demand at reasonable price while Medone has favorable demand at high price in both domestic and international markets. Although Pawsan is denoted as quality rice and high-priced rice, its production and export are fewer than Emata variety. Myanmar is chiefly exporting the Emata variety including Manawthukha and Zeya.

2.5.3 Trends of rice export

Before World War II, Myanmar stood as a top rice exporting country in the world. In the early 1940s, the country produced about 8 million tons of paddies and stood first among the rice exporting countries in the world. However, because of stagnation of production since the early 1960s, Thailand took the place of Myanmar in the export market, as exports declined from 1.7 million tons in 1962 to 0.3 million tons in 1975. .

Myanmar exported about 168.4 thousand metric tons of rice in 2003-2004, and it was 0.74 % of total production. However, subsequent year up to 2006-2007, rice export of Myanmar drastically declined. Then, in 2007-2008, rice export had raised again to 358.5 thousand metric tons, but the percentage of export on total production was accounted for 1.16% and after that, it was gradually increasing in Figure 2.3. During 2008-2009, Myanmar's rice was mainly exported to Bangladesh (30%), South Africa (28%), Ivory Coast (27%) and others (15%) in Figure 2.4. Share of rice export value increased to 16.9% in 2009.

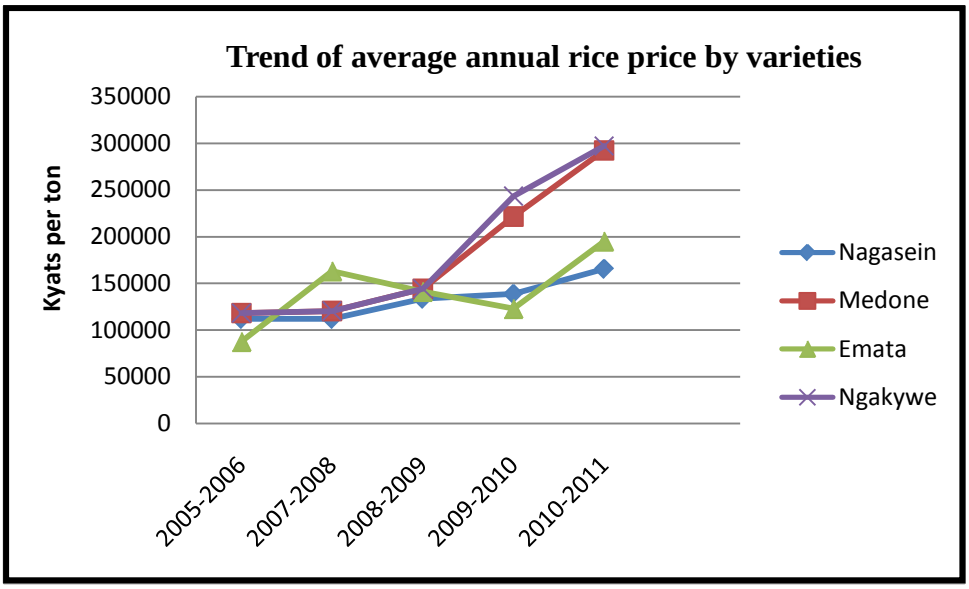

Figure 2.2 Trend of average annual rice price by varieties in Myanmar

Source:MOAI (2011)

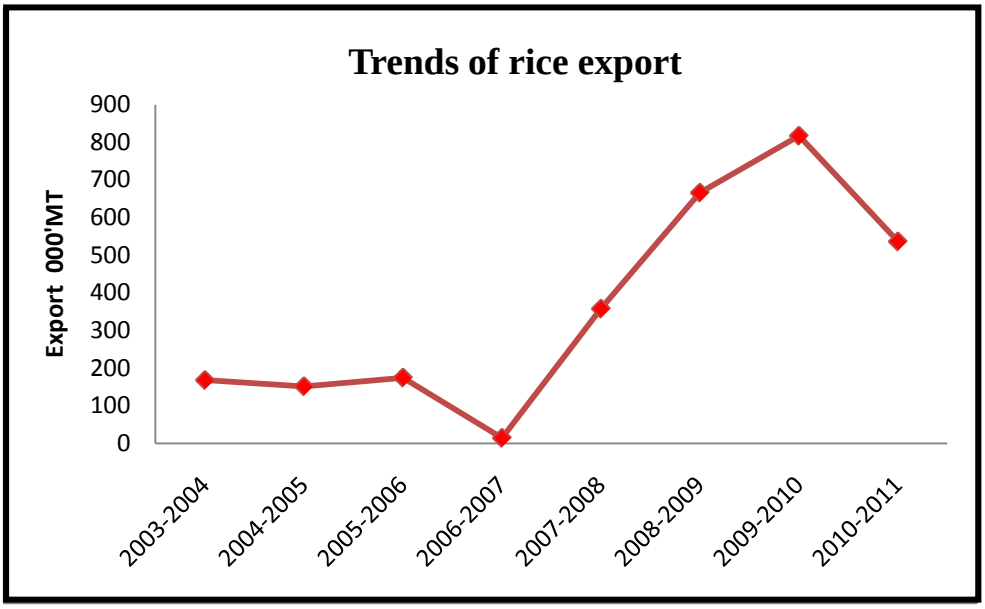

Figure 2.3Trends of rice export

Source: MOAI (2011)

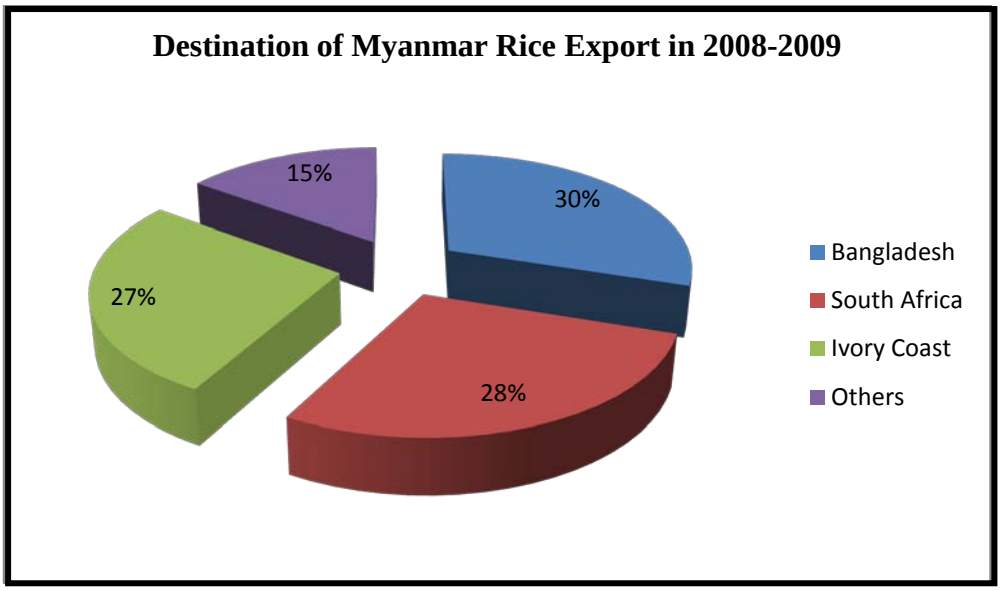

Figure 2.4 Myanmar's major rice export countries

2.5.4 Establishment of Myanmar Rice Federation (MRF)

Myanmar rice Federation (MRF) has been formally formed in January 2010 by integrating the three formerly existing associations- Myanmar Paddy Producers Association, Myanmar Rice Millers Association and Myanmar paddy and rice traders association. MRF is private association dealing for recommending the companies which are eligible to export. The expected role of MRF is to increase the productivity and to reestablish the country as a major rice exporter in the world market while considering the strategic plans and addressing the challenges and risks of the industry. The Members of MRF are farmer, miller, brokers, traders, exporters and other stakeholders in Myanmar rice industry. The major objective of the formation of MRF is to develop the supply chain mechanism in Myanmar and to bring about high and efficient increase in productivity, thereby ensuring the domestic food security and becoming a major rice exporter. For international buyers, MRF is willing and ready to facilitate the business matching and other necessary assistance.

2.5.4.1 Recent development in Myanmar rice industry- formation of rice specialization companies (RSC)

In major production areas, rice specialization companies are formed joint production between major companies and local traders, millers and farmers. The intention of RSC formation was to upgrade the small scale farms into more commercialized ones and finally aims to transform as public companies. More comprehensive and effective contact farming initiatives are being implemented by rice specialization companies. Major activities include: seasonal loans with very minimal and reasonable interest rate, credit- in kind in terms of seeds and chemical inputs, procurement of produce at harvest. It also aims to purchase paddy at just price in the harvesting time. According to Ye (2011), present secretary general of MRF, RSC network operation now only covers 5 to 8% of the sown area in some township and hoping that it will be broadened in future. Ministry of Agriculture provides technical support and extension services, including supply of pure line varieties for commercial production of certified seeds by Rice Specialization Companies.

2.5.4.2 Establishment of leading agriculture development companies (ADC)

- For rice and pulse major growing areas reasonable amount of credit to farmers amounting to Kyat 50,000 to Kyat 100,000 per acre with only 2% interest rate per month.

- Provide not only agricultural credit but also required agricultural inputs such as improved seeds, fertilizer, insecticides etc.

2.5.5 Climate change in Bago (East) region

Climate change is likely to affect the agricultural economy. Agriculture is strongly influenced by weather and climate. While farmers are often flexible in dealing with weather and year-to-year variability, there is nevertheless a high degree of adaptation to the local climate in the form of established infrastructure, local farming practice and individual experience.

The projected increasing temperature and decreasing rainfall in central Myanmar may lead to the expansion of the country's dry zone, in which annual rainfall is less than 1,000 mm. In other areas, increasing heavy rain in the upper watersheds can increase the occurrence of flash floods, resulting in drowning of people and livestock and destroying infrastructure. Late monsoon onset will delay agricultural cycles, such as soil preparation for rice cultivation. This delay will disturb crop growth in the subsequent months, while abnormal weather may damage the crops. In the harvesting period, adverse climatic conditions can damage the ripening crop. Besides, if climate sensitive sectors, such as agriculture, livestock, and fisheries are largely disrupted by climate extremes, food security of rural communities could be impaired.

According to the (http://karennews.org/2011), farmers in Bago region area have lost their farmlands to floods caused by heavy rain that has devastated the area since mid July. It is estimated that over a thousand acres of farmlands affected by the floodwaters are unable to be worked on. The heavy rain caused the Bago River to overflow its banks with water levels reaching a record high – the highest recorded in 47 years. Floodwaters have destroyed farmlands according to a local farmer who owns 30 acres at Kama Nat Kwin near Bago. Every farm in the area is destroyed. This year, we can't afford to work our farms anymore. This year we've been flooded three times. Whenever there is flood, we have to repair our farms and replant crops – it's a big investment each time. The heavy

rains in late July caused the rivers to break their banks detroying many farms in the township of Bago, Nyaunglebin, Shwe Kyin, Tha Nat Pin, Daik Oo and Ka Wa.

According to the (http://www.myanmarnews.net/story), over 20 villages in Kawa Township, Bago Region, were inundated after the Bago River spilled over its banks, threatening rice production in the area. Incessant heavy rain over a five-day period has led to flooding in villages including Neikban, Pai Kyone, Taunggyi, Na Be Pin, Moe Khaing, Kyar Tet, Kamar Pale and others. The flood inundated many paddy fields in the area.In the recent bean growing season, many bean and pulse farmers in Bago Region lost their crops due to bad weather.

2.6. Review of Empirical Marketing Studies on Rice in Developing Countries

Minot and Goletti (2000) conducted the rice market liberalization in Viet Nam. They studied the structure and operation of rice marketing system that described the various marketing channels and examined the margins that the assumption of margins will decline if market becomes more competitive and traders become efficient. The channels showed from surplus farmers to urban consumers and exporters. Furthermore, the channels are numerous and differ from one region to another. The larger margin would be expected based on marketing and transportation costs.

Raham et al. (2006) reported about rice farmers' marketing efficiency in Southwestern Part of Bangladesh. This study focuses on the standard of living of rice farmers, production structure, rice selling, marketing channel, rice prices, profit by intermediaries, marketing efficiency and farmers' attitudes towards marketing. In the surveyed area six types of middlemen and eighteen types of major marketing channels were identified. The study found that 27 (82%) farmers sold exclusively unhusked rice and only 6 (18%) farmers sold partially husked rice. The quantity of unhusked rice sold to wholesalers of unhusked rice, stockists, huskers and village merchants were 32%, 19%, 27% and 14%, respectively. Although, among all eighteen channels husked rice selling to retailers of husked rice was observed to be the best channel, only 3% of unhusked rice was converted to husked rice and sold through this channel. Husked rice sold through wholesalers of husked rice was also found to be a comparatively efficient channel, but only 5% of unhusked rice was converted to husked rice and sold through this channel. The study found that the marketing of rice in the surveyed area was not efficient.

Sajjad et al. (2008) reported about an investigation into marketing channels and margins of rice in district Malakand. This study is aimed at determining the distributive

marketing margins of rice and the shares of different marketing functionaries involved in the marketing margins in Batkhela Tehsil of Malakand district during the year 2004. It was observed that two marketing channels:

1) Producer→ wholesalers (Pharia → retailer→ consumer and

2) Producer →beopari →wholesaler (Pharia) →retailer → consumer, involved in trading of rice in the study area. In channel 1, the producer received 17.9% net margin and 41.04% gross margin. However, in channel 2, it was found that the producer gained less net margin 36.36% and 14.54% gross margin. The main reason behind the reduction into net margin and gross margin was observed to be relatively low involvement of farmer in the marketing activities. Furthermore it was also observed that the lack of capital, poor extension services, high input price and lack of marketing channels were the main marketing problem of rice producers in the study area. Additionally total production, marketing intelligence, education, marketable surplus and marketing price are important variables affecting marketing margin.

Hayami et al. (1998) reported about middlemen and peasants in rice marketing in Philippines. The results of the survey covered all links in the channel of rice marketing from farmers to consumers in Laguna province, in Philippines. They had highly competitive nature of rice marketing where several middlemen compete in the procurement of paddy from farmers and leaving little room for monopoly. The result showed that farmers received about 70% of consumers' shares and the rest 30% comprises the total marketing margin. Of this total margin, less than half is the income of all the agents involved in the marketing chain. The share for each marketing agent is estimated to be about 5% of less of the retail price. If mills or traders store paddy for about 3 months from harvesting to lean months, the marketing margin can be increased about 50% of the retail price.

2.7. Review of Empirical Market Studies on Rice in Myanmar

Theingi Myint (2007) reported about Myanmar rice market: Market integration and price causality. Farmers from surplus regions (Yangon, Pathein and Pyay) sold 75% of the total production and the rest was consumed. Millers had higher potential for getting paddy directly from farmers in surplus regions. About 40% of sample farmers sold their paddy to millers, 32% of farmers sold to primary collectors, 24% of farmers sold to wholesalers and 4% of farmers sold to local retailers. There was no link found between farmer and consumer as direct marketing in surplus regions.

The sample farmers in deficit regions (Mandalay, Taunggyi and Mgway) sold paddy about 39% of the total production. 32% of sample farmers sold paddy to local millers, and 17% of them marketed directly to the consumer. About 39%, 33%, and 28% of sample millers sold rice to consumers, wholesaler and retailers respectively. On average, 40% of wholesalers sold rice to consumers and other 40% of wholesaler's rice flowed to retailers.

The lowest marketing cost of wholesalers was found in Pathein and the highest was found in Taunggyi. Among the marketing cost, the packaging cost was the highest one in surplus regions while transportation cost was the highest in deficit areas The highest net profit over variable cost was received by retailers in Magway while the lowest profit of retailer was found in Yangon.

Exploring the gross marketing margin, Yangon market gross marketing margin was found to be the lowest one as it was equal to 26% of consumer price. The highest marketing margin, which was equal to 49% of the consumer price of rice, was found in Magway market.

Lwin et al. (2006) reported about a case study of rice marketing in selected areas of Myanmar. The main rice marketing channels in the studied sites indicate that almost all products of farmers flow to collectors and millers. Lack of formal cooperative structures, farmers support groups and growing market power of millers at the farm-gate level result that farmers possess low bargaining power in the trading of paddy and rice at the studied areas.

Hnin Yu Lwin (2006) conducted a study of rice market performance in Myanmar. This study indicates the boosting market power of millers not only at the farm-gate level but also among rice market intermediaries. The large-scaled and medium-scaled mills mainly provide milling services for farmer, traders and some collectors. Using boiler engines in large-scaled mills that do not have high cost in fuel which is a prime basis to result the low processing costs. The main rice marketing channels in the studied sites indicate that almost all products of farmers flow to collectors and millers. The percentage of profit per cost price indicator (return on investment) is used in this study in order to compare their achievement in the marketing channel. Because of the business integration of millers by doing milling and trading of rice simultaneously, the percentage of profit per cost price is the highest in the millers' case.

Nay Myo Aung (2012) reported about production and economic efficiency of farmers and Millers in Myanmar rice industry. This research reported addresses the

challenges and prosperous facing by farmers and millers in selected townships. The average inefficiency for both studied areas is about 16% means that 16 percent of total sampled farmers are trapped in economic inefficiency due to lack to access to credit, lower schooling year, poor communication with extension workers, poor socio-economic conditions, and so on. The partial budget analysis reveals that huller owners have positive net profit from mill operations though they need capital to buy paddy for milling in the whole year. Required amount of money in hand to get such a sustained net profit would be about 15 million Kyats.

As a result of the lack of working capital, there is a significant gap between paddy production and utilized milling capacity of hullers in the studied area. Medium-sized mill owners generally have enough capital, easy access to government loan, adequate storage facility for one time purchase, and efficient rice marketing network. The major for those mills are derived from buying paddy about 48 percent of total cost followed by interest on working capital which accounts for around 15 percent of total cost. Thus, it shows that the current post harvest handling practices by farmers are relatively poor.

2.8 Review of Empirical Studies on Income in Developing Countries

Byerlee and Collinson (1980) mentioned that farmers face many constraints which directly limit production and incomes, such as weeds, pests, diseases, inferior varieties and drought. So priorities must be established to make research on few problems which are most important in limiting farmers' production and incomes and for which technological components exist that promise immediate solutions to these problems.

Estudillo and Otsuka (1999) attempted to identify the major determinants of the household income using data collected from the rice-farming households in the Philippines between 1966 to 1994, which encompassed the pre- and post-green revolution periods. They found among other things that there has been as structural shift of household income away from land to labor. The adoption of MVs made modest contribution to such as structural shift by increasing the labor demand and decreasing the return to land relative to other factors of production. The increase in labor demand, however, was largely offset by the widespread adoption of laborsaving technologies.

Similarly Joshi (2003) suggested that the farmers with bigger size of landholding had more income than the smaller holders. The education level of the household head seemed to have better opportunities for skilled non-farm activities as seen from the positive and significant coefficient of education. The result also revealed that when

technologies progress (MVs) was associated with the development of infrastructure facilities like irrigation would contribute to household income. The number of working members in a household also seemed to contribute to the household income by their involvement in agricultural and non-agricultural activities.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Primary Data Collection for Rice Marketing

3.1.1 Description of the study area

Waw Township is located in the Bago (East) Region with a total population of 185095 according to SLRD report 2011. It is situated at 96.41 N latitude and 17.28° E longitude. Waw Township was selected as the study area because rice production is concentrated in Bago (East) Region. The total land area of the township is 376.7 sq.miles (97616 ha) and 72339 ha of the township are cultivated. Waw Township altitude is estimated as 23.8 feet above the sea level, the minimum annual temperature is 86.68°F, the maximum annual temperature reached as high as 103° F and the mean annual rainfall is 126 inches.

The criteria for selecting the study area were on the basic of rice growing acreage. Waw Township is located in Bago District, 21 miles away from Bago Township which is the capital of Bago (East) Region. Bago (East) Region is divided into two districts: Bago district and Taungoo district. By comparing these two districts in Bago (East) Region in 2010-2011, Bago district has occupied 69.13 % in total sown areas of Bago (East) Region and 66.26 % in total rice production of Bago (East) Region (Appendix 1). Although Waw Township represented 13.9 % of total district rice sown areas, all the market intermediaries were operating in Waw rice market.

The survey was conducted from December 2011 to January 2012 to study the marketing activities of all the market participants in Waw Township. There were 58 village tracts in Waw Township and rice has been grown in all tracts. To represent the rice growers, Win Ka Dark, Hmone Ka Tone, and Oak Pho villages were selected for survey, because Win Ka Dark is 20 miles far from Waw Township, Hmone Ka Tone is 15 miles far from Waw Township and Oak Pho is 12 miles far from Waw Township.

There were 430 farmers and 1880.97 ha of rice sown area in Win Ka Dark. Harvested area was 1,880.97 ha and produces 18,420.96 metric tons of rice in 2010-2011. In Hmone Ka Tone village, 615 farmers grew 1,525.91 ha of rice. The harvested area was 1,525.91 ha and produced 15,548.14 metric tons of rice in 2010-2011. In Oak Pho village, 352 farmers grew 1,007.29 ha of rice. The harvested area was 1,007.29 ha and produced 9,411.55 metric tons of rice in 2010-2011.

Within each township, three villages were randomly chosen and total number of respondents was 94 farmers from three villages. And also wholesalers, millers, retailers of rice market were interviewed in Waw Township.

3.1.2 Sampling method and data collection of primary data

Field survey for collecting the primary data was carried out to access the current performance of the rice markets in Waw Township in January 2012.The data were collected for the investigation of marketing cost and profit of various stakeholders and marketing channels. Both primary and secondary data were considered in this study. The number of respondents from the different strata in each market is shown in Table 3.1. Then, personal interviews were implemented with different structured questionnaires for each stratum.

For this study, 94 rice farmers, 4 wholesalers, 7 people who work as both milling and wholesaling and 5 retailers were interviewed with different set of structured questionnaires to obtain clear understanding of the current marketing channel of rice sector.

Farmers related questionnaire was used to collect farmer's socio-economic data such as age, education, family size, farm ownership, farm size, rice sown area, harvested area, yield, crop production, output prices, labor costs, transportation costs, marketing costs, extension service, credit taken, loan for money lender, amount of surplus, rice varieties, production cost of paddy and constraints etc. The market related questionnaire was used to collect farm level detailed measures of prices and quantity, purchased and sold system, marketing costs of various stakeholders', storage facilities, transport facilities, access to market information.

Secondary data were taken from published and official records of Ministry of Agriculture and Irrigation (MOAI), various government organizations, Food and Agriculture Organization (FAO), Central Statistical Organization (CSO) and the other related publications.

By conducting the survey, socio-economic data, production data and marketing data of farmers were collected. Local trader questionnaires were used to collect data regarding marketing costs, transportation, product prices and other social data.

Table 3.1 Number of respondents in the study area

Market participants	Number of sample respondents
Farmer	94
Miller or Wholesaler	7
Only Wholesaler	4
Retailer	5
Total	**110**

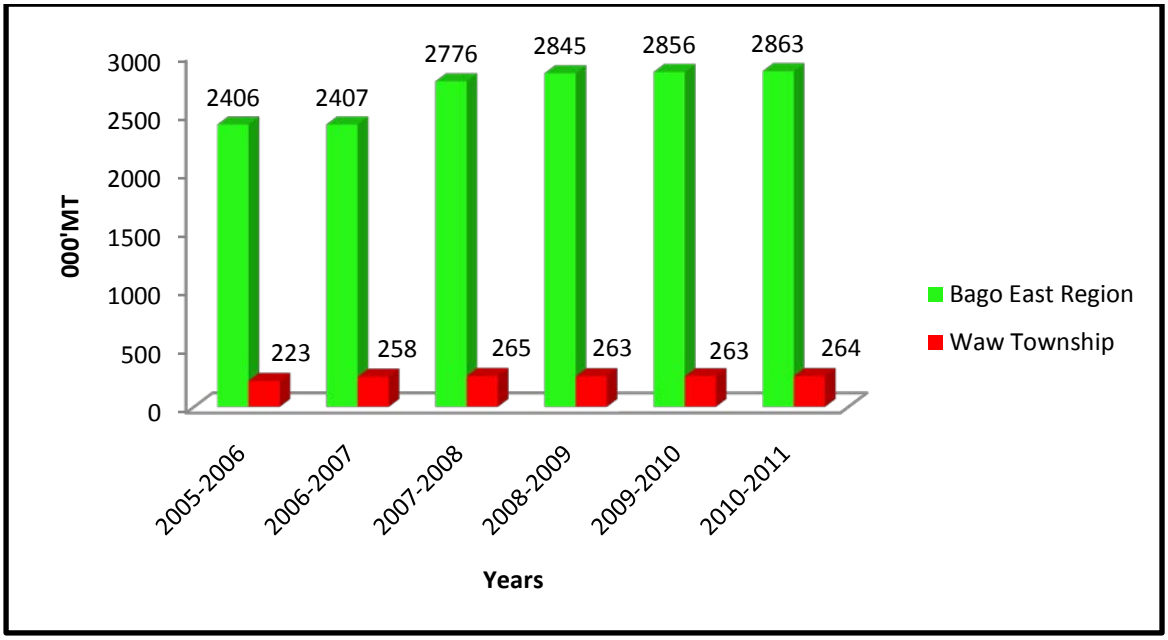

Figure 3.1 Rice production of Bago (East) region and Waw Township

3.2 Data Analysis Methods

The data collected from the farmers, traders and other sources were analyzed using descriptive and econometric models were also applied by the help of statistical software packages such as SPSS Version16.0.The descriptive statistics analysis that were employed using diagrams, charts, percentages, means, variances and standard deviations in examining the rice marketing system as well as farmers' demographic and socio-economic characteristics, role of traders characteristics and profitability of rice at various stakeholders.

3.3 Cost and Return Analysis

Enterprise budgeting is used in the economic analysis. The evaluation and focus on the economic and technical performance of an individual farm enterprise is called an enterprise budget which is used to examine the profitability of specific farm enterprise and to compare the profitability of existing and proposed enterprises. The cost and return analysis was used to determine the profitability of the crop in the study area. Both cash and non-cash items were included in the estimation of material cost and labor cost. Non-cash items for material cost were owned seeds, owned working animals, owned FYM and so on. Cash payment for labor included hired labor, payment for land preparation (custom-hired tractor or working animals).

In order to estimate total gross returns for crop average yield and average price were used. Costs and returns of rice production were computed for 33 and 47 households who grew Shwewarhtun rice variety by using different cultivation methods (broadcasting and transplanting), 16 and 20 households of Manawthukha by different cultivation methods (broadcasting and transplanting), 33 households of Shwetasope by broadcasting cultivation method and 6 and 19 households of other rice varieties by different cultivation methods (broadcasting and transplanting).

To compare the profitability of different farm sizes and different yield levels, the concept of enterprise budget was used. In this calculation, the effective price of input and output were used.

Profitable measures were estimated by using the following formulae:

1. **Return Above Variable Cost= Total Gross Return- Total Variable Cost**

RAVC=TGR-TVC

2. **Return Above Variable Cash Cost= Total Gross Return- Total Cash Cost**

RAVCC=TGR-TVC

3. **Benefit Cost Ratio= Total Gross Return/ Total Cost**

BCR=TGR / TC

4. **Gross margin per unit of land =Total Gross Return-Total Variable Cost**

Other measurements were used in economic analysis are as follows;

Total variable cash cost = Total material costs+ Total hired labor cost

Total variable cost = Total variable cash costs+ Total family labor cost

Where,

TC= TVC+TFC

TC= Total Cost (or) Total Farm Expense

TVC= Total Variable Cost

TFC= Total Fixed Cost

3.3.1Analysis of Profit Shares

Farmer profit share (%) $= \frac{P_f}{P_T} \times 100$

Wholesaler profit share (%) $= \frac{P_w}{P_T} \times 100$

Miller profit share (%) $= \frac{P_m}{P_T} \times 100$

Retailer profit share (%) $= \frac{P_r}{P_T} \times 100$

Where,

p_f = Profit of the farmer

P_w = Profit of the wholesaler

P_m = Profit of miller

P_r = Profit of retailer

P_T = Total profit(farmer+ wholesaler+ miller+ retailer)

3.4 Method of Marketing Cost and Margin Analysis

3.4.1 Analytical framework

Marketing margins reflect both the cost of marketing and the profits of marketing agents. Thus, marketing margins are differences between prices at different events in the marketing channel.

The price paid by the eventual consumer is thus made up of the amount of money paid to the farmer for his product plus all of the costs involved in getting it to the consumer in the form in which he or she purchases it and a reasonable return to those doing the rice marketing and processing. The percentage share of the final price that is taken up by the marketing function is known as the marketing margin.

As the theoretical concept of marketing margin, it may be defined in two ways: (1) as the differences between consumer retail price and what farmers receive and (2) as the price of marketing services provided. The difference between what the consumer pays for food and what the farmer receives i.e. a marketing margin is simply the difference between the primary and derived demand curves for a particular product.

3.4.2Methods of marketing margin analysis

When marketing margins at different levels of the marketing chain are to be compared, it is common to use the consumer price as to common denominator for all margins. The following are some commonly used indicators in the analysis.

***(a) Total Gross Marketing Margin* (TGMM)**

TGMM = (Consumer Price –Farmer's Price)/Consumer Price ×100

Margin of Wholesaler = (Consumer Price –Wholesaler's Price)/Consumer Price×100

Margin of Miller = (Consumer Price –Miller's Price)/Consumer Price×100

Margin of Retailer = (Consumer Price –Retailer's Price)/Consumer Price×100

(b) Farmer's Portion of Producer's Gross Marketing Margin (PGMM)

PGMM = (Consumer Price – Marketing Gross Margin)/Consumer Price×100

(c) Gross Marketing Margin= Average Selling price – Average Buying price

(d) Profit= Gross Marketing margin-Total Marketing cost

The magnitude of margins are considered as improving efficiency in the marketing channel which could go a long way in increasing income of farmers and/or ensuring affordable prices to the urban consumers.

3.5 Analysis of Concentration Ratio

A market concentration ratio is a measure of the percentage share of the market controlled by a specified percentage of firms ranked in order of market share from the largest to the smallest. The concentration ratio is expressed in the terms CR_x, which stands for the percentage of the market sector controlled by the biggest x firms.

$$\mathbf{CR} = \sum_{\boldsymbol{i=1}}^{\boldsymbol{r}} \mathbf{S_i}$$

Where,

$CR =$ Concentration ratio,

$S_i =$ The percentage share of the all firms and

r = The number of the largest firms for which the ratio is to calculate

$$\mathbf{MS_i} = \frac{\mathbf{V_i}}{\sum \mathbf{V_i}}$$

Where

$V_i =$ Amount of product handled by buyer i

$MS_i =$ Market share of buyer i

$\sum V_i =$ Total amount of product handled by the r firms

(Source: Bain, 1968)

3.6 The Determinants Factors on Rice Income of the Selected Farm Households

The following model was used to examine the determinants factors of rice income of the selected farm households.

$$\mathbf{Ln\ RIn = \beta_0 + \beta_1\ LnX_{1i} + \beta_2\ LnX_{2i} + \beta_3\ LnX_{3i} + \beta_4\ LnX_{4i} + - - - - - - - - - + \beta_9\ LnX_{9i} + u_i}$$

Where;

LnRIn	=	natural log of rice income
LnX_{1i}	=	natural log of yield(ton/ha)
LnX_{2i}	=	natural log of farm experience(yr)
LnX_{3i}	=	natural log of family size
LnX_{4i}	=	natural log of farm size(ha)
LnX_{5i}	=	natural log of marketing margin (Ks)
LnX_{6i}	=	natural log of materials cost(Ks /ha)
LnX_{7i}	=	natural log of home consumption(ton/yr)
LnX_{8i}	=	natural log of reserved seed(ton/yr)
u_i	=	Error term

3.7 The Determinants Factors on Rice Yield of the Selected Farm Households

The following model was used to examine the determinants factors of rice income of the selected farm households.

$$\mathbf{Ln\ RY = \beta_0 + \beta_1\ LnX_{1i} + \beta_2\ LnX_{2i} + \beta_3\ LnX_{3i} + \beta_4\ LnX_{4i} + \text{---------} + \beta_8\ LnX_{8i} + u_i}$$

Where;

LnRY	=	natural log of rice yield(ton/ha)
LnX_{1i}	=	natural log of family size (no)
LnX_{2i}	=	natural log of schooling year (yr)
LnX_{3i}	=	natural log of sown areas grown by using broadcasting method (ha)
LnX_{4i}	=	natural log of sown areas grown by using transplanting method (ha)
LnX_{5i}	=	natural log of total labor quantity(no/ha)
LnX_{6i}	=	natural log of urea quantity (Kg/ha)
LnX_{7i}	=	natural log of farm yard manure quantity ((Kg/ha)
X_{8i}	=	Flooding in rice field (Dummy variable, yes=1,no=0)
u_i	=	Error term

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Descriptive Statistics of Background Information of the Sample Farm Households

4.1.1 Classification of the sample farm households by land holding size

The selected sample farmers were categorized into three groups: small farm households (who owned farm size of less than 2.03 ha), medium farm households (who owned farm size of 2.03 ha to 4.05 ha) and large farm households (who owned farm size of above 4.05 ha). In Table 4.1, among the selected farm households, there were 14 small farm households, 36 medium farm households and 44 large farm households. Therefore, the total sample farm households were 94. The average land size of small, medium and large farm households was 1.71 ha, 3.31 ha and 8.56 ha, respectively. Thus, the average land size was significantly different among different farm size groups at 1% level.

Table 4.1 Different farm size groups of the sample farm households

Different farm size groups	Sample farm households (Number and Percentage)	Average land size(ha)
1) Small farm households (0 to 2.02 ha)	14(14.9%)	1.71
2) Medium farm households (2.03 ha to 4.05 ha)	36(38.3%)	3.31
3) Large farm households (> 4.05 ha)	44(46.8%)	8.56
Total farm households	94(100%)	**F=49.44 P=000*** **

Source: Field survey (2011)

Note: *** significant at 1% level.

4.1.2 Comparison of the demographic and social characteristics of the sample farm households

The social characteristics of the farm households were described for three main groups: small farm households, medium farm households and large farm households in Table 4.2.

In the study areas, the average age of small, medium and large farm households were 50, 54 and 54 years, respectively. Thus, the household head's age was not significantly different among different farm size groups. Farmers' working experience also plays an important role in agricultural farming activities. Experience of farming was 19.57, 31.08 and 30.48 years respectively for small, medium and large farm households. The average farm experience was statistically significant at 5% level. The average family members were about 5.07, 5.25 and 5.25 for small, medium and large farm households. The average family size was not significantly different among three farm size groups.

The level of education of the farmers was important for decision making of farming system and marketing practices. In this study, education level of the sample farmers was categorized into four groups: (1) "Monastery education" referred informal schooling although they could read and write; (2) "Primary level" referred formal schooling up to 5 years; (3) "Secondary level" intended formal schooling up to 9 years, and (4) "High school level and above " referred the formal schooling up to 11 years and above (received degree from college or university). The education level of farmers was assumed to determine decision making of their farming system.

In study areas, 42.9% and 57.1% of small farm households attained monastery and primary education level, respectively. About 41.7 % of medium farm households had attained the monastery education level. The remaining 36.1%, 13.9 %, 8.3 % of medium farmers obtained primary, secondary, high school and above education level of education respectively. The majority of large farmers (38.6%) had attained monastery education level. About 27.3%, 18.2% and 15.9% of large farm households received the primary and secondary, high school and above education levels. The Chi-square test showed that the average education level were not significantly different among different farm size groups.

Table 4.2 Demographic and social characteristics of the sample farm households in the study area

No	Items	Units	Small farm households (N = 14)	Medium farm households (N = 36)	Large farm households (N = 44)
1.	Average head's age	Yr	50.00	54.19	54.00
	Standard deviation		1.13	1.28	1.19
	F test			**0.54^{ns}**	
2.	Average farm experience	Yr	19.57	31.08	30.48
	Standard deviation		13.01	13.16	12.97
	F test			**0.02****	
3.	Average family size	No	5.07	5.25	5.25
	Standard deviation		1.59	1.9	1.53
	F test			**0.94^{ns}**	
4.	**Education level of household head**				
	Monastery level	Percent	6(42.9%)	15(41.7%)	17(38.6%)
	Primary level		8(57.1%)	13(36.1%)	12(27.3%)
	Secondary level		0(0%)	5(13.9%)	8(18.2%)
	High school and above		0(0%)	3(8.3%)	7(15.9%)
	Chi- square			**0.23^{ns}**	

Source: Field survey (2011)

Note: ** significant at 5% level, ns = not significant

4.1.3 Comparison of farming assets of sample farm households

The farming assets of the sample farm households were shown in Table 4.3. About 92.9 %, 100 % and 100 % of small, medium and large farm households owned harrow for land preparation. Then, all of medium and large farm households possessed a bullock, and 91.7% and 95.5% of them owned bullock cart for transportation crops from field to home and for travelling from village to village or town. Nearly 56.8 percent of large farm households had a tractor for land preparation in crops production and for transporting purpose. Only 15.9% of the large farm households had threshing machine for threshing paddy. But, all small and medium households did not possess the threshing machine and telephone.

About 64.3%, 91.7 % and 95.5 % of small, medium and large farm households had sprayer for spraying herbicide. Most of medium and large farm households' possessed warehouse for storing paddy. About 61.1%, 81.8% of medium and large farm households possessed warehouse. About 61.4 % and 75 % of large farm households' possessed motorcycle and bicycle. But, 21.4% of small farm households owned motorcycle. Only 25% of large farm households own the telephone.

Table 4.3 Productive and household assets of the sample farm households

(Number and percentage of households)

Own assets	Unit	Small farm households (N = 14)	Medium farm households (N = 36)	Large farm households (N = 44)
Harrow	No	13 (92.9)	36(100)	44(100)
Cattle	No	13 (92.9)	35(97.2)	57(100)
Bullock cart	No	8 (57.1)	33(91.7)	42(95.5)
Tractor	No	0(0)	2(5.6)	25(56.8)
Water pump	No	0(0)	0(0)	5(11.4)
Sprayer	No	9(64.3)	33(91.7)	42(95.5)
Threshing machine	No	0(0)	0(0)	7(15.9)
Warehouse	No	6(42.9)	22(61.1)	36(81.8)
Motorcycle	No	3(21.4)	9(25)	27(61.4)
Bicycle	No	8(57.1)	21(58.3)	33(75)
Phone	No	0(0)	1(2.8)	11(25)
TV	No	1(7.1)	7(19.4)	26(59.1)
Generator	No	0(0)	1(2.8)	3(6.8)

Source: Field survey (2011)

4.1.4 Crop calendar and rice-based cropping patterns of the sample farmers

The crop calendar was presented in Table 4.4. The cropping pattern was monsoon paddy (especially Shwewarhtun, Manawthukha, Shwetasope, Thukhahtun, Baykyarlay and Sinthiri) followed by pulses.

Farmers prepared their land and grew different varieties in the May and harvested in the mid of December. After harvested different rice varieties, most of the farmers grew pulses. Among different varieties, farmers grew Shwewarhtun rice variety in the June and was harvested in the mid of November. Manawthukha rice variety was grown in the mid June and was harvested in the end of October. Shwetasope rice variety was grown in the May and was harvested in the first week of December. Farmers grew Thukhahtun rice variety in the May and harvested in the mid of December. Farmers grew Baykyarlay (Pawsan) and Sinthiri rice variety in the mid of May and harvested in the October. After growing of monsoon paddy, farmers grew pulses (green gram and black gram).

The rice -based cropping pattern mostly grown in Waw Township are presented in Table 4.5. There were thirteen rice-based cropping patterns in the study area. Among these cropping patterns, only Shwewarhtun rice variety followed by pulses was grown by 35.7 % of the small farm households, 33.3 % of the medium farm households and 22.7 % of the large farm households. Six farmers (16.7 %) of medium farm households and thirteen farmers (29.5%) of the large farm households grew Shwewarhtun rice variety plus Shwetasope rice variety followed by pulses. Also Shwewarhtun plus Manawthukha rice variety followed by pulses, there were three farmers (8.3%) of medium farm households and seven farmers (15.9%) of the large farm households.

4.1.5 Average sown area of different rice varieties

The average sown areas of different rice varieties practiced by different cultivation systems for different farm size groups were showed in Table 4.6 and 4.7. Majority of sample farm households grew Shwewarhun rice variety by using broadcasting cultivation method. The average sown area of Shwewarhtun rice variety for small, medium and large farm households was 1.61 ha, 2.87 ha and 5.33 ha, respectively. The average sown area of Manawthukha rice variety was 1.01 ha, 2.14 and 4.39 ha, respectively in small, medium and large farmers.

Table 4.4 Rice-based cropping patterns of the sample farmers in Waw Township

Cropping Pattern	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Shwewarhtun						From June to mid Nov						
Manawthukha						From mid June to Oct						
Shwetasope					From May to first week of Dec							
Thukhahtun					From May to mid Dec							
Barkyarlay(Pawsan)						From mid May to Oct						
Sinthiri						From mid May to Oct						
Monsoon paddy - pluses	Pulses					Monsoon paddy (from May to mid Dec)						Pulses
Monsoon paddy - pluses	Pulses					Monsoon paddy (from mid May to Oct)					Pulses	

Table 4.5 Percentage of sample farmers for each rice-based cropping pattern in the study area

Rice cropping pattern	Small farm households (n=14)		Medium farm households (n=36)		Large farm households (n=44)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
OnlySw-Ps	5	35.7	12	33.3	10	22.7
Sw+Mn+St-Ps	0	0	0	0	4	9.1
OnlyMn-Ps	0	0	5	13.9	2	4.5
Sw+Mn-Ps	1	7.1	3	8.3	7	15.9
Sw+St-Ps	2	14.3	6	16.7	13	29.5
Sw+St+Or-Ps	0	0	1	2.8	1	2.3
Sw+Or-Ps	1	7.1	4	11.1	2	4.5
Mn+St-Ps	1	7.1	0	0	1	2.3
St+Or-Ps	1	7.1	1	2.8	0	0
OnlyOr-Ps	2	14.3	1	2.8	1	2.3
Sw+Mn+Or-Ps	0	0	2	5.6	2	4.5
Mn+Or-Ps	0	0	0	0	1	2.3
OnlySt-Ps	1	7.1	1	2.8	0	0

Note: Sw= Shwewarhtun, Mn= Manawthukha, St= Shwetasope, Or=Other varieties (Sinthiri, Thukhahtun and (Pawsan) Baykyarlay) , Ps=Pulses

Table 4.6 Average sown area of Shwewarhtun, Manawthukha, Shwetasope and Other varieties (Sinthiri, Thukhatun and (Pawsan) Baykyarlay) for different farm size groups

Different farm size groups	Sown area Shwewarhtun (ha)	Sown area of Manawthukha (ha)	Sown area of Shwetasope (ha)	Sown area of Other rice varieties (ha)
Small farm households				
Average	**1.61**	**1.01**	**0.95**	**1.31**
Minimum	0.81	1.01	0.81	1.01
Maximum	2.02	1.01	1.01	1.70
Medium farm households				
Average	**2.87**	**2.14**	**1.49**	**2.30**
Minimum	1.21	0.40	0.81	0.61
Maximum	4.05	3.24	2.43	4.05
Large farm households				
Average	**5.33**	**4.39**	**3.85**	**3.79**
Minimum	1.62	1.21	2.02	1.21
Maximum	19.03	8.91	8.10	7.29

Source: Field survey (2011)

Table 4.7Average sown area of Shwewarhtun, Manawthukha, Shwetasope and Other varieties (Sinthiri, Thukhahtun and (Pawsan) Baykyarlay) by different cultivations (broadcasting and transplanting) for different farm size groups

Different farm size groups	Shwewar-htun (Br)	Shwewarhtun (Tp)	Manawthu-kha (Br)	Manawthu-kha (Tp)	Shwetasope (Br)	Other Varieties (Br)	Other Varieties (Tp)
Small farm households							
Average	**2.02**	**1.69**	**1.01**	**0**	**1.01**	**0.49**	**1.15**
Minimum	2.02	0.81	1.01	0	0.81	0.49	1.01
Maximum	2.02	2.02	1.01	0	1.21	0.49	1.21
Medium farm households							
Average	**2.85**	**1.81**	**1.36**	**1.69**	**1.49**	**1.42**	**1.79**
Minimum	1.21	0.81	0.40	0.40	0.81	1.21	0.61
Maximum	4.05	4.05	2.43	2.83	2.43	1.82	2.83
Large farm households							
Average	**6.69**	**3.10**	**3.28**	**3.01**	**3.85**	**1.62**	**3.38**
Minimum	1.62	1.21	1.62	1.21	2.02	1.21	1.21
Maximum	19.03	6.07	6.07	4.86	8.10	2.02	6.48

Note: Br = Broadcasting and Tp = Transplanting

Source: Field survey (2011)

4.2 Comparison of Resources Use and Average Yield of Paddy Grown by Using Different Cultivation Methods (broadcasting and transplanting)

In order to understand the economic conditions of the sample farmers in relation to their performances of rice cultivations, the summarized basic data such as average yield levels, average amount of seed rate, average amount of chemical fertilizers (urea, compound), average amount of herbicide and farm yard manure (FYM) were shown in Table 4.8,4.9,4.10,4.11.

4.2.1 Comparison of resources use and average yield of Shwewarhtun rice variety grown by using different cultivation methods (broadcasting and transplanting)

Resources use and yield of Shwewarhtun rice variety grown by using different cultivation methods (broadcasting and transplanting) were summarized in Table 4.8.

The average yields of Shwewarhtun rice variety in broadcasting method was 2.1 tons per hectare. The average yield of Shwewarhtun rice variety in transplanting method was 3.35 tons per hectare. The average farm gate price in broadcasting and transplanting methods were 160,606 kyats per ton and 158,966 kyats per ton respectively. The average yield and price in these methods were statistically significant between broadcasting and transplanting methods. The average amount of seed rate used in broadcasting method was 118.67 kilogram per hectare and that used in transplanting method was 102.31 kilogram per hectare. The independent t-test showed that there was significant difference in seed rate used between broadcasting and transplanting methods. Therefore, the average seed cost was 28,255 kyats per kilogram in broadcasting method and 24,464 kyats per kilogram in transplanting method. The independent t-test showed that there was no significance difference between broadcasting and transplanting method. The average rate of urea application in broadcasting and transplanting methods were 31.45 kilogram per hectare and 32.33 kilogram per hectare. The average rate of FYM application in broadcasting and transplanting methods were 582.18 kilogram per hectare and 712.38 kilogram per hectare, respectively. The average amount of herbicide application was 0.03 liter per hectare and 0.06 liter per hectare, respectively in broadcasting and transplanting methods. The average rate of compound fertilizer application was 10.51 kilogram per hectare in transplanting method. The independent t-test showed that there was no significant difference between broadcasting and transplanting method except compound fertilizer.

4.2.2 Comparison of resources use and average yields of Manawthukha rice variety grown by using different cultivation methods (broadcasting and transplanting)

Resources use and yield of Manawthukha rice variety grown by using different cultivation methods (broadcasting and transplanting) were summarized in Table 4.9.

The average yield of Manawthukha rice variety in broadcasting method was 2.27 tons per hectare. The average yield of Manawthukha rice variety in transplanting method was 3.55 tons per hectare. The independent t-test showed that there was significant difference in average yield between broadcasting and transplanting methods. The average farm gate price in broadcasting and transplanting methods was 169,047 kyats per ton and 169,523 kyats per ton, respectively. The independent t-test showed that there was no significant difference in farm gate price between broadcasting and transplanting methods. The average amount of seed rate used in broadcasting method was 111.85 kilogram per hectare and that used in transplanting method was 99.85 kilogram per hectare. The independent t-test showed that there was significant difference in seed used between broadcasting and transplanting methods. Therefore, the average seed cost was 27,941.00 kyats per kilogram in broadcasting method and 26,613.00 kyats per kilogram in transplanting method. The independent t-test showed that there was no significance in seed cost difference between broadcasting and transplanting methods. The average rate of urea application in broadcasting method was 25.5 kilogram per hectare, 39 kilogram per hectare used in transplanting method. The independent t- test showed that there was significance difference in urea fertilizer application between broadcasting and transplanting method. The average rate of FYM application in broadcasting method was 781.80 kilogram per hectare and 682.61 kilogram per hectare used in transplanting method. The average amount of herbicide was 0.14 liter per hectare in broadcasting method. The average rate of compound fertilizer was 9.2 kilogram per hectare in broadcasting method and 1.23 kilogram per hectare in transplanting method. The independent t-test showed that there was no significance difference in FYM, herbicide and compound fertilizer application between broadcasting and transplanting.

Table 4.8 Comparison of resources use and average yield of Shwewarhtun rice variety grown by using different cultivation methods (broadcasting and transplanting) of the sample farmers

Items	Units	Mean		t
		Broadcasting (N = 33)	Transplanting (N = 47)	
Yield	Ton/ha	2.10	3.35	-20.86***
Farm gate price	Ks/ton	160,606.00	158,966.00	1.82*
Seed rate	Kg/ha	118.67	102.31	7.003***
Seed cost	Ks/kg	28,255.00	24,464.00	-0.178^{ns}
Urea	Kg/ha	31.45	32.33	-.553^{ns}
Herbicide	Liter/ha	0.03	0.06	-1.36^{ns}
FYM	Kg/ha	582.18	712.38	-1.365^{ns}
Compound fertilizer	Kg/ha	0.00	10.51	-1.957*

Source: Field survey (2011)

Note: ***,* significant at 1% and 10% level, ns= not significant

Table 4.9 Comparison of resources use and average yields of Manawthukha rice variety grown by using different cultivation methods (broadcasting and transplanting) of the sample farmers

Items	Units	Mean		t
		Broadcasting (N = 16)	Transplanting (N = 20)	
Yield	Ton/ha	2.27	3.55	-22.02***
Farm gate price	Ks/ton	169,047.00	169,523.00	-0.689^{ns}
Seed rate	Kg/ha	111.85	99.85	3.286**
Seed cost	Ks/kg	27,941.00	26,613.00	1.254^{ns}
Urea	Kg/ha	25.50	39.00	-1.83*
Herbicide	Liter/ha	0.14	0.00	1.635^{ns}
FYM	Kg/ha	781.80	682.61	0.507^{ns}
Compound fertilizer	Kg/ha	9.20	1.23	1.137^{ns}

Source: Field survey (2011)

Note: ***, **,* significant at 1%, 5% and 10% level, ns= not significant

4.2.3 Resources use and average yield of Shwetasope rice variety grown by using broadcasting cultivation method

Resources use and yield of Shwetasope rice variety grown by using broadcasting cultivation method were summarized in Table 4.10.

The average yield of Shwetasope rice variety in broadcasting method was 2.17 tons per hectare. The average price of Shwetasope rice variety in broadcasting method was 143,290.00 kyats per ton which is lower than 160,606.00 kyats per ton in Shwewarhtun rice variety and 169047.00 kyats per ton in Manawthukha rice variety.

The average amount of seed rate was 109.24 kilogram per hectare. Therefore, the average seed cost was 21,727 kilogram per hectare. The average amount of urea, FYM and compound fertilizer application were 27.52 kilogram per hectare, 611.19 kilogram per hectare and 6.74 kilogram per hectare. But, the average amount of herbicide application was only 0.08 liter per hectare.

4.2.4 Comparison of resources use and average yield of other rice varieties grown by using different cultivation methods (broadcasting and transplanting)

Resources use and average yield of other rice varieties grown by using different cultivation methods (broadcasting and transplanting were summarized in Table 4.11.

The average yield of other rice varieties in broadcasting method was 2.29 tons per hectare. The average yield of other rice varieties in transplanting method was 3.2 tons per hectare. The independent t-test showed that there was significant difference in average yield between broadcasting and transplanting methods. The average farm gate price in broadcasting and transplanting methods was 153,968 kyats per ton and 174,185 kyats per ton, respectively. The independent t-test showed that there was no significant difference in farm gate price between broadcasting and transplanting methods. The average amount of seed rate used in broadcasting method was 129.68 kilogram per hectare and that used in transplanting method was 107.84 kilogram per hectare. The independent t-test showed that there was no significant difference in seed used between broadcasting and transplanting methods. Therefore, the average seed cost was 25,523 kyats per kilogram in broadcasting method and 31,134 kyats per kilogram in transplanting method. The independent t-test showed that there was significance in seed cost difference between broadcasting and transplanting methods. The average rate of urea application in broadcasting method was 52.51 kilogram per hectare, 43.24 kilogram per hectare used in transplanting method. The average rate of FYM application in broadcasting method was

432.43 kilogram per hectare and 464.94 kilogram per hectare used in transplanting method. The independent t-test showed that there was no significance difference in urea and FYM application between broadcasting and transplanting methods.

4.3 Gross Margin Analysis of Rice Varieties Production Grown by Using Different Cultivation Methods (broadcasting and transplanting)

Gross margin analysis of rice production can be compared between the cultivation methods (broadcasting and transplanting) of rice varieties as shown in Table 4.12, 4.13 4.14 and 4.15.

4.3.1 Gross margin analysis of Shwewarhtun rice variety grown by using different cultivation methods (broadcasting and transplanting)

The gross margin analysis for Shwewarhtun rice production grown by using broadcasting and transplanting method was indicated in Table 4.12. It was found that broadcasting method expensed total variable cost (198,898.90Ks/ha) and transplanting method expensed total variable cost (297,627.81 Ks/ha). The average yield in broadcasting method (2.1 tons/ha) (Appendix 2) was lower than that of transplanting method (3.36 tons/ha (Appendix 3). Therefore, total gross benefit for broadcasting method was 337,272.73 kyats per hectare and transplanting method was 534,128 kyats per hectare. Total material cost in broadcasting method was 13,523.50 kyats per hectare and transplanting method was 16,130.60 kyats per hectare. Total opportunity cost includes family labor cost and seed and farm yard manure cost. Total opportunity cost was 106,918.31 kyats per hectare in broadcasting method and 102,087.42 kyats per hectare in transplanting method. It was expensed for the hired labor cost 63,127.15 kyats per hectare in broadcasting method and 146,819.67 kyats per hectare in transplanting method. In the total interest cost on cash cost, broadcasting method expensed 15,330.13 kyats per hectare and transplanting method was 32,590.12 kyats per hectare. Return above variable cash cost (RAVCC) were 245,291.95 kyats per hectare in broadcasting method and 338,587.61 kyats per hectare in transplanting method. Gross margin per unit of land for broadcasting and transplanting methods were 138,373.83 kyats per hectare and 236,500.19 kyats per hectare respectively. Therefore, the benefit and cost ratio of broadcasting and transplanting methods were 1.69 and 1.8 respectively.

Table 4.10 Resources use and average yield of Shwetasope rice variety grown by using broadcasting method of the sample farmers

Items	Units	Mean
		Broadcasting (N = 33)
Yield	Ton/ha	2.17
Farm gate price	Ks/ton	143,290.00
Seed rate	Kg/ha	109.24
Seed cost	Ks/kg	21,727.00
Urea	Kg/ha	27.52
Herbicide	Liter/ha	0.08
FYM	Kg/ha	611.19
Compound fertilizer	Kg/ha	6.74

Source: Field survey (2011)

Table 4.11 Comparison of resources use and average yield of other rice varieties grown by using cultivation methods (broadcasting and transplanting) of the sample farmers

Items	Units	Mean		t
		Broadcasting (N = 6)	Transplanting (N=19)	
Yield	Ton/ha	2.29	3.20	-5.653***
Farm gate price	Ks/ton	153,968.00	174,185.00	-1.212^{ns}
Seed rate	Kg/ha	129.68	107.84	-0.76^{ns}
Seed cost	Ks/kg	25,523.00	31,134.00	-1.85*
Urea	Kg/ha	52.51	43.24	0.639^{ns}
FYM	Kg/ha	432.43	464.94	-0.269^{ns}

Source: Field survey (2011)

Note: ***, * significant at 1% and 10% level, ns= not significant

Table 4.12Gross margin analysis of Shwewarhtun rice production grown by using different cultivation methods (broadcasting and transplanting) during monsoon season

Items	Average Value(kyats/ha) (Broadcasting method) (n=33)	Average Value(kyats/ha) (Transplanting method) (n=47)
1.Gross Benefit	**337,272.73**	**534,128.00**
2.Variable cost		
(a) Materials cost		
-Urea	13,283.50	13,668.80
-Herbicide	240.00	570.00
-Compound	0.00	1,891.80
Total Materials cost (a)	**13,523.50**	**16,130.60**
(b) Opportunity Cost		
(i)Family Labor Cost		
-Land preparation with machinery	5,987.87	3,760.00
-Land preparation with draft cattle	49,025.76	45,693.60
-Broadcasting	673.62	0.00
-Seed-bed preparation	0.00	975.00
-Fertilizer application	785.91	1,110.00
-Manual weeding	898.17	0.00
-Threshing with machine	2,470.00	2,844.00
-Threshing with draft cattle	149.68	200.00
-Winnowing and drying	396.71	234.00
-Transportation	7,896.52	6,437.02
Total Family Labor Cost (i)	**68,284.24**	**61,253.62**
(ii) Material Cost		
-seed	28,255.87	24,463.30
-FYM	10,378.20	16,370.50
Total Material Cost (ii)	**38,634.07**	**40,833.8**
Total Opportunity Cost (i+ ii) (b)	**106,918.31**	**102,087.42**
(c) Hired Labor Cost		
-Land preparation with machinery	2,395.13	1,280.00
-Seed-bed preparation	0.00	4,035.00
-Broadcasting	3,031.35	0.00
-Fertilizer application	3,143.64	2,835.00
-pulling of seedling	0.00	29,680.90
-Transplanting	0.00	65,731.00
Manual weeding	10,329.09	0.00

Table 4.12 (Continued) Gross margin analysis of Shwewarhtun rice production grown by using different cultivation methods (broadcasting and transplanting) during monsoon season

Items	Average Value(kyat/ha) (Broadcasting method) (n=33)	Average Value(kyat/ha) (Transplanting method) (n=47)
-Harvesting	34,692.26	33,781.20
-Threshing with machinery	4,715.45	6,026.67
-Winnowing and drying	3,285.84	3,149.99
-Transportation	1,534.39	300.00
Total Hired labor cost(c)	**63,127.15**	**146,819.67**
(d) Interest on cash cost		
-Material cost	2,704.70	3,226.12
-Hired labor cost	12,625.43	29,364.00
Interest on cash cost (d)	**15,330.13**	**32,590.12**
Total variable cost (a+ b+ c+ d)	**198,898.90**	**297,627.81**
Total variable cash cost (a+ c+ d)	**91,980.78**	**195,540.39**
Gross margin per unit of land	**138,373.83**	**236,500.19**
Return above variable cash cost(RAVCC)	**245,291.95**	**338,587.61**
Benefit and cost ratio (BCR)	**1.69**	**1.8**

Source: Field survey (2011)

4.3.2 Gross margin analysis of Manawthukha rice variety grown by using different cultivation methods (broadcasting and transplanting)

The gross margin analysis for Manawthukha rice production grown by using broadcasting and transplanting methods was indicated in Table 4.13. It was found that broadcasting method expensed total variable cost (202,808.73Ks/ha) and transplanting method expensed total variable cost (308,749.62 Ks/ha). The average yield in broadcasting method (2.27 tons/ha) (Appendix4) was lower than that of transplanting method (3.55 tons/ha) (Appendix5). Therefore, total gross benefit in broadcasting method was 383,738 kyats per hectare and transplanting method was 601,809.49 kyats per hectare. Total material cost in broadcasting method was 13,506.8 kyats per hectare and transplanting method was 15,982.26 kyats per hectare. Total opportunity cost was 112,895.69 kyats per hectare in broadcasting method and 114,630.59 kyats per hectare in transplanting method. It was expensed for the hired labor cost 61,420.74 kyats per hectare in broadcasting method and 145,783.60 kyats per hectare in transplanting method. In the total interest cost on cash cost, broadcasting method expensed 14,985.5 kyats per hectare and transplanting method was 32,353.17 kyats per hectare. Return above variable cash cost (RAVCC) were 293,824.96 kyats per hectare in broadcasting method and 407,690.46 kyats per hectare in transplanting method. Gross margin per unit of land for broadcasting and transplanting methods were 180,929.27 kyats per hectare and 293, 059.87 kyats per hectare, respectively. Therefore, the benefit and cost ratio of broadcasting and transplanting methods were 1.89 and 1.95 respectively.

Table 4.13 Gross margin analysis of Manawthukha rice production grown by using different cultivation methods (broadcasting and transplanting) during monsoon season

Items	Average Value(kyat/ha) (Broadcasting method) (n=16)	Average Value(kyat/ha) (Transplanting method) (n=20)
(1) Gross Benefit	**383,738.00**	**601,809.49**
2.Variable cost		
(a) Materials cost		
-Urea	10,671.80	15,773.16
-Herbicide	1,225.00	0.00
-Compound	1,610.00	209.10
Total Materials cost (a)	**13506.80**	**15,982.26**
(b) Opportunity Cost		
(i) Family Labor Cost		
-Land preparation with machinery	5,928.00	4940.00
-Land preparation with draft cattle	47,315.90	54,463.50
-Broadcasting	926.25	0.00
-Seed-bed preparation	0.00	926.25
-Manual weeding	926.25	0.00
-Fertilizer application	926.25	555.75
-Threshing with machinery	2,470.00	2,531.75
-Threshing with draft cattle	1,312.19	1,296.75
-Winnowing and drying	120.00	0.00
-Transportation	7,718.75	7,780.50
Total Family Labor Cost (i)	**67,643.59**	**72,494.5**
(ii) Material cost		
-seed	27,950.00	26,613.59
-FYM	17,302.10	15,522.50
Total Material Cost (ii)	**45,252.10**	**42,136.09**
Total Opportunity Cost (i+ ii) (b)	**112,895.69**	**114,630.59**
(c) Hired Labor Cost		
-Land preparation with machinery	3,680.00	0.00
-Seed-bed preparation	0.00	4,080.00
-Broadcasting	3,010.31	0.00
-Fertilizer application	3,241.88	3,135.00
-Pulling of seedling	0.00	29,640.00
-Transplanting	0.00	65,189.05
-Manual weeding	9,030.94	0.00

Table 4.13(Continued) Gross margin analysis of Manawthukha rice production grown by using different cultivation methods (broadcasting and transplanting) during monsoon season

Items	Average Value (kyat/ha) (Broadcasting method)(n=16)	Average Value (kyat/ha) (Transplanting method)(n=16)
-Harvesting	35,043.1	37,275.00
-Threshing with machinery	2,933.13	2,722.50
-Threshing with draft cattle	375.00	0.00
-Winnowing and drying	3,488.88	3,742.05
-Transportation	617.50	0.00
Total Hired labor cost (c)	**61,420.74**	**145,783.6**
(d)Interest on cash cost		
-Material cost	2,701.35	3,196.45
-Hired labor cost	12,284.15	29,156.72
Interest on cash cost (d)	**14,985.50**	**32,353.17**
Total variable cost (a+ b+ c+ d)	**202,808.73**	**308,749.62**
Total variable cash cost (a+ c+ d)	**89,913.04**	**194,119.03**
Gross margin per unit of land	**180,929.27**	**293,059.87**
Return above variable cash cost (RAVCC)	**293,824.96**	**407,690.46**
Benefit and cost ratio (BCR)	**1.89**	**1.95**

Source: Field survey (2011)

4.3.3 Gross margin analysis of Shwetasope rice variety grown by using broadcasting cultivation method

The gross margin analysis of Shwetasope rice production grown by using broadcasting method was indicated in Table 4.14. The average yield of broadcasting method was 2.17 tons per hectare (Appendix6). Total gross benefit of broadcasting method was 310,920.61 Kyats per hectare. The total materials cost expensed 13,504.43 kyats per hectare in broadcasting method. Total opportunity cost was 102,145.47 kyats per hectare in broadcasting method. The hired labor cost expensed 62,109.79 kyats per hectare in broadcasting method. The total variable cost was 192,882.53 kyats per hectare in broadcasting method. In the total interest cost on cash cost, broadcasting method was 15,122.83 kyats per hectare. Return above variable cash cost (RAVCC) and gross margin per unit of land were 220,183.54 kyats per hectare and 118,038.07 kyats per hectare, respectively. Therefore, the benefit and cost ratio of broadcasting method was 1.61.

4.3.4 Gross margin analysis of other rice varieties grown by using different cultivation methods (broadcasting and transplanting)

The gross margin analysis for other rice (Sinthiri, Thukhahtun and Baykyarlay) production grown by using broadcasting and transplanting methods was indicated in Table 4.15. It was found that broadcasting method expensed total variable cost (212,517.37 Ks/ha) and transplanting method expensed total variable cost (308,800.34 Ks/ha). The average yield in broadcasting method (2.29 tons/ha) (Appendix 7) was lower than that of transplanting method (3.2 tons/ha) (Appendix 8). Therefore, total gross benefit for broadcasting method was 352,587.32 kyats per hectare and transplanting method was 557,393.60 kyats per hectare. Total material cost in broadcasting method was 20,921.13 kyats per hectare and transplanting method was 17,872.40 kyats per hectare. Total opportunity cost was 112,396.84 kyats per hectare in broadcasting method and 111,686.83 kyats per hectare in transplanting method. It was expensed for the hired labor cost 62,512.64 kyats per hectare in broadcasting method and 146,388.85 kyats per hectare in transplanting method. In the total interest cost on cash cost, broadcasting method expensed 16,686.75 kyats per hectare and transplanting method was 32,852.25 kyats per hectare. Return above variable cash cost (RAVCC) were 252,466.79 kyats per hectare in broadcasting method and 360,280.09 kyats per hectare in transplanting method. Gross margin per unit of land for broadcasting and transplanting methods were 140,069.95 kyats per hectare and 248,593.26 kyats per hectare, respectively. Therefore, the benefit and cost ratio of broadcasting and transplanting methods were 1.65 and 1.81 respectively.

Table 4.14 Gross margin analysis of Shwetasope rice production grown by using broadcasting method during monsoon season

Items	Average value(kyat/ha)(Broadcasting method)(n=33)
1.Gross Benefit	**310,920.61**
2.Variable cost	
(a) Materials cost	
-Urea	11,597.75
-Compound	1,226.68
-Herbicide	680.00
Total Materials cost (a)	**13,504.43**
(b) Opportunity Cost	
(i) Family Labor Cost	
-Land preparation with machinery	4,720.00
-Land preparation with draft cattle	51,540.89
-Broadcasting	555.00
-Fertilizer application	450.00
-Manual weeding	673.64
-Threshing with machinery	2,199.09
-Threshing with draft cattle	990.00
-Winnowing and drying	207.00
-Transportation	5,537.65
Total Family Labor Cost (i)	**66,873.27**
(ii) Material Costs	
-Seed	21,673.22
-FYM	13,598.98
Total Material Cost (ii)	**35,272.20**
Total Opportunity Cost (i+ ii) (b)	**102,145.47**
(c) Hired Labor Cost	
-Land preparation with machinery	2,400.00
-Broadcasting	3,300.00
-Fertilizer application	3,585.00
-Manual weeding	9,885.00
-Harvesting	35,105.02
-Threshing with machinery	3,718.20
-Winnowing and drying	3,231.57
-Transportation	885.00
Total Hired Labor Cost (c)	**62,109.79**

Table 4.14 (Continued) Gross margin analysis of Shwetasope rice production grown by using broadcasting method during monsoon season

Items	Average value(kyat/ha) (Broadcasting method)(n=33)
(d) Interest on cash cost	
-Materials cost	2,700.88
-Hired labor cost	12,421.95
Interest on cash cost (d)	**15,122.83**
Total variable cost (a+ b+ c+ d)	**192,882.52**
Total variable cash cost (a+ c+ d)	**90,737.05**
Gross margin per unit of land	**118,038.07**
Return above variable cash cost (RACC)	**220,183.54**
Benefit and Cost Ratio (BCR)	**1.61**

Source: Field survey (2011)

Table 4.15 Gross margin analysis of other rice varieties production grown by using different cultivation methods (broadcasting and transplanting) during monsoon season

Items	Average Value(kyat/ha) (Broadcasting method)(n=6)	Average Value(kyat/ha) (Transplanting method)(n=19)
1.Gross Benefit	**352,587.32**	**557,393.60**
2.Variable cost		
(a) Materials cost		
-Urea	20,921.13	17,632.40
-Herbicide	0.00	240.00
Total Materials cost (a)	**20,921.13**	**17,872.40**
(b) Opportunity Cost		
(i) Family Labor Cost		
-Land preparation with machinery	6,560.00	7,280.00
-Land preparation with draft cattle	53,010.00	50,569.99
-Broadcasting	630.00	0.00
-Seedbed preparation	0.00	585.00
-Fertilizer application	630.00	390.00
-Threshing with machinery	1,050.00	2,238.33
-Threshing with draft cattle	0.00	750.00
-Winnowing and drying	0.00	135.00
-Transportation	8,233.35	8,579.99
Total Family Labor Cost (i)	**70,113.35**	**70,528.31**
(ii) Materials Cost		
-seed	31,905.17	31,134.42
-FYM	10,378.32	10,024.10
Total Material Cost (ii)	**42,283.49**	**41,158.52**
Total Opportunity Cost (i+ ii) (b)	**112,396.84**	**111,686.83**
(c) Hired Labor Cost		
-Land preparation with machinery	0.00	960.00
-Seed-bed preparation	0.00	4,485.00
-Broadcasting	3,075.00	0.00
-Fertilizer application	3,075.00	3,525.00
-Pulling of seedling	0.00	28,600.00
-Transplanting	0.00	65,091.00
-Manual weeding	9,270.00	0.00

Table 4.15(Continued) Gross margin analysis of other rice varieties production grown by using different cultivation methods (broadcasting and transplanting) during monsoon season

Items	Average Value (kyat/ha) (Broadcasting method) (n= 6)	Average Value (kyat/ha) (Transplanting method) (n=19)
-Harvesting	37,729.11	33,605.00
-Threshing with machinery	5,535.00	3,965.00
-Threshing with draft cattle	0.00	2,400.00
-Winnowing and drying	3,828.53	3,757.85
Total Hired Labor Cost (c)	**62,512.64**	**146,388.85**
(d) Interest on cash cost		
-Materials cost	4,184.23	3,574.48
-Hired labor cost	12,502.53	29,277.77
Interest on cash cost (d)	**16,686.76**	**32,852.25**
Total variable cost (a+ b+ c+ d)	**212,517.37**	**308,800.34**
Total variable cash cost (a+ c+ d)	**100,120.53**	**197,113.51**
Gross margin per unit of land	**140,069.95**	**248,593.26**
Return above variable cash cost (RACC)	**252,466.79**	**360,280.09**
Benefit and cost ratio (BCR)	**1.65**	**1.81**

Source: Field survey (2011)

4.4 Characteristics of Market Participants

4.4.1 Marketed surplus of the sampled farmers, their selling method and mode of transportation

The marketed surplus is estimated by the deduction of the household consumption and reserved seed from the total production of the sample farmers. The marketed surplus of rice varieties was shown in Table 4.16.

The average production of Shwewarhtun rice variety per household was 10.77 tons per year and the average marketed surplus per household was about 8.02 tons per year. The range of marketed surplus was quite large from 0.75 tons per year to 35.66 tons per year. The average home consumption per household was 2.34 tons per year in one household and the rest were reserved seed and marketed surplus. The average production of Manawthukha rice variety was 10.23 tons per year and the marketed surplus was 7.71 tons per year in one household. The range of marketed surplus was quite large from 0.31 tons per year to 25.35 tons per year. They stored home consumption (2.42tons/yr) and reserved seed (0.48tons/yr). For Shwetasope rice variety, the average production was 6.24 tons per year and the marketed surplus was 5.06 tons per year in one household. The average home consumption of Shwetasope rice variety was lower than that of different rice varieties. The average production of other rice varieties was 8.26 tons per year in one household. The average home consumption of this variety was higher than that of different varieties in one household. Therefore, the average marketed surplus in one household was lower than that of different varieties.

There were various categories of market participants in rice marketing channel in the study area in Table 4.17. First, paddy flowed initially from farmers through different participants to ultimate consumer. The majority of farmers (86.02%) sold their paddy to millers or wholesalers. Rice wholesalers are also rice millers in the study area. Only 13.98% of the sample farmers sold to primary collector. According to the responses of farmers, farmers were likely to sell their paddy to miller as well as wholesaler rather than selling to the primary collector.

The modes of transport used by the sample farmers were shown as percentage in Table 4.18. The most convenient system for transportation was by tractor. About 64.2% of sample farmers transported their paddy by tractor. But, some farmers (27.16%) used cart in transportation because it was the cheapest system. Almost all of the sample farmers owned bullock cart and used in farming practices. Only 8.64% of the sample farmers used motorboat in transportation of paddy.

Table 4.16 Paddy production, consumption and marketed surplus of different households per sample household (Tons)

Items	Shwe War Htun (N=67)	Manaw Thu Kha (N=26)	Shwe Ta Sope (N=33)	Other Varieties (N=19)
Total production				
Mean and std.deviation	10.77(7.06)	10.23(6.2)	6.26(4.10)	8.26(6.22)
Range (Minimum-Maximum)	1.6-39.22	1.46-27.95	1.67-16.69	2.19-23.23
Household consumption				
Mean and std.deviation	2.34(1.08)	2.42(1.39)	1.47(0.65)	2.95(1.74)
Range(Minimum-Maximum)	0.52-5.4	0.83-6.26	0.21-2.29	0.31-6.26
Marketed Surplus				
Mean and std.deviation	8.02(6.59)	7.71(5.53)	5.06(3.82)	4.94(4.67)
Range (Minimum-Maximum)	0.75-35.46	0.31-25.35	0.06-14.81	0-15.85
Reserved seed				
Mean and std. deviation	0.59(0.52)	0.48(0.28)	0.42(0.3)	0.68(1.22)
Range (Minimum-Maximum)	0.08-3.13	0.10-1.15	0.10-1.57	0.1-5.53

Note: Data in parenthesis represent standard deviation.
Source: Field survey (2011)

Table 4.17 Selling method of the sample farmers

Main buyers of Paddy	Waw Township
Primary Collector	13(13.98%)
Miller/Wholesaler	81(86.02%)
Total	94(100%)

Source: Field survey (2011)

Table 4.18 Mode of transportation of sample farmers

Mode of transport	Waw Township
By Cart	22(27.16)%
By Motorboat	7(8.64%)
By tractor	52(64.2%)
Total	100%

Source: Field survey (2011)

4.4.2 General characteristics of millers and milling capacity of rice-mills

Table 4.19 showed the characteristics of the sample millers. The average age of the all millers was 58 years old when they had years of experience from 5 to 40 years. In the sample millers, 22.22% of millers were found with the bachelor degrees and 33.34% of millers was found with the high school level in the study area. Therefore, millers were educated person. As their alternative business, most of the millers were wholesalers.

Rice mills were categorized into two groups according to their milling capacity in Table 4.20. The capacity of large mills was ranged from 20 tons to 70 tons of paddy per day. Therefore, 77.78% of sample mills were large mill. The capacity of small mill (huller) was less than 8 ton per day. Only 22.22% of sample mills was small mill (huller). In April 2003, large and medium mills started operating in private rice market. Farmers or primary collector needed to transport the paddy to distant mills from farm site or village.

4.4.3 General characteristics and marketing activities of wholesalers

Wholesalers have been leading the spatial rice marketing sector. They tend to be more specialized in rice trade than other participants and they operate on a much larger scale of business. In this township, millers conducted the wholesalers. Most of the wholesalers in Waw Township were millers. Therefore, average general characteristics and marketing activities of wholesalers were the average of wholesalers of which most were millers also.

In general, mean age of wholesalers was 54 years ranging from 40 years to 76 years. The education levels of wholesalers were high as most of them were high school levels and some were graduate level. High ratio of wholesalers operated the business as millers as shown in Table 4.21.

Purchasing types of the wholesalers were different as shown in Table 4.22. About fifty percent of wholesalers employed cash down system. Most of them were millers; therefore they milled the paddy by their own rice mills.

Selling types of wholesalers were found as cash down system and credit system and most of the wholesalers usually used both types of selling. Only 9.09% of the wholesalers sold their rice with only cash down system. Destination of wholesaling from study area were Mawlamyine, Hpa-an, Kyaikhto, Theinzayat and Myingyan markets.

Table 4.19 Age, experience and education level of millers

Characters	Waw Township
Age (year)	
Mean	58.00
Standard Deviation	15.76
Range	40-78
Experience (year)	
Mean	19.78
Standard Deviation	9.58
Range	5-40
Education level (%)	
Monastery	1(11.11%)
Primary level	1(11.11%)
Secondary level	2(22.22%)
High School level	3(33.34%)
Graduate level	2(22.22%)
Other business	
Farmer	0
Wholesalers	3(37.5%)
Wholesalers and other traders	5(62.5%)

Table 4.20 Milling capacity of sample rice-mills

Types and capacity	Waw Township
Large mill	
Capacity (20-70 ton/day)	7(77.78%)
Small mill	
Capacity(< 8 ton/day)	2(22.22%)

Table 4.21 Age, experience and education level of wholesalers

Characters	Waw Township
Age (year)	
Mean	54,00
Standard Deviation	12.59
Range	40-76
Experience (year)	
Mean	17.00
Standard Deviation	9.33
Range	5-40
Education level (%)	
Primary level	1(9.09%)
Secondary level	3(27.27%)
High School level	6(54.55%)
Graduate level	1(9.09%)
Other business	
Farmer	1(9.09%)
Millers	3(27.27%)
Millers and merchants	5(45.45%)
Merchants	2(18.18%)

Table 4.22 Marketing activities of wholesalers, 2011

Activities	Waw Township
Type of purchasing	
Use cash down system	6(54.54%)
Received half of the credit and cash down	4(36.37%)
Use cash down system with commission agents	1(9.09%)
Type of selling	
Only cash down system	1(9.09%)
Received half of the cash down and credit	10(90.91%)
Mode of transport	
By truck	9(81.82%)
By truck and by Boat	2(18.18%)
Destination of selling	
Retailer in Waw market	(51.13%)
Spatial markets	Mawlamyine, Hpa-an, Myingyan, Kyaikhto,Theinzayat(48.86%)

4.4.4 General characteristics and marketing activities of retailers

Retailer is the market participant who is close to consumer in general. Rice retailers can be found in every formal and informal market, every village, every quarter of the towns and cities. Retailers were very familiar with consumer who eat rice at least twice a day and spend their income regularly for rice.

Table 4.23 showed the general characteristics of sample retailers. Ages of retailers were found within the range of 30 years to 50 years and 60% of the respondents had more than 5 years experiences in rice marketing. Education level of retailers was found mostly in high school level.

Marketing activities of sample retailers was presented in Table 4.24. Like other participants, retailer purchased rice by using half of the cash down and credit system and they resold to consumers with same system. With regard to transportation, retailers generally used by truck because the distances between buying and selling were far.

Table 4.23 Age, experience and education level of retailers

Characters	Waw Township
Age (year)	
Mean	39.40
Standard Deviation	8.30
Range	30-50
Experience (year)	
Mean	7.80
Standard Deviation	5.22
Range	2-15
Education level (%)	
Primary level	0(0%)
Secondary level	2(40%)
High School level	3(60%)
Graduate level	0(0%)
Other business	
Farmers	20%
Wholesalers	0%

Table 4.24 Marketing activities of retailers, 2011

Activities	Waw Township
Type of purchasing	
Received half of the cash down and credit	5(100%)
Type of selling	
Received half of the cash down and credit	5(100%)
Mode of transport	
By truck	5(100%)

4.5 Rice Marketing Channels, Costs and Margins

4.5.1 Rice marketing channels in Waw Township

The analysis of channel was intended to demonstrate the paddy flow from farmers to ultimate rice consumers in study area. The rice market channel of Shwewarhtun rice variety was shown in Figure 4.1 The average marketed surplus of sample farm households was 74.46% of their production. Therefore, 25.54% of their production was used for household consumption and seed purpose. According to the farmer survey, millers had higher potential for getting paddy directly from farmers in study area. The sample farmers sold 83.73% of their marketed surplus to millers, 16.27 % of their marketed surplus sold to primary collectors. There was no marketing link between farmer and consumer in study area. Miller and wholesalers traded 22.49% of their rice to Mawlamyine, 18.6% to Hpa-an, 19.8% to other spatial markets, 29.62% to local retailers and 9.49% to local consumer. Paddy from primary collectors flowed to millers in most surplus regions.

The marketing channel of Manawthukha rice variety was shown in Figure 4.2. The average marketed surplus of sample farm households was 75.37% of their production and the rest were home consumption and reserved seed. The sample farmers sold 92.76% of their marketed surplus to millers and wholesalers and 7.24% of their paddy sold to primary collector. Most of millers and wholesalers traded 25.37% of their rice to Mawlamyine, 20.19% to Hpa-an, 11.85% to other spatial markets, 32.22% to local retailers and 10.36% to local consumers. The marketing channel of Shwetasope rice variety was shown in Figure 4.3. The average marketed surplus of this variety was 70.31% of their production and the rest were home consumption and reserved seed. Most of the farmers sold 94.14% of their marketed surplus to millers and wholesalers and 5.81% to primary collectors. Most of the millers and wholesalers traded 28.29% of their rice to other spatial markets, 59.98% to local retailers and 11.73% to local consumers.

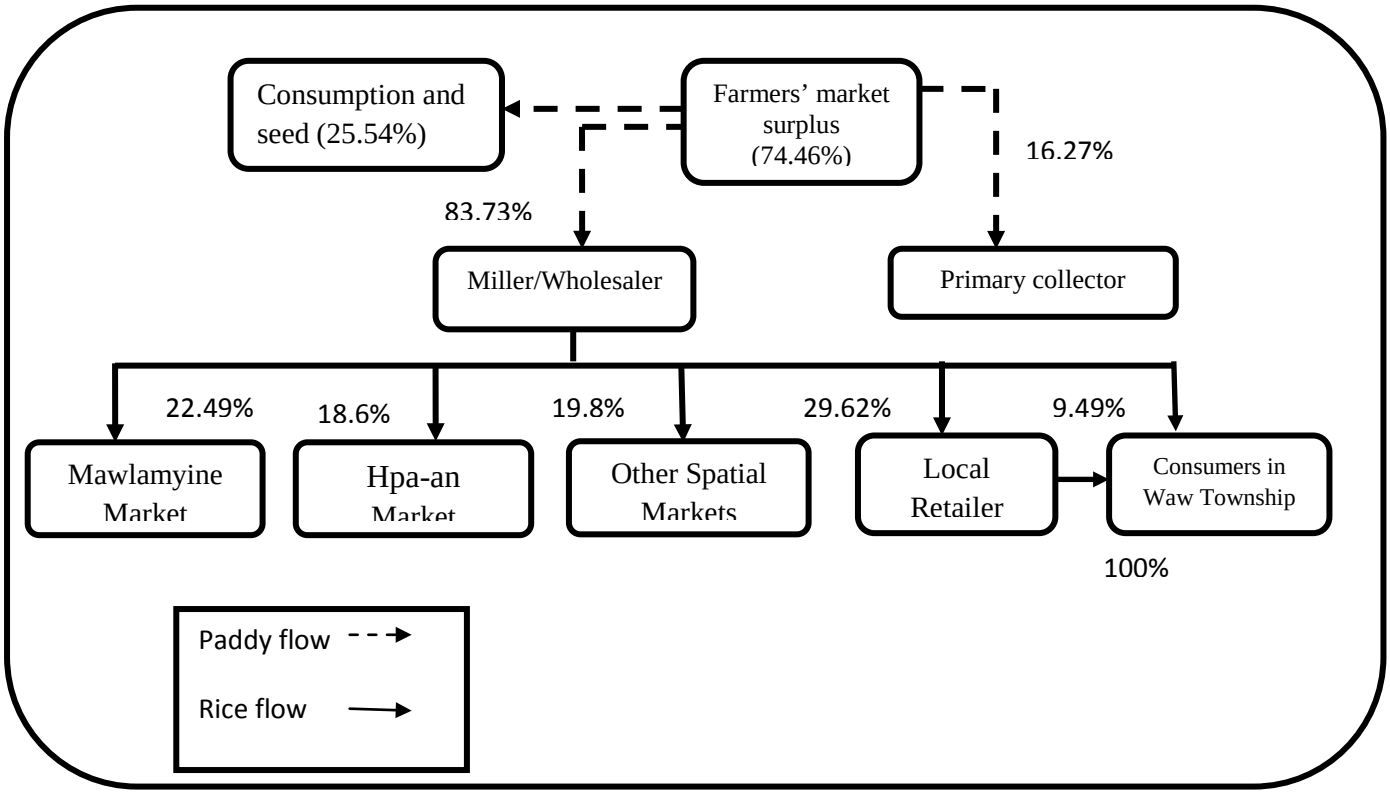

Figure 4.1 Marketing channel of Shwewarhtun rice variety in Waw market

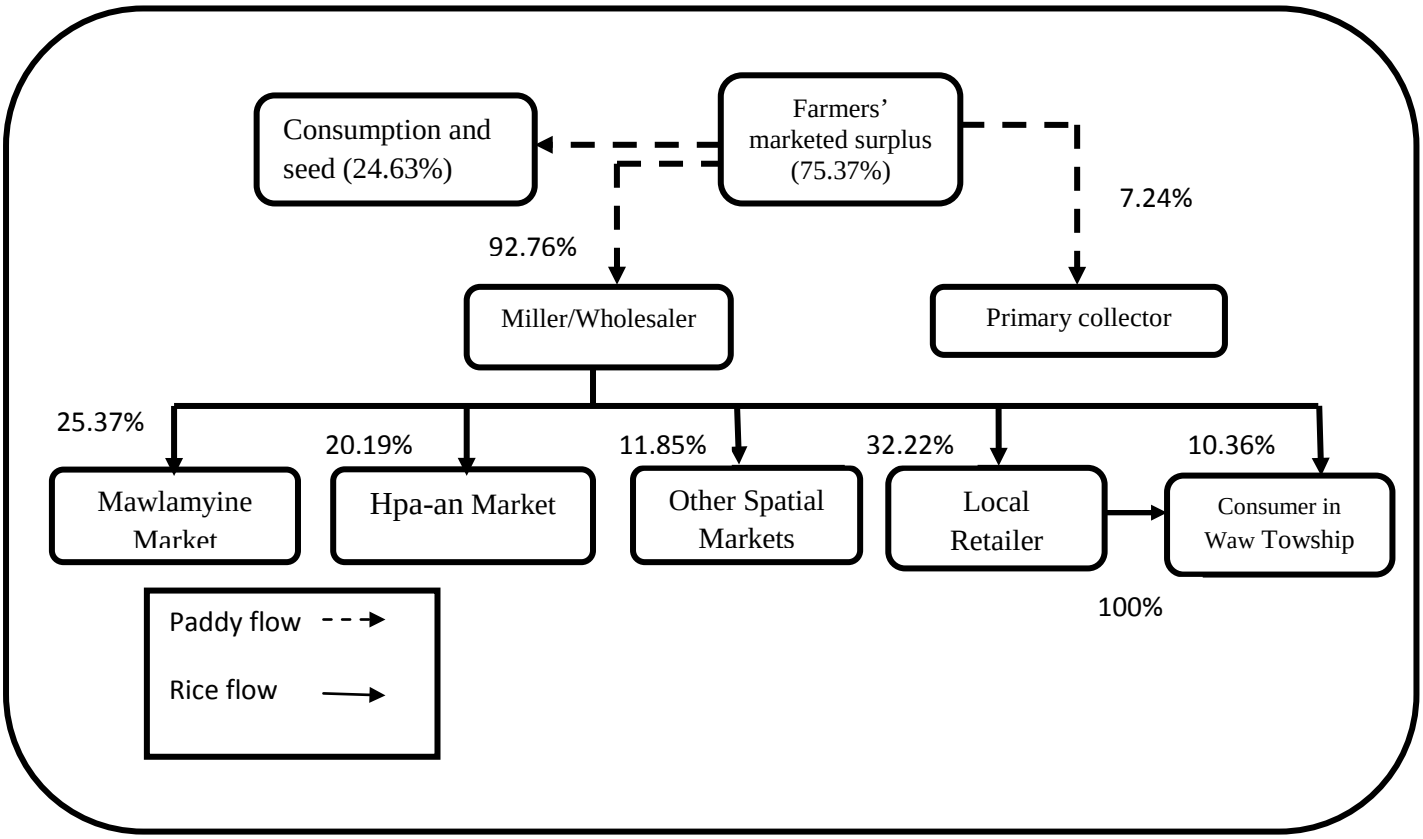

Figure 4.2 Marketing channel of Manawthukha rice variety in Waw market

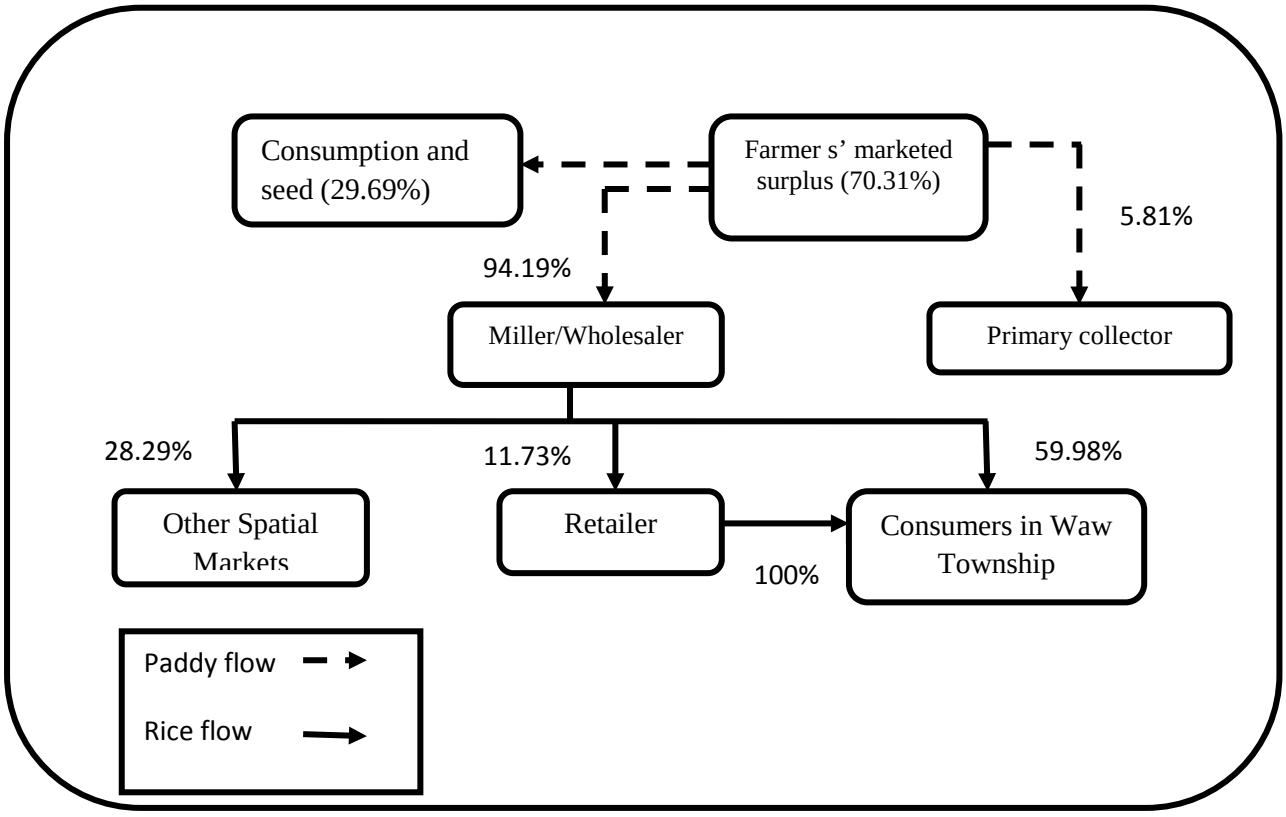

Figure 4.3 Marketing channel of Shwetasope rice variety in Waw market

4. 5.2 Marketing margin, cost and profit of wholesalers for Shwewarhtun, Manawthukha and Shwetasope rice varieties

In Table 4.25, 4.26 and 4.27 showed marketing margin, cost and profit of the wholesalers for Shwewarhtun, Manawthukha and Shwetasope rice varieties. The local transportation cost in Waw Township for these rice varieties were the lowest (zero). However, wholesalers from Waw Township needed to pay cost for transportation to other regions. The cost of transportation from Waw market to Myingyan market was the highest followed by Mawlamyine market.

In Shwewarhtun rice variety, the wholesalers who traded the rice to Myingyan market obtained maximum marketing margin and marketing cost (80,403.67 Ks/ton and 57,213.16Ks/ton) and the wholesalers who sold in local market obtained minimum marketing margin and marketing cost (33,406.67 Ks/ton and 17,634.62Ks/ton). The marketing margin and cost of wholesalers who traded to Mawlamyine and Hpa-an markets were nearly the same. Also the marketing margin and cost of wholesalers who traded to Kyaikhto and Theinzayat markets was nearly the same. The profit of wholesalers who traded to Mawlamyine, Hpa-an and Myingyan markets was the highest (23,127.51 Ks/ton) and the profit of wholesalers sold in local market was the lowest (15,772.05Ks/ton)

In Manawthukha rice variety, the wholesalers who traded the rice to Myingyan market obtained maximum marketing margin and marketing cost (80,620.67 Ks/ton and 57,213.16Ks/ton) and the wholesalers who sold in local market obtained minimum marketing margin and marketing cost (33,596.67 Ks/ton and 17,634.62Ks/ton). The marketing margin and cost of wholesalers who traded to Mawlamyine and Hpa-an markets was nearly the same. Also the marketing margin and cost of wholesalers who traded to Kyaikhto and Theinzayat markets was nearly the same. The profit of wholesalers who traded to Hpa-an and Myingyan markets was the highest (23,407.51 Ks/ton) and the profit of wholesalers who sold to Theinzayat and Kyaikhto markets was the lowest (15,570.18 Ks/ton)

In Shwetasope rice variety, the wholesalers who traded the rice to Kyaikhto market obtained maximum marketing margin and marketing cost (36,250.67 Ks/ton and 25,863.82 Ks/ton) and the wholesalers who sold in local market obtained minimum marketing margin and marketing cost (28,413.30 Ks/ton and 17,634.62 Ks/ton). But, the profit of wholesalers who in local market was the highest (10,778.68 Ks/ton).

Table 4.25 Marketing cost, margin and profit of wholesalers for Shwewarhtun rice variety

Items	Unit	Markets					
		Waw	**Mawlamyine**	**Hpa-an**	**Kyaikhto**	**Theinzayat**	**Myingyan**
(1)Buying price of paddy 73 bsk	Ks	240,900.00	240,900.00	240,900.00	240,900.00	240,900.00	240,900.00
(2)Selling price of milled rice*	Ks/ ton	274,306.67	297,818.67	293,900.00	283,515.50	281,556.20	321330.67
(3)Marketing Margin (2-1)	**Ks/ ton**	**33,406.67**	**56,918.67**	**53,000.00**	**42,615.50**	**40,656.20**	**80430.67**
(4)Total Marketing cost	**Ks/ ton**	**17,634.62**	**33,791.16**	**29,782.49**	**25,863.82**	**23,904.49**	**57213.16**
-Cost of packaging	Ks/ ton	2,250.89	2,250.89	2,250.89	2,250.89	2,250.89	2250.89
-Cost of transportation	Ks/ ton	0	15,764.67	11,756.00	7,837.33	5,878.00	39186.67
-Cost of labor	Ks/ ton	783.73	1,175.60	1,175.60	1,175.60	1,175.60	1175.60
-Milling cost	Ks/ ton	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14600.00
(5)Profit(3-4)	**Ks/ ton**	**15,772.05**	**23,127.51**	**23,217.51**	**16,751.68**	**16,751.71**	**23217.51**

Note:* Rice 1ton=73 basket of paddy

Table 4.26 Marketing cost, margin and profit of wholesalers for Manawthukha rice variety

Items	Unit	Markets					
		Waw	Mawlamyine	Hpa-an	Kyaikhto	Theinzayat	Myingyan
(1) Buying price of paddy 73 bsk	Ks	270,100.00	270,100.00	270,100.00	270,100.00	270,100.00	270,100.00
(2) Selling price of milled rice*	Ks/ ton	303,696.67	327,208.67	323,290.00	311,534.00	309,574.67	350,720.67
(3) Marketing Margin (2-1)	**Ks/ ton**	**33,596.67**	**57,108.67**	**53,190.00**	**41,434.00**	**39,474.67**	**80,620.67**
(4) Total Marketing cost	**Ks/ ton**	**17,634.62**	**33,791.16**	**29,782.49**	**25,863.82**	**23,904.49**	**57,213.16**
-Cost of packaging	Ks/ ton	2,250.89	2,250.89	2,250.89	2,250.89	2,250.89	2,250.89
-Cost of transportation	Ks/ ton	0.00	15,764.67	11,756.00	7,837.33	5,878.00	39,186.67
-Cost of labor	Ks/ ton	783.73	1,175.60	1,175.60	1,175.60	1,175.60	1,175.60
-Milling cost	Ks/ ton	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00
(5) Profit (3-4)	**Ks/ ton**	**15,962.05**	**23,317.51**	**23,407.51**	**15,570.18**	**15,570.18**	**23,407.51**

Note:* Rice 1ton=73 basket of paddy

Table 4.27 Marketing cost, margin and profit of wholesalers for Shwetasope rice variety

Items	Unit	Markets		
		Waw	**Kyaikhto**	**Theinzayat**
(1)Average buying price of rice 73 bsk	Ks	226,300.00	226,300.00	226,300.00
(2) Average selling price of rice	Ks/ ton	254,713.30	262,550.67	260,591.30
(3) Marketing margin (2-1)	**Ks/ ton**	**28,413.30**	**36,250.67**	**34,291.30**
(4) Total Marketing cost	**Ks/ ton**	**17,634.62**	**25,863.82**	**23,904.49**
- Cost of packaging	Ks/ ton	2,250.89	2,250.89	2,250.89
-Cost of transportation	Ks/ ton	0	7,837.33	5,878.00
-Cost of labor	Ks/ ton	783.73	1,175.60	1,175.60
-Milling cost	Ks/ ton	14,600.00	14,600.00	14,600.00
(5)Profit (3-4)	**Ks/ ton**	**10,778.68**	**10,386.85**	**10,386.81**

Note:* Rice 1ton=73 basket of paddy

4.5.3 Marketing margin, cost and profit of retailers

Average marketing margin, cost and profit of retailers for three varieties were presented in Table 4.28. Cost of marketing functions were transportation cost, tax and labor cost. The result shows that the transportation, tax and labor costs per ton of rice were 1,959.33kyats, 99.13kyats, and 1,371.5kyats respectively.

The highest marketing costs were transportation cost followed by labor and tax. The marketing margin of retailers who sold Manawthukha rice variety was 25,471.33 kyats per ton. The margin of Manawthukha rice variety was higher than that of other rice varieties. Therefore, the profit of Manawthukha rice variety was the highest among these varieties.

4.5.4 Composition of consumer price in Waw market

In Table 4.29 showed the percentage composition of consumer price as well as the percentage share of the consumer price at different stages of the marketing channel. The farmers' profit over the unit variable cost of paddy production was interesting to compare the profit of other market participants along the channel. There were several types of marketing margins, based on the market level being considered. First consideration of the unit profit of the farmers was the difference between unit cost and farm gate price of paddy. Then, wholesaler margin was the deduction of the paddy price paid by wholesaler from obtained value of rice by wholesaler. This margin included the profit of wholesaler and costs of the marketing functions made by wholesaler. At this stage of marketing functions, the value of processing from paddy to rice has to be added. The retail margin was the difference between the retailer paid price and the consumer paid price.

The percent share of farm gate price was 81.97%, 82.05% and 82.49% of the consumer price of rice in Shwewarhtun, Manawthukha and Shwetasope varieties respectively. If profits of market participants along the channel were compared, the highest profit percentage was obtained by farmer in all rice varieties. The profit share of farmers was 35.5%, 42% and 33.89% of consumer price for Shwewarhtun, Manawthukha and Shwetasope rice varieties. The lowest profit share was received by wholesalers in all rice varieties.

Table 4.28 Marketing margin, cost and profit of retailers in Waw Township

Items	Unit	Shwewartun	Manawthukha	Shwetasope
(1)Average buying price of rice	Ks/ ton	274,305.69	303,696.67	254,713.00
(2) Average selling price of rice	Ks/ ton	293,900.00	329,168.00	274,307.00
(3) Marketing margin (2-1)	**Ks/ ton**	**19,594.31**	**25,471.33**	**19,593.00**
(4) Total Marketing cost	**Ks/ ton**	**3,429.96**	**3,429.96**	**3,430.00**
-Cost of transportation	Ks/ ton	1,959.33	1,959.33	1,959.30
-Cost of tax	Ks/ ton	99.13	99.13	99.13
-Cost of labor	Ks/ ton	1,371.5	1,371.50	1,371.50
(5) Profit(3-4)	**Ks/ ton**	**16,164.35**	**22,041.37**	**16,163.00**

Table 4.29 Percent composition of consumer price

Composition of consumer price	Waw Market		
	Shwewarhtun (%)	Manawthukha (%)	Shwetasope (%)
Share of paddy's unit cost	**46.42**	**40.10**	**48.60**
Profit of farmer	(35.55)	(42.00)	(33.89)
Share of farm gate price	**81.97**	**82.05**	**82.49**
Marketing margin of wholesalers	(11.37)	(10.21)	(10.36)
Marketing cost of wholesalers	(6.00)	(5.36)	(6.43)
Marketing profit of wholesalers	(5.37)	(4.85)	(3.93)
Share of price to retailer	**93.34**	**92.26**	**92.85**
Marketing margin of retailer	(6.66)	(7.74)	(7.15)
Marketing cost of retailer	(1.17)	(1.04)	(1.25)
Marketing profit of retailer	(5.50)	(6.69)	(5.89)
Consumer paid price	**100**	**100.00**	**100.00**

4.6 Market Concentration Analysis

4.6.1 Degree of buyers and sellers concentration

The degree of buyer and seller concentration refers to the number of rice traders in the rice market. This concentration ratio can be interpreted as an indicator for the degree of competitiveness among rice traders. Concentration ratio was calculated by taking annual volume of rice purchased in 2011 in Table 4.30.

This study indicates that the rice market is dominated by few wholesalers. The CR_3 ratio was about 54.86%. That means 54.86% of the market volume was occupied by top three wholesalers. The calculation of the concentration indices for both wholesalers and millers together. In this township, millers were conducted as wholesalers.

4.7 Constraints of Rice Production and Marketing

4.7.1 General constraints for production and marketing of sample farmers

The general constraints production and marketing of sampled farmers were shown in Table 4.31.

(1) Insufficient fertilizer application and higher fertilizer prices

High fertilizer price was the main important problem. All of farm households faced this problem. So, they cannot apply adequate fertilizer due to higher price of fertilizer. This has an effect on the yield of paddy.

(2) Low technology

Problem of low technology was responded positively by 92.9% of small farm households, 86.1% of medium farm households and 72.7% of large farmers perceived it. This has an effect on the quality and yield of rice for marketing.

(3) Insufficient capital investment

About 71.4 % of small farm households, 41.7 % of medium farm households and 40.9 % of large farm households have positively responded these problems. Farmers have an urgent need for money immediately after harvest. Even if the price of paddy is always at lowest during that period, farmers needed cash during this period in order to pay their rent and debts.

(4) Problem of flooding in rice fields

Problem of flooding in rice fields was faced by 57.1 % of small farm households, 66.7 % of medium farm households and 56.8 % of large farm households. Farmers have lost their farmlands to floods caused by heavy rain that has devastated the area since mid July. This has an effect on yield and quality of rice for rice production

(5) Low farm-gate price of paddy

Low farm-gate price problem was faced by all of farm households. This problem was respond positively by small farm households 92.9 %, medium farm households 91.7 % and large farm households 77.3 %. This problem has on effect of profit and income of farmers.

(6) Lack of contact with extension workers

This is another problem as 64.3 % of small farm households, 58.3 % of medium farm households, 70.5 % of large farm households perceived positively it. So, small farm households were the highest lacking of contact with extension workers than other farmers group. Therefore, weakness of extension services can be observed in study area.

(7) Seed impurity

Unavailability of purified seed was responded positively by 2 (14.3 %) of small farm households among 14 small farm households, 8(22.2%) of medium farm households among 36 medium farm households, 9 (20.5%) of large farmers among 44 large farm households. So, it needs to get purified seeds in study area.

(8) Lack of market information

Poor contact or communication was also one of the problems of the sampled farmers. Information on market price, demand and supply is also mentioned as a problem by sample households. About 1(7.1%) of small farm households among 14 medium farm households and 5(5.3%) of large farm households among 44 large farm households faced this problem.

(9) High transportation cost

About 2 (14.3%) of small farm households and 9(25%) of medium farm households and 13 (29.5%) responded positively about high transportation cost. This has an effect on the profit of farmers.

4.7.2 Major constraints of millers

As indicated in Table 4.32, the major problems of millers were high tax rate, low quality of paddy, lack of modernized machinery and lack of improved huller. These are responded by (66.67%) followed by higher tax rates, low quality of paddy and lack of modernized machinery and lack of improved huller. Usually millers as well as wholesalers pay tax based on the number of milling machine they have. Storage facilities are also a problem but almost millers have improved rice storage facilities. But, it was responded by 55.56% of the sampled millers. Lack of information was also a problem but only 44.4% of sample millers faced this problem.

Table 4.30 Market concentration of rice wholesalers

Name of wholesalers	Capacity of mill-size	Amount of selling				
		Ton/yr	% Share	Rank	3 Firms	
Respondents 1	Medium-sized mill	1762.50	21.04	1st	*	
Respondents 2	Medium-sized mill	1429.06	17.05	2nd	*	**54.86%**
Respondents 3	Medium-sized mill	1405.24	16.77	3rd	*	
Respondents 4	Medium-sized mill	826.81	9.87	4th		
Respondents 5	Medium-sized mill	741.75	8.85	5th		
Respondents 6	-	680.50	8.12	6th		
Respondents 7	-	612.45	7.31	7th		
Respondents 8	Medium-sized mill	442.33	5.28	8th		
Respondents 9	-	183.74	2.19	9th		
Respondents 10	-	159.92	1.90	10th		
Respondents 11	Huller	133.21	1.59	11th		
Total sum		**8377.51**	**100.00**			
Concentration ratio (CR_3 in %)			**54.86**			

Table 4.31 General constraints of rice production and marketing in the study area

No	Descriptions	Small farm households (N = 14)	Medium farm households (N = 36)	Large farm households (N = 44)
1	High fertilizer price	14(100)	33(91.7)	31(70.5)
2	Low technology	13(92.9)	31(86.1)	32(72.7)
3	Insufficient of capital investment	10(71.4)	15(41.7)	18(40.9)
4	Problem of flooding in rice field	8(57.1)	24(66.7)	25(56.8)
5	Low farm gate price for paddy	13(92.9)	33(91.7)	34(77.3)
6	Lack of contact with extension worker	9(64.3)	21(58.3)	31(70.5)
7	Insufficient of fertilizer application	12(85.7)	25(69.4)	34(77.3)
8	Seed impurity	2(14.3)	8(22.2)	9(20.5)
9	Lack of market information	1(7.1)	0(0)	5(5.3)
10	High transportation cost	2 (14.3)	9(25)	13(29.5)

Note: Figures in the parentheses represent percentage.

Source: Field survey (2011)

Table 4.32 Major constraints of millers in Waw market

(%)

Problems	Percent of millers(N=9)
High income tax rate	66.67
Low quality of milled rice	66.67
Lack of modernized machinery	66.67
Lack of improved huller	66.67
Lack of improved rice storage facilities	55.56
Lack of information	44.4

4.8 Determinants of Rice Yield of the Sampled Farm Households

Rice yield of the sampled farm households was estimated by using log form of sown area grown by using broadcasting method (LOGSABR), sown area grown by using transplanting method (LOGSATP), total labor quantity (LOGTLQ), urea quantity (LOGUREQ), farm yard manure quantity(LOGFYMQ). Other socio-economic variables included in the regression equation were log form of schooling year (LOGSYr), family size (LOGFZ), and land size (LOGLS).

In the production function, family size, farm size, schooling year, sown area grown by using broadcasting method, sown area grown by using transplanting method, total labor quantity, urea quantity and farm yard manure quantity were the independent variables, and rice yield was dependent variable. Dummy variable of flooding in rice field (flooding = 1, no flooding = 0) was also included. In Table 4.33, the mean values of the independent variables and dependent variables of rice production were described.

According to the rice yield regression estimates, the significant influencing factors of rice yield were sown areas grown by using broadcasting method, total labor quantity, urea quantity, farm yard manure quantity and flooding in rice field. Rice yield was positive relationship with total labor quantity, urea quantity, farm yard manure quantity at1%, 5% and 10% level. Other things being equal, if one percent increased in total labor quantity, urea quantity, farm yard manure quantity, rice yield will be increased by 0.240%, 0.016% and 0.025% respectively.

Sown areas grown by using broadcasting method and flooding in rice field negatively and significantly influenced on rice yield at 5% and 1% level respectively. So, if one percent increased in sown area grown by using broadcasting method, rice yield will be reduced by 0.11%. The F value shows that the selected model was significant at 1% level. The adjusted R squared points out that the model is significant and it can explain on the variation in rice yield by 69.7 percent in Table 4.34.

Table 4.33 Mean values of dependent and independent variables of rice yield function

Variables	Mean	Std. Deviation
Rice yield (ton/ha)	2.75	0.47
Schooling year (yr)	5.88	2.14
Family size (no)	5.27	1.65
Farm size (ha)	5.6	4.01
Sown area of paddy by using broadcasting method(ha)	3.21	3.58
Sown area of paddy by using transplanting method(ha)	2.28	2.09
Total labor quantity (no)	100.18	23.68
Total urea quantity (Kg/ha)	31.65	22.92
Total farm yard manure quantity (Ks /ha)	659.27	444.34
Flooding in rice field	0.61	0.49
No of respondents	**92**	

Table 4.34 Determinants of rice yield of the sample farm households

Variables	Unstandardized Coefficient		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-1.093	.198		-5.521	.000***
Log of sown area of paddy by broadcasting method	-.111	.031	-.537	-3.623	.001**
Log of sown area of paddy by transplanting method	.037	.029	.141	1.277	.205^{ns}
Log of schooling year	-.025	.034	-.046	-.735	.465^{ns}
Log of total labor quantity	.240	.040	.414	6.086	.000***
Log of urea quantity	.016	.009	.118	1.859	.067*
Log of FYM quantity	.025	.010	.154	2.555	.012*
Log of family size	.028	.028	.060	1.015	.313^{ns}
Log of farm size	.010	.044	.037	.228	.820^{ns}
Flooding in rice field	-.050	.021	-.141	-2.363	.021*
R square			**72.7%**		
Adjusted R square			**69.7%**		
$F_{(9,82)}$			**24.23*** **		

4.9 Determinants of Rice Income of the Selected Rice Farmers

Rice income of the sampled farm households was estimated by using log form of paddy yield (LOGPY), materials cost (LOGMC), home consumption (LOGHC), reserved seed (LOGRS) and marketing margin (LOGMM). Other socio-economic variables included in the regression were log form of farm experience (LOGFE), family size (LOGFS), farm size (LOGFS).

In this study, farm experience, family size, farm size, marketing margin, materials cost, home consumption and reserved seed of rice production were the independent variables, and rice income was dependent variable. In Table 4.35, the mean values of the independent variables and dependent variable rice production were described.

Rice income of the sample farm households was positively and significantly influenced by yield and farm size at 1 percent level and influenced by farm experience at 10% level. According to the regression estimates, if one percent increases in yield and farm size, the rice income will increase. Marketing margin, home consumption and reserved seed negatively and significantly influenced on rice income at 5 percent level and 1 percent level. If one per cent increased in marketing margin, home consumption, reserved seed, rice income of farm households will be reduced by 0.195 %, 0.461 % and 0.170% respectively. Family size and materials cost positively related with rice income but not significant. The result showed that the farmers who had larger farm size can be received higher rice income. Rice yield was also major influencing factor to get more rice income. The result showed that the farmer who had stored more home consumption and reserved seeds can be received lower rice income because of lower marketable surplus.

The marketing margin is the difference between the price paid by the ultimate consumer and the price received by the producer. Thus, retail price falls and farm price increases resulting in a smaller marketing margin. So, marketing margin and rice income negatively related. The F value showed that the selected model was significant at 1% level. The adjusted R^2 pointed out that the model was significant and it can explain the variations in rice income by 92 percent in Table 4.36.

Table 4.35 Mean values of dependent and independent variables of rice income function

Variables	Mean	Std. Deviation
Rice income (Ks /yr)	1794275.00	1476613.00
Yield (ton)	2.75	0.47
Farm experience (yr)	29.59	13.19
Family size (no)	5.27	1.65
Farm size (ha)	5.63	4.00
Marketing margin	106318.20	20129.31
Materials cost (Ks/ha)	60018.32	15138.82
Home consumption (ton/yr)	3.00	1.45
Reserved seed (ton/yr)	0.79	0.63
No of respondents	**92**	

Table 4.36 Determinants of rice income of the sample farm households

Variables	Unstandardized Coefficient		Standardized Coefficients	t-value	Sig.
	B	Std.Error	B		
(Constant)	13.633	1.556		8.762	.000***
Log of yield	1.440	.167	.290	8.612	.000***
Log of farm experience	.081	.047	.053	1.718	.090**
Log of family size	.006	.070	.002	.083	.934^{ns}
Log of farm size	1.594	.089	1.178	17.922	.000***
Log of marketing margin	-.195	.105	-.058	-1.858	.067**
Log of reserved seed	-.170	.081	-.136	-2.099	.039**
Log of material cost	.017	.082	.007	.210	.834^{ns}
Log of home consumption	-.461	.054	-.302	-8.577	.000***
R square		**93%**			
Adjusted R square		**92%**			
$F_{(8,83)}$		**136.83*** **			

Dependent variable: rice income.

***, **, * significant at 1%, 5% and 10% level, respectively, ns = not significant

CHAPTER 5
SUMMARY, CONCLUSION, RECOMMENDATIONS AND POLICY IMPLICATIONS

5.1 Summary and Conclusion of Findings

5.1.1 Descriptive analysis of the sample farmers

According to the results of the descriptive analysis, about 14.9 %, 38.3% and 46.8 % of the sample farm households were small, medium and large farm households. Small farm households were younger, lesser experience and lower family size than large farm households. The education level of the majority of medium and large farmers was monastery level. The education level of the majority of small farmers was primary education level. The demographic characteristics (age, family size and education level) were not statistically significant among the different farm size groups. The large farm households owned more number of productive and luxury assets. Majority of sample farm households grew Shwewarhtun rice variety. The average sown area of Shwewarhtun rice variety for small, medium and large farm households was 1.61 ha, 2.87 ha and 5.33 ha, respectively.

5.1.2 Gross margin analysis of case study

According to the gross margin analysis, yield and gross return of different rice varieties sown by broadcasting method was lower than that of varieties sown by transplanting method. Among rice varieties, the highest yield was received from Manawthukha rice variety grown by transplanting method and the lowest yield was received from Shwetasope rice variety grown by broadcasting method. The gross margin per unit land of Shwewarhtun rice variety in broadcasting and transplanting methods was 138,373 kyats per hectare and 236,500 kyats per hectare respectively. The gross margin per of unit land in transplanting method was significantly higher than that of broadcasting method. The benefit cost ratio (BCR) of Shwewarhtun in broadcasting and transplanting methods were 1.69 and 1.79 respectively. They are statistically significant between broadcasting and transplanting.

The gross margin per unit of land of Manawthukha rice variety was 180,932 kyats per hectare and 293,061 kyats per hectare in broadcasting and transplanting methods respectively. The gross margin per unit of land in transplanting method was significantly

higher than that of broadcasting method. The benefit and cost ratio (BCR) of Manawthukha rice variety was 1.89 and 1.95 respectively in broadcasting and transplanting method. The benefit and cost ratio was not statistically significant between broadcasting and transplanting methods.

The gross margin per unit of land of Shwetasope rice variety was 118,040 kyats per hectare and benefit and cost ratio (BCR) was 1.61. The gross margin per unit of land of other rice varieties in broadcasting and transplanting methods were 140,070 kyats per hectare and 248,596 kyats per hectare respectively. The BCR of other rice varieties was 1.66 and 1.81 in broadcasting and transplanting methods. The gross margin per unit of land and benefit and cost ratio (BCR) of other rice varieties (Sinthiri, Thukhahtun and Baykyarlay) grown by using transplanting method were significantly higher than that of broadcasting method.

The gross margin analysis clearly showed that Manawthukha rice variety was more beneficial for farmers than that of all different varieties studied in this research because the gross benefit, gross margin per unit land and benefit and cost ratio of Manawthukha rice variety were the highest.

5.1.3 General characteristics of market participants

Among the market participants, the mean age of millers and wholesalers were above 50 years old. Retailers had relatively less experiences than millers and wholesalers. Mostly, millers or wholesaler had more than 10 years of experience in rice marketing. Millers or wholesalers had more experience than that of only wholesalers. Retailers had less experience of marketing. Most of market participants obtained high school level education and some of millers or wholesalers were graduates. Around 50% of millers were wholesalers as well as traders. About 50% of wholesalers in the market were millers as well as merchants. Wholesalers used different types of purchasing such as cash down system, received half of the credit and cash down, cash down with commission agents. Type of purchasing of retailers was by received half of the credit and cash down system. Some participants used tractor for transportation of paddy and rice while water way was used by some participants.

5.1.4 Rice marketing channels

Among the market participants, millers had the highest potential for getting paddy directly from farmers. Therefore, they played an important role in the rice marketing. There was no direct link between farmers and consumer in the study area.

For Shwewarhtun rice variety, the sample farmers sold 83.73% of their marketed surplus to millers. Wholesalers traded 22.49%, 18.6% and 19.8% of their milled rice to Mawlamyine, Hpa-an and other markets (Kyaikhto, Theinzayat and Myingyan markets) respectively. About 29.62% of their rice sold to the local retailer. Only 9.49% of their rice sold directly to consumers in the local market.

For Manawthukha rice variety, the sample farmers sold 92.76 % of their marketed surplus to millers. Wholesalers traded 25.37%, 20.19% and 11.85% of their rice to Mawlamyine, Hpa-an and other spatial markets, respectively. Moreover, 32.22% and 10.36% of their rice sold to local retailers and consumer in local market.

For Shwetasope, the sample farmers sold 94.14 % of their marketed surplus to millers. Wholesalers traded 28.29 %, 59.98 % and 11.73 % of their milled rice to other spatial markets, local retailers and consumers in Waw Township. Therefore, most of wholesalers traded rice locally.

The three firms' concentration ratio (CR_3) indicates the three largest wholesalers handled 54.86 % of the total volume of purchased paddy.

5.1.5 Marketing margin, cost and profit of wholesalers and retailers

In Shwewarhtun and Manawthukha rice varieties, marketing margin and cost of wholesalers who sold rice locally was narrow but that for wholesalers who sold rice to Myingyan market was large because of higher transportation cost. The highest profit for Shwewarhtun rice variety was obtained by wholesalers selling to Mawlamyine, Hpa-an and Myingyan markets. Wholesalers who sold in Waw towship get the lowest profit from milling rice. The highest profit of Manawthukha rice variety was obtained by wholesalers selling to Hpa-an and Myingyan market followed by those selling to Mawlamyine market. For Shwetasope rice variety, the profit of wholesalers who sold in local was higher than that of wholesalers who sold to other markets. The highest profit of retailers received from Manawthukha rice variety.

Looking at the composition of consumer price and margin in different market channels, the percentage share of farm gate price was the lower than that of retailer price. Among the market participants along the channel, the lowest profit percentage of

consumer paid price was obtained by wholesalers and the highest profit percentage of consumer paid price was received by farmers followed by retailers for Shwewarhtun, Manawthukha and Shwetasope rice varieties.

5.1.6 Constraints of rice production and marketing of the sample farm households

Constraints of rice production and marketing with different farm households can be classified into ten groups. The most serious constraints of small farm households were high fertilizer price, low technology and insufficient of investment for paddy production. Medium and large farm households faced the main problems of higher fertilizer price, low technology for production. So, the major problems of total farm households were high fertilizer price, low technology for production. But, the major problem of total farm households for marketing was low farm gate price for paddy. The major constraints of millers are high income tax rate, low quality of milled rice due to lack of modernized machinery and huller.

5.1.7 Regression analysis of case study

According to the rice yield regression estimates, the significant influencing factors of rice yield were total labor quantity, urea quantity, farm yard manure quantity and flooding in rice field. Rice yield was positively relationship with total labor quantity, urea quantity, farm yard manure quantity. Other things being equal, if one percent increased in total labor quantity, urea quantity, farm yard manure quantity, rice yield was increased by 0.240%, 0.016% and 0.025% respectively. Sown area of paddy by using broadcasting method and flooding in rice field negatively and significantly related with rice yield at 5% and 1% level respectively. So, if one percent increased in sown area of paddy by using broadcasting method and rice yield will be reduced by 0.11%.

The F value shows that the selected model was significant at 1% level. The adjusted R squared points out that the model is significant and it can explain on the variation in rice yield by 69.7 percent.

According to the income regression analysis, yield, farm experience and farm size positively and significantly related to the rice income of the selected farmers at 1% and 10% level, respectively. According to the regression estimates, if one percent increased in yield and farm size, the rice income will be increased. Marketing margin, home consumption and reserve seed negatively and significantly related to the rice income at 1%, 5% and 5% level, respectively. If 1% increased in marketing margin, home

consumption and reserved seed, rice income of farm households will be reduced by 0.06%, 0.3% and 0.12% respectively. The result showed that the farmer who had stored more home consumption and reserved seed can be received lower rice income because of lower marketable surplus. Farm size was also major influencing factor to get more rice income. The F value showed that the selected model was significant 1% level.

5.2 Recommendations and Policy Implications

5.2.1 Provision of technology and high yield varieties for farmers

According to the research findings, most of the farmers obtained the highest profit from Manawthukha rice variety. But, more than half of the sampled farmers were growing with low yielding local varieties. Therefore, the farmers in the study area should be provided Manawthukha rice variety or high yield varieties. According to the Cobb Douglas regression model, they should practice transplanting method and farmers should apply more urea and manure in order to increase yield from rice. To overcome the major constraint of low technology, the Dept. of Agriculture should provide effective extension service to the farmers for adopting appropriate technology (HYV, sub-merged variety, GAP and transplanting method) to increase yield.

In addition, marketing margin, home consumption and reserved seed negatively and significantly related to the rice income. If the regional government provides the seeds for flooded area with reasonable price, the farmers will not store large amount of paddy for reserve seed, and thus their income will be increased. When technologies are transferred to the farmers, priorities should be focused on improving rice seed and varieties, the IPM program and post harvest technologies like drying and milling. Research activities and seed supply network should be reinforced, through those channels high-quality varieties have been disseminated to farmers.

5.2.2 Development of rice milling sector

Improvement of rice milling is essential for rice industry development. The development of rice milling is very important for rice trading. It needs to establish modern rice mills to produce the world standard rice. According to the survey results, the major constraints for the millers were high tax rate and low quality of milled rice due to lack of modernized machinery and huller. Millers should modernize their milling machines for reducing high cost of milling and marketing margin. If the government and

international organizations support loan for up scaling the rice mills and storage facility, quality of milled rice will be improved in the study area.

5.2.3 Provision of marketing services

Based on the result findings, marketing margin of the wholesalers who sold rice in local market was narrow but marketing margin of wholesalers for sold rice in other market was large due to mainly high transportation cost. Therefore, the wholesalers received the highest profit in Mawlamyine, Hpa-an and Myingyan markets than Waw market especially for Shwewarhtun and Manawthukha rice varieties.

The road infrastructures (road, bridge) should be upgraded in order to reduce high transportation costs or for reduction of marketing margin. Government investment in roads is a major means to reduce the cost of marketing. Alternative policies should be focused especially on the farm to wholesale marketing services such as transportation, packaging, and milling to reduce the marketing margin. Therefore, the public private partnership scheme with the help of the local government, NGOs, cooperatives, and local community should encourage the type of road network to reduce the marketing margin. Government investments in agricultural research and extension to discover profitable crops and cropping system, as well as for increasing crop yield and product quality, are vital not only for improving farm production but also for increasing income and employment opportunities in the marketing activities.

5.2.4 Provision of market information

In Myanmar rice market; there was limited information of price, traded volume, exported quality, transaction cost, etc. Provision of market information is very important for rice market development. Moreover, the result of the study informed that the price information was transmitted from millers or wholesalers to the farmers. Therefore, government should provide market information on different varieties of rice in local and spatial markets in timely not only for producers but also for all other market participants in the rice marketing channels. Media such as radio and mobile communication should be used for transmission of price information. This could possibly help the farmers sell their products at higher prices which can eventually help to reduce the marketing margin.

5.2.5 Promoting of marketing efficiency

Due to high marketing efficiency in the study area, farmers received the highest profit shares in rice marketing channels. The farmers themselves should carry out the marketing activities. This will increase their share in consumer price. Agricultural extension should encourage farmers for direct marketing. If the state provides more formal credit to practically cover the cost of production as well as marketing functions, paddy production and marketing activities of the farmer level will be much efficient for long standing prospect of farmer profit share of consumer price. Both private and public institutions need to provide credit to marketing agents (such as wholesalers and millers) in order to facilitate procurement operations, storage activities and investment in processing and transportation. There is a need to reduce the taxes and fees for the traders, wholesalers and their business activities, which may lead to reduce in the marketing margin and thus improve the rice supply chain management in the study area.

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APPENDICES

Appendix 1 Sown area, harvested areas, Yield and Production in Bago (East) Region from 2005-2006 to 2010-2011

No	Township	2005-2006				2006-2007				2007-2008			
		Sown area (ha)	Harvested area (ha)	Yield (MT/ ha)	Product-ion (MT)	Sown area (ha)	Harvested area (ha)	Yield (MT/ ha)	Producti-vity (MT)	Sown area (ha)	Harvested area (ha)	Yield (MT/ ha)	Producti-vity (MT)
1	**Taungoo district**	202173.3	201176.5	4.03	811338.9	224872.1	220074.5	4.05	890927.3	224951.4	224951.4	4.12	927446.4
2	Taungoo	22744.94	20825.1	4.20	91969.61	28818.22	27987.45	4.09	114529	28795.14	28795.14	4.14	119335.6
3	Yaytarshay	29656.68	29486.64	4.14	122003.4	33006.07	31912.15	4.14	131989.7	32995.95	32995.95	4.18	137988.4
4	Kyaukkyi	24536.84	24536.84	3.70	90684.89	31915.38	31012.55	3.73	115772.8	31944.53	31944.53	3.83	122410.6
5	Phyu	60046.56	60046.56	4.08	244820.9	61927.53	60947.37	4.14	252049	61946.96	61946.96	4.27	264241.5
6	Oaktwin	36419.84	36419.84	4.08	148471.6	40353.04	39363.16	4.08	160710.1	40365.18	40365.18	4.14	167076.8
7	Htantapin	28768.42	28768.42	3.94	113388.5	28851.82	28851.82	4.02	115876.7	28903.64	28903.64	4.03	116393.5
8	**Bago District**	454772.9	454575.7	3.51	1595155	489745.7	481635.6	3.15	1516036	489967.2	489696.4	3.77	1848489
9	Bago	46085.02	46085.02	3.22	148523.9	48963.16	47842.91	3.31	158545.4	48583	48583	3.52	171171
10	Tanappin	70070.85	69873.68	3.09	215595.7	72739.68	71406.07	3.20	228359.8	72878.54	72607.69	3.52	255629.1
11	Kawa	79363.97	79363.97	3.12	247779.1	81897.98	80860.32	3.24	262351.8	81783.4	81783.4	3.46	282847.6
12	Waw	68572.87	68572.87	3.25	223162.3	72852.23	72361.13	3.57	257973.5	72880.57	72880.57	3.63	264904.5
13	Nyaunglaypin	53063.16	53063.16	4.02	213115.9	54847.77	54393.52	4.02	218487.1	54721.46	54721.46	4.18	228957
14	Kyauktadar	57571.66	57571.66	4.07	234373.6	62568.42	60889.07	4.13	25349.97	62759.11	62759.11	4.16	261129
15	Daikoo	69491.9	69491.9	3.98	276407.7	76489.07	74495.14	3.99	297462	76113.36	76113.36	4.08	310276
16	Shwekyin	10553.44	10553.44	3.43	36196.52	19387.45	19387.45	3.48	67506.54	20247.77	20247.77	3.63	73575.21
17	**Bago(East) Region**	656946.2	655752.2	3.67	2406494	714617.8	701710.1	3.43	1516036	714918.6	714647.8	3.88	2775936

Appendix 1 (Continued) Sown area, harvested areas, Yield and Production in Bago (East) Region from 2005-2006 to 2011-2012

No	Township	2008-2009				2009-2010				2010-2011			
		Sown area (ha)	Harves-ted area (ha)	Yield (MT/ ha)	Producti-vity (MT)	Sown area (ha)	Harvest-ed area (ha)	Yie-ld (M T/ ha)	Producti -vity (MT)	Sown area (ha)	Harvest-ed area (ha)	Yield (MT/ ha)	Producti-vity (MT)
1	**Taungoo district**	227893.1	562896	4.20	957023.14	228525.91	228525.9	4.21	962889.2	228614.2	228614.2	4.23	966217.05
2	Taungoo	29797.57	73600	4.15	123582.2	29801.21	29798.79	4.15	123602.6	29805.26	29805.26	4.17	124198.79
3	Yaytarshay	33603.24	83000	4.24	142332.16	33604.05	33604.05	4.23	142127.4	33606.07	33606.07	4.23	142222.7
4	Kyaukkyi	32627.13	80589	3.95	129001.32	32956.28	32956.28	3.94	129945.4	32996.76	32996.76	3.94	130139.14
5	Phyu	62247.37	153751	4.36	271114.21	62489.88	62489.88	4.40	274753.3	62492.31	62492.31	4.40	275148.98
6	Oaktwin	40489.88	100010	4.16	168491.75	40490.69	40490.69	4.16	168505.6	40495.55	40495.55	4.20	170041.46
7	Htantapin	29127.94	71946	4.21	122501.5	29186.23	29186.23	4.25	123954.8	29218.22	29218.22	4.26	124465.98
8	**Bago District**	489979.8	1210250	3.85	1888249.6	491229.96	49064.37	3.86	1892844	491684.6	491316.6	3.86	1897145.7
9	Bago	48806.48	120552	3.69	179945.32	48808.10	48808.1	3.69	179951.3	48808.1	48808.1	3.69	179966.24
10	Tanappin	72827.13	179883	3.54	257478.72	72859.51	72394.33	3.57	258079.7	72578.14	72260.73	3.57	257936.93
11	Kawa	81914.17	202328	3.56	291904.07	82801.21	82801.21	3.57	295248.2	83426.32	83375.71	3.57	297930.09
12	Waw	72252.23	178463	3.64	262993.6	72316.19	72316.19	3.64	263002.5	72332.39	72332.39	3.65	263770.81
13	Nyaunglaypin	54398.79	134365	4.26	231763.09	54452.63	54452.63	4.26	231825.8	53747.37	54474.9	4.26	231834.27
14	Kyauktadar	62905.26	155376	4.24	266802.96	63046.15	63046.15	4.24	267302.9	62642.51	63047.37	4.24	267373.14
15	Daikoo	76317.81	188505	4.18	319027.57	76321.46	76321.46	4.18	319097.1	76110.93	76321.46	4.18	319017.14
16	Shwekyin	20557.89	50778	3.81	78334.287	20621.05	20624.7	3.80	78336.4	20695.95	20695.95	3.83	79317.047
17	**Bago(East) Region**	717872.9	1773146	3.96	2845272.8	719755.87	719290.7	3.97	2855733	711289.1	719930.8	3.98	2863362.7

Appendix 2 Gross margin analysis of Shwewarhtun rice production grown by using broadcasting method during monsoon season in study area (N=33)

Items	Units	Level	Effective price	Total Value (kyats/ha)
1.Gross Benefit	**Ks/ha**	**2.1**	**160606.1**	**337,272.73**
2.Variable cost				
(a) Materials cost				
-Urea	Kg/ha	31.45	423.08	13,283.50
-Herbicide	Liter/ha	0.03	8000	240.00
Total Materials cost (a)				**13,523.5**
(b) Opportunity Cost				
(i)Family Labor Cost				
Land preparation with machinery	Mad/ha	0.74	8000	5,987.87
Land preparation with draft cattle	Amd/ha	2.85	17242.42	49,025.76
Broadcasting	Md/ha	0.45	1500	673.62
Fertilizer application	Md/ha	0.52	1500	785.91
Manual weeding	Md/ha	0.59	1500	898.17
Threshing with machinery	Mad/ha	0.74	3000	2,470.00
Threshing with draft cattle	Amd/ha	0.07	2000	149.68
Winnowing and drying	Md/ha	0.75	525	396.71
Transportation	Amd/ha	4.13	1928.57	7,896.52
Total Family Labor Cost (i)				**68,284.24**
Material Cost (ii)				
-seed	Kg/ha	118.67	238.1	28,255.87
-FYM	Kg/ha	582.18	18.06	10,378.20
Total Material Cost (ii)				**38,634.07**
Total Opportunity Cost (i+ ii) (b)	**Ks/ha**			**106,918.31**
(c)Hired Labor Cost				
Land preparation with machinery	Mad/ha	0.29	8000	2,395.13
Broadcasting	Md/ha	2.02	1500	3,031.35
Fertilizer application	Md/ha	2.09	1500	3,143.64
Manual weeding	Md/ha	6.89	1500	10,329.09
Harvesting	Md/ha	13.8	2633.33	34,692.26
Threshing with machinery	Mad/ha	1.58	3000	4,715.45
Winnowing and drying	Md/ha	6.6	496.97	3,285.84
Transportation	Amd/ha	0.67	2300	1,534.39
Total Hired Labor Cost (c)	**Ks/ha**			**63,127.15**
(d) Interest on cash cost				
Materials cost	Ks/ha	13523.5	0.2	2,704.70
Hired labor cost	Ks/ha	63127.15	0.2	12,625.43
Total interest on cash cost (d)				**15,330.13**

Appendix 3 Gross margin analysis of Shwewarhtun rice production grown by using transplanting during monsoon season in study area (N=47)

Items	Units	Level	Effective price	Total value (kyats/ha)
1.Gross Benefit	**Ks/ha**	**3.36**	**158967**	**534,128.00**
2.Variable cost				
(a) Materials cost				
Urea	Kg/ha	32.33	422.79	13,668.80
Herbicide	Liter/ha	0.06	9500	570.00
Compound	Kg/ha	10.51	180	1,891.80
Total Materials cost (a)	**Ks/ha**			**16,130.60**
Opportunity Cost (b)				
(i) Family Labor Cost				
Land preparation with machinery	Mad/ha	0.47	8000	3,760.00
Land preparation with draft Cattle	Amd/ha	2.6	17574.5	45,693.60
seed bed preparation	Md/ha	0.65	1500	975.00
Fertilizer application	Md/ha	0.74	1500	1,110.00
Threshing with machinery	Mad/ha	0.79	3600	2,844.00
Threshing with draft cattle	Amd/ha	0.1	2000	200.00
Winnowing and drying	Md/ha	0.52	450	234.00
Transportation	Amd/ha	4.71	1366.67	6,437.02
Total Family Labor Cost (i)	**Ks/ha**			**61,253.62**
Material Cost(i)				
Seed	Kg/ha	102.31	239.11	24,463.30
FYM	Kg/ha	712.38	22.98	16,370.50
Total Material Cost(ii)	**Ks/ha**			**40,833.80**
Total Opportunity Cost (i+ii) (b)	**Ks/ha**			**102,087.42**
Hired Labor Cost (b)				
Land preparation with machinery	Mad/ha	0.16	8000	1,280.00
seed-bed preparation	Md/ha	2.69	1500	4,035.00
Fertilizer application	Md/ha	1.89	1500	2,835.00
pulling of seedling	Md/ha	12.4	2393.62	29,680.90
Transplanting	Md/ha	45.1	1457.45	65,731.00
harvesting	Mad/ha	13.1	2578.72	33,781.20
Threshing with machinery	Md/ha	1.6	3766.67	6,026.67
Winnowing and drying	Amd/ha	6.9	456.52	3,149.99
Transportation	Amd/ha	0.2	1500	300.00
Total Hired Labor Cost (c)	**Ks/ha**			**146,819.67**
Interest on cash cost (d)				
Materials cost	Ks/ha	16130.6	0.2	3,226.12
Hired labor cost	Ks/ha	146820	0.2	29,364.00
Interest on cash cost (d)	**Ks/ha**			**32,590.12**

Appendix 4 Gross margin analysis of Manawthukha rice production grown by using broadcasting method during monsoon season (N=16)

Items	Unit	Level	Effective price	Total Value (Kyats/ha)
1.Gross Benefit	**Ks/ha**	**2.27**	**169048**	**383,738.00**
2.Variable cost				
(a) Materials cost				
Urea	Kg/ha	25.5	418.5	10,671.80
Compound	Kg/ha	9.2	175	1,610.00
Herbicide	Liter/ha	0.14	8750	1,225.00
Total Materials cost (a)	**Ks/ha**			**13,506.80**
Opportunity Cost (b)				
(i) Family Labor Cost				
Land preparation with machinery	Mad/ha	0.74	8000	5,928.00
Land preparation with draft cattle	Amd/ha	2.62	18031.3	47,315.90
Broadcasting	Md/ha	0.62	1500	926.25
Fertilizer application	Md/ha	0.62	1500	926.25
Manual weeding	Md/ha	0.62	1500	926.25
Threshing with machinery	Mad/ha	0.93	2666.67	2,470.00
Threshing with draft cattle	Amd/ha	0.6	2166.67	1,312.19
Winnowing and drying	Md/ha	0.3	400	120.00
Transportation	Amd/ha	4.63	1666.67	7,718.75
Total Family Labor Cost (i)	**Ks/ha**			**67,643.59**
Material Cost (ii)				
Seed	Kg/ha	111.8	250	27,950.00
FYM	Kg/ha	781.84	22.13	17,302.10
Total Material Cost (ii)	**Ks/ha**			**45,252.10**
Total Opportunity Cost (i+ ii) (b)	Ks/ha			**112,895.80**
(c)Hired Labor Cost				
Land preparation with machinery	Mad/ha	0.46	8000	3,680.00
Broadcasting	Md/ha	2	1500	3,010.31
Fertilizer application	Md/ha	2.16	1500	3,241.88
Manual weeding	Md/ha	6.02	1500	9,030.94
Harvesting	Md/ha	14	2500	35,043.10
Threshing with machinery	Mad/ha	1.08	2714.29	2,933.13
Threshing with draft cattle		0.15	2500	375.00
Winnowing and drying	Md/ha	7.11	487.5	3,488.88
Transportation	Amd/ha	0.31	2000	617.50
Total Hired Labor Cost (c)	**Ks/ha**			**61,420.77**
(d) Interest on cash cost				
Materials cost	Ks/ha	13506.75	0.2	2,701.35
Hired labor cost	Ks/ha	61420.77	0.2	12,284.15
Interest on cash cost (d)	**Ks/ha**			**14,985.50**

Appendix 5 Gross margin analysis of Manawthukha rice production grown by using transplanting method during monsoon season (N=20)

Items	Units	Level	Effective price	Total Value (Kyats/ha)
1.Gross Benefit	**Ks/ha**	**3.55**	**169523.8**	**601,809.49**
2.Variable cost				
(a) Materials cost				
Urea	Kg/ha	39	404.44	15,773.16
compound	Kg/ha	1.23	170	209.10
Total Materials cost (a)	**Ks/ha**			**15,982.26**
Opportunity Cost (b)				
(i) Family Labor Cost				
Land preparation with machinery	Mad/ha	0.62	8000	4,940.00
Land preparation with draft cattle	Amd/ha	2.9	18800	54,463.50
Seed-bed preparation	Md/ha	0.62	1500	926.25
Fertilizer application	Md/ha	0.37	1500	555.75
Threshing with machinery	Mad/ha	0.98	2562.5	2,531.75
Threshing with draft cattle	Amd/ha	0.61	2125	1,296.75
Transportation	Amd/ha	4.94	1575	7,780.50
Total family labor Cost (i)	**Ks/ha**			**72,494.5**
Material Cost (ii)				
Seed	Kg/ha	99.85	266.66	26,613.59
FYM	Kg/ha	682.61	22.74	15,522.5
Total Material Cost (ii)	**Ks/ha**			**42,136.09**
Total Opportunity Cost (i+ii) (b)	**Ks/ha**			**114,630.59**
(c)Hired Labor Cost				
Seed-bed preparation	Md/ha	2.72	1500	4,080.00
Fertilizer application	Md/ha	2.09	1500	3,135.00
pulling of seedling	Md/ha	12.35	2400	29,640.00
Transplanting	Md/ha	46.07	1415	65,189.05
Harvesting	Md/ha	14.2	2525	37,275.00
Threshing with Machinery	Mad/ha	0.99	2750	2,722.50
Winnowing and drying	Md/ha	7.41	505	3,742.05
Total Hired Labor Cost (c)	**Ks/ha**			**145,783.60**
(d) Interest on cash cost				
Materials cost	Ks/ha	15982.26	0.2	3,196.45
Hired labor cost	Ks/ha	145783.6	0.2	29,156.72
Total Interest on Cash Cost (d)				**32,353.17**

Appendix 6 Gross margin analysis of Shwetasope rice production grown by using broadcasting during monsoon season (N= 33)

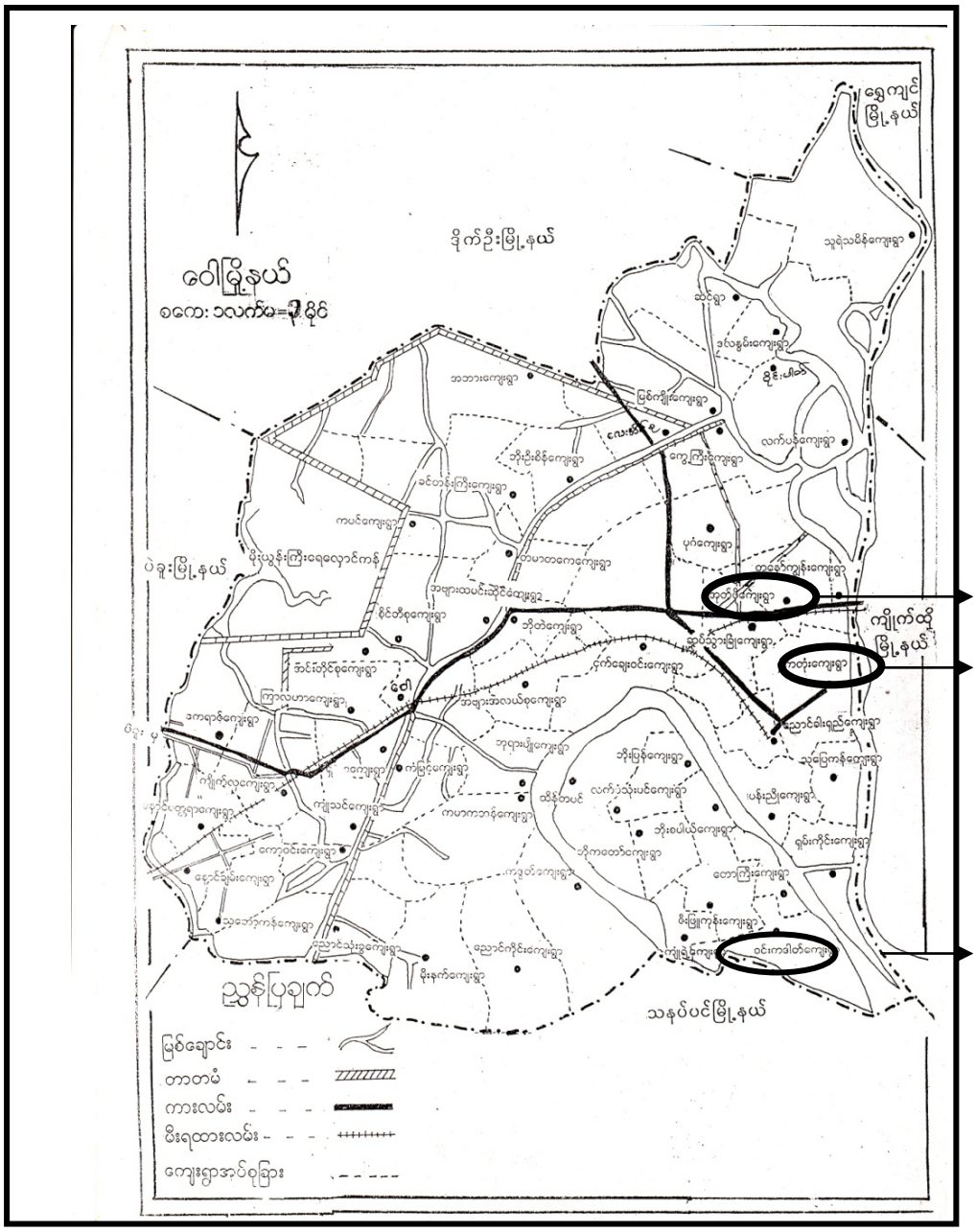
Items	Units	Level	Effective price	Total Value (Kyats/ha)
1.Gross Benefit	**Ks/ha**	**2.17**	**143290.04**	**310,920.61**
2.Variable cost				
(a) Materials cost				
Urea	Kg/ha	27.52	421.43	11,597.75
Compound	Kg/ha	6.74	182	1,226.68
Herbicide	Liter/ha	0.08	8500	680.00
Total Materials cost (a)	**Ks/ha**			**13,504.43**
Opportunity Cost (b)				
(b) Family Labor Cost				
Land preparation with machinery	Mad/ha	0.59	8000	4,720.00
Land preparation with draft cattle	Amd/ha	2.9	17772.72	51,540.89
Broadcasting	Md/ha	0.37	1500	555.00
Fertilizer application	Md/ha	0.3	1500	450.00
Manual weeding	Md/ha	0.45	1500	673.64
Threshing with machinery	Mad/ha	0.82	2681.82	2,199.09
Threshing with draft cattle	Amd/ha	0.45	2200	990.00
Winnowing and drying	Md/ha	0.45	460	207.00
Transportation	Amd/ha	4.49	1233.33	5,537.65
Total Family Labor Cost (i)	**Ks/ha**			**66,873.27**
Material Cost (ii)				
Seed	Kg/ha	109.24	198.43	21,673.22
FYM	Kg/ha	611.19	22.25	13,598.98
Total Material Cost (ii)	**Ks/ha**			**35,272.20**
Total Opportunity cost (i+ii) (b)	**Ks/ha**			**102,145.47**
(c)Hired Labor Cost				
Land preparation with machinery	Mad/ha	0.3	8000	2,400.00
Broadcasting	Md/ha	2.22	1500	3,300.00
Fertilizer application	Md/ha	2.39	1500	3,585.00
Manual weeding	Md/ha	6.59	1500	9,885.00
Harvesting	Md/ha	13.09	2681.82	35,105.02
Threshing with machinery	Mad/ha	1.29	2882.35	3,718.20
Winnowing and drying	Md/ha	6.97	463.64	3,231.57
Transportation	Amd/ha	0.59	1500	885.00
Total Hired Labor Cost (c)	**Ks/ha**			**62,109.79**
(d) Interest on cash cost				
Materials cost	Ks/ha	13504.43	0.2	2,700.88
Hired labor cost	Ks/ha	62109.79	0.2	12,421.95
Interest on cash cost(d)	**Ks/ha**			**15,122.83**

Appendix 7 Gross margin analysis of other varieties rice production grown by using broadcasting method during monsoon season in study area (N=6)

Items	Unit	Level	Effective price	Total Value (kyats/ha)
1.Gross Benefit	**Ks/ha**	**2.29**	**153968.3**	**352,587.32**
2.Variable cost				
(a) Materials cost				
Urea	Kg/ha	53	393.33	20,921.13
Total Materials cost (a)				**20,921.13**
Opportunity Cost (b)				
(i) Family Labor Cost				
Land preparation with machinery	Mad/ha	0.82	8000	6,560.00
Land preparation with draft Cattle	Amd/ha	2.79	19000	53,010.00
Broadcasting	Md/ha	0.42	1500	630.00
Fertilizer application	Md/ha	0.42	1500	630.00
Threshing(Machinery)	Mad/ha	0.42	2500	1,050.00
Transportation	Amd/ha	4.94	1666.67	8,233.35
Total Family Labor Cost (i)	**Ks/ha**			**70,113.35**
Material Cost (ii)				
Seed	Kg/ha	129.68	246.03	31,905.17
FYM	Kg/ha	432.43	24	10,378.32
Total Material Cost (ii)	**Ks/ha**			**42,283.49**
Total Opportunity Cost (i+ii) (b)				**112,396.84**
(c)Hired Labor Cost				
Broadcasting	Md/ha	2.05	1500	3,075.00
Fertilizer application	Md/ha	2.05	1500	3,075.00
Manual weeding	Md/ha	6.18	1500	9,270.00
Harvesting	Md/ha	18.11	2083.33	37,729.11
Threshing with machinery	Mad/ha	2.05	2700	5,535.00
Winnowing and drying	Md/ha	7.41	516.67	3,828.53
Total Hired labor cost (c)	**Ks/ha**			**62,512.64**
(d) Interest on cash cost				
Materials cost	Ks/ha	20921.13	0.2	4,184.23
Hired labor cost	Ks/ha	62512.64	0.2	12,502.53
Total interest on cash cost(d)				**16,686.76**

Appendix 8 Gross margin analysis of other varieties production grown by using transplanting method during monsoon season in study area (N=19)

Items	Units	Level	Effective price	Total Value (kyats/ha)
1.Gross Benefit	**Ks/ha**	3.2	174185.5	557,393.60
2.Variable cost				
(a) Materials cost				
Urea	Kg/ha	43.24	407.78	17,632.40
Herbicide	liter/ha	0.03	8000.00	240.00
Total Materials cost (a)	**Ks/ha**			**17,872.40**
Opportunity Cost (b)				
(i) Family Labor Cost				
Land preparation with machinery	Mad/ha	0.91	8000	7,280.00
Land preparation with draft cattle	Amd/ha	2.75	18368.42	50,569.99
seed bed preparation	Md/ha	0.39	1500	585.00
Fertilizer application	Md/ha	0.26	1500	390.00
Threshing with machinery	Mad/ha	0.79	2833.33	2,238.33
Threshing with draft cattle	Mad/ha	0.25	3000	750.00
Winnowing and drying	Mad/ha	0.27	500	135.00
Transportation	Amd/ha	4.94	1736.84	8,579.99
Total Family Labor Cost	**Ks/ha**			**70,528.31**
Material Cost (ii)				
Seed	Kg/ha	107.84	285.71	31,134.42
FYM	Kg/ha	464.94	21.56	10,024.10
Total Material Cost (ii)	**Ks/ha**			**41,158.52**
Total Opportunity cost (i+ii) (b)				**111,686.83**
(c)Hired Labor Cost				
Land preparation with machinery	Mad/ha	0.12	8000	960.00
seed preparation	Md/ha	2.99	1500	4,485.00
Fertilizer application	Md/ha	2.35	1500	3,525.00
Pulling of seedling	Md/ha	12.49	2289.47	28,600.00
Transplanting	Md/ha	45.81	1421.05	65,091.00
Harvesting	Md/ha	15.46	2405.26	33,605.00
Threshing with machinery	Mad/ha	1.43	2772.73	3,965.00
Threshing with draft cattle	Amd/ha	0.12	2000.00	2,400.00
Winnowing and drying	Md/ha	7.14	526.31	3,757.85
Total Hired Labor Cost (c)	**Ks/ha**			**146,388.85**
(d) Interest on cash cost				
Materials cost	Ks/ha	17872.41	0.2	3,574.48
Hired labor cost	Ks/ha	146388.9	0.2	29,277.77
Interest on cash cost(d)	**Ks/ha**			**32,852.25**



Oak Pho village far 12 miles from Waw Township

Hmonekatone village far 15 miles from Waw Township

Winkadark village far 20 miles from Waw Township

Appendix 9 Map of Waw Township

Appendix 10 Sown areas, yield, total yield, home consumption, reserved seed and marketed surplus of Shwewarhtun rice variety grown by using broadcasting and transplanting methods

Variety	Sown area (Br)	Yield (bsk/ac)	Total yield (bsk/ac)	Sown area (Tp)	Yield (bsk/ac)	Total yield (bsk)	Home consumption (bsk/yr)	Total Reserved (bsk)	Total Marketing (bsk/yr)
Shwewarhtun	7	40	280	3	70	210	170	30	290
Shwewarhtun	15	40	600				100	45	455
Shwewarhtun	8	40	320				40	15	265
Shwewarhtun	5	40	200				125	15	60
Shwewarhtun	7	40	280				150	25	105
Shwewarhtun	7	45	315				125	20	170
Shwewarhtun	18	40	720				150	60	510
Shwewarhtun	17	50	850					55	795
Shwewarhtun	10	40	400				100	50	250
Shwewarhtun	20	50	1000					70	930
Shwewarhtun	21	40	840	5	60	200	200	80	760
Shwewarhtun	10	40	400				100	30	270
Shwewarhtun	47	40	1880				30	150	1700
Shwewarhtun	6	40	240				100	15	125
Shwewarhtun	10	40	400					25	375
Shwewarhtun	20	50	1000				50	60	890
Shwewarhtun	2	40	80						80
Shwewarhtun	14	40	560				260	40	260
Shwewarhtun	23	45	1035				100	75	860
Shwewarhtun	8	40	320	2	60	120	200	27	213
Shwewarhtun	10	40	400				200	25	175

Variety	Sown area (Br)	Yield (bsk/ac)	Total yield (bsk/ac)	Sown area (Tp)	Yield (bsk/ac)	Total yield (bsk)	Home consumption (bsk/yr)	Total Reserved (bsk)	Total Marketing (bsk/yr)
Shwewarhtun	5	40	200				140	10	50
Shwewarhtun	4	40	160	4	60	240	100	20	280
Shwewarhtun				5	60	300	130	20	150
Shwewarhtun				7	60	420	100	20	300
Shwewarhtun	8.5	50	425				100	30	295
Shwewarhtun	10	40	400	10	60	600	200	50	750
Shwewarhtun	23	50	1150	3	70	210	200	100	1060
Shwewarhtun				9.5	70	665	100	24	541
Shwewarhtun				7	70	490	125	15	350
Shwewarhtun				6	70	420	150	20	250
Shwewarhtun				5	60	200	75	15	110
Shwewarhtun				4	70	280	100	8	172
Shwewarhtun				3	70	210	25	20	165
Shwewarhtun				6	60	360	50	15	295
Shwewarhtun				5	70	350	50	8	292
Shwewarhtun				13	70	910	50	26	834
Shwewarhtun				3	70	210	124	6	80
Shwewarhtun				8	70	560	50	25	485
Shwewarhtun				5	70	350	40	10	300
Shwewarhtun				3	70	210	50	7	153
Shwewarhtun				5	70	350	150	20	180
Shwewarhtun	13	40	520	10	70	700	200	50	970
Shwewarhtun				4	70	280	150	10	120
Shwewarhtun				5	60	300	100	12	188

Variety	Sown area (Br)	Yield (bsk/ac)	Total yield (bsk/ac)	Sown area (Tp)	Yield (bsk/ac)	Total yield (bsk)	Home consumption (bsk/yr)	Total Reserved (bsk)	Total Marketing (bsk/yr)
Shwewarhtun				5	60	300	100	10	190
Shwewarhtun				5	60	300	150	20	130
Shwewarhtun	7.5	40	300	2.5	60	150	70	45	335
Shwewarhtun	10	40	400	15	60	900	200	20	1080
Shwewarhtun				5	60	300	100	10	190
Shwewarhtun				6.5	70	455	100	18	337
Shwewarhtun				5	70	350	150	7.5	192.5
Shwewarhtun	5	40	200	5	60	300	50	25	425
Shwewarhtun				10	60	600	100	35	465
Shwewarhtun				2	70	140	100	4	36
Shwewarhtun				5	60	300	150	10	140
Shwewarhtun				5	60	300	50	10	240
Shwewarhtun	3	50	150	3	70	210	100	10	250
Shwewarhtun				3	70	210	140	10	60
Shwewarhtun				15	70	1050	150	40	860
Shwewarhtun				8	70	560		10	550
Shwewarhtun				10	60	600	150	20	430
Shwewarhtun				6	70	420	100	30	290
Shwewarhtun				7.5	70	525	100	20	405
Shwewarhtun				12	70	840	50	30	760
Shwewarhtun				5	70	350	75	10	265
Shwewarhtun	4	40	160	7	70	350	100	20	390

Appendix 11 Sown areas, yield, total yield, home consumption, reserved seed and marketed surplus of Manawthukha rice variety grown by using broadcasting and transplanting methods

Variety	Sown area (Br)	Yield (bsk/ac)	Total yield (bsk/ac)	Sown area(Tp)	Yield (bsk/ac)	Total yield (bsk/ac)	Home Consumption (bsk/yr)	Reserved seed (bsk)	Total Marketing (bsk/yr)
Manawthukha	15	40	600				100	45	455
Manawthukha	6	45	270				100	20	150
Manawthukha				2	60	120	40	5	75
Manawthukha				1	70	70		55	15
Manawthukha				11.5	70	805	100	30	675
Manawthukha	2	50	100	5	70	300	200	20	180
Manawthukha	5.5	50	275				100	12	163
Manawthukha	2.5	40	100					10	90
Manawthukha	5	50	250				50	10	190
Manawthukha				3	70	210	40	10	160
Manawthukha				10	60	600	100	35	465
Manawthukha	10	50	500	12	70	840	100	25	1215
Manawthukha	1	60	60	4	70	280	150	12.5	177.5
Manawthukha	6	40	240	7	70	490	300	35	395
Manawthukha	4	55	220	8	70	560	250	25	505
Manawthukha									0
Manawthukha				10	70	700	150	40	510
Manawthukha				4	70	280		15	265
Manawthukha	12	40	480	6	70	420	100	30	770
Manawthukha				5.5	70	385	100	14	271
Manawthukha				7.5	70	525	100	20	405
Manawthukha	1	50	50	5.36	70	375.2	70	15	340.2
Manawthukha	6	50	300	8	70	560	50	50	760
Manawthukha	5	50	250					10	240
Manawthukha			0	7	70	490	150	16	324
Manawthukha	7	50	350	4	70	280	150	25	455
Manawthukha	3	40	120	5	60	300	50	15	355

Appendix 12 Sown areas, yield, total yield, home consumption, reserved seed and marketed surplus of Shwetasope rice variety grown by using broadcasting and transplanting methods

Variety	Sown area(Br)	Yield (bsk/ac)	Total yield(bsk/ac)	Home consumption(bsk/yr)	Reserved seed (bsk)	Total Marketing (bsk/yr)
Shwetasope	10	40	400	100	30	270
Shwetasope	10	40	400		40	360
Shwetasope	7	40	280	50	25	205
Shwetasope	9	40	360		25	335
Shwetasope	20	40	800	100	75	625
Shwetasope	5	45	225	50	20	155
Shwetasope	2.5	40	100	50	10	40
Shwetasope	6	40	240		15	225
Shwetasope	6	40	240	100	20	120
Shwetasope	3	50	150	30	6	114
Shwetasope	2.5	50	125	10	10	105
Shwetasope	5	50	250	50	10	190
Shwetasope	6	40	240		15	225
Shwetasope	6	40	240	50	20	170
Shwetasope	4	40	160	40	5	115
Shwetasope	3	40	120		7	113
Shwetasope	6	40	240		20	220
Shwetasope	2	40	80	50		30
Shwetasope	7	40	280		20	260
Shwetasope	6	40	240		15	225
Shwetasope	7	40	280		15	265
Shwetasope	10	40	400		25	375
Shwetasope	9	40	360		20	340
Shwetasope	13	40	520	100	20	400
Shwetasope	3	40	120	110	7	3
Shwetasope	6.5	40	260	100	18	142
Shwetasope	9	40	360	100	23	237
Shwetasope	15	45	675	100	30	545
Shwetasope	2	40	80		5	75
Shwetasope	18	40	720		40	680
Shwetasope	15	50	750		40	710
Shwetasope	2.5	40	100	75	5	20

Appendix 13 Sown areas, yield, total yield, home consumption, reserved seed and marketed surplus of other rice varieties grown by using broadcasting and transplanting methods

Variety	Sown area (Br)	Yield (bsk/ac)	Total yield (bsk/ac)	Sown area(Tp)	Yield (bsk/ac)	Total yield (bsk/ac)	Home Consumption (bsk/yr)	Reserved seed (bsk)	Total Marketing (bsk/yr)
Other varieties	3.67	45	165.15				100	15	50.15
Other varieties	16	45	720				200	50	470
Other varieties	3	45	135				120	15	0
Other varieties	5	40	200				100	10	90
Other varieties	1.5	70	105					5	100
Other varieties	3	50	150				85	5	60
Other varieties	6	60	360	4.5	45	202.5	200	25	337.5
Other varieties	7	70	490				200	15	275
Other varieties	3	60	180	3	50	150	125	15	190
Other varieties	4	70	280	3	40	120	100	15	285
Other varieties	6	70	420				100	15	305
Other varieties	5	70	350				50	12.5	287.5
Other varieties	13	70	910	5	40	200	300	50	760
Other varieties	5	70	350				100	12	238
Other varieties	14.2	70	994	3	40	120	300	60	754
Other varieties	3	70	210				70	15	125
Other varieties	3	70	210	1.2	60	72	235	17	30
Other varieties	7	40	280				15	265	0
Other varieties	2.5	60	150					5	145