FERTILIZER SUPPLY CHAIN AND MARKET STRUCTURE: A CASE STUDY IN TATKON TOWNSHIP, NAY PYI TAW

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SEPTEMBER 2015

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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)

Yezin Agricultural University

SEPTEMBER 2015

The thesis attached here to, entitled **"Fertilizer Supply Chain and Market Structure: A Case Study in Tatkon Township, Nay Pyi Taw"** was prepared and submitted by July Soe under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee and the board of examiners as a partial fulfillment of the requirements for the degree of **Master of Agricultural Science (Agricultural Economics).**

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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.

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DEDICATED TO MY BELOVED PARENTS,

U TIN SOE AND DAW NI

ACKNOWLEDGEMENT

First and foremost, I would like to express my deep and sincere gratitude to Dr. Myo Kywe (Rector), Dr. Soe Soe Thein, Pro-Rector (Academic) and Dr. Nang Hseng Hom, Pro-Rector (Administration), Yezin Agricultural University, for their kind permission to attend master degree, administrative support to do my research work, and valuable suggestions to improve this study.

I wish to express my sincere gratitude to Dr. Cho Cho San, Professor and Head, Department of Agricultural Economics, Yezin Agricultural University, for permission to attend the master program and critical reviews and constructive comments to improve this dissertation and throughout my research. I also convey my sincere appreciation to Dr. Theingi Myint, Associate Professor, Department of Agricultural Economics, YAU for her generous helps, kindness, and valuable suggestions during my study.

I sincerely thanks to the external examiner, Dr. Khin Oo, Professor and Principal (Retd.), Hmawbi Campus, YAU, for her kind help, motherly concern, cooperation, correction of my mistakes, and valuable suggestions for this manuscript.

I would like to express my deepest appreciation and gratitude to my supervisor Dr. Hnin Yu Lwin, Lecturer, Department of Agricultural Economics, YAU, for her keen interest, guidance, invaluable advices, generous helps, motherly concern, encouragements, moral support, valuable supervisions and understanding to me throughout my study.

I profoundly thanks to the members of my advisory committee Daw Nang Ei Mon The, Assistant Lecturer, Department of Agricultural Economics, YAU and Dr. Swe Swe Mar, Assistant Lecturer, Department of Soil and Water Science, YAU for their guidance to my difficulty, encouragement, moral support, and kindness, and their critical and patient reading, and comments during the conceptualization of this study and the manuscript preparation.

My special thanks also extend to the market intermediaries and sampled farmers at Tatkon Township for their patient answers to the long questionnaires. I really appreciate to the village leaders, my friend Swe Nyein for their kind help in obtaining the necessary primary data for this thesis. I am grateful to Ma Zin Myu Myu Ko (DoP) and Ma Swe Swe Win (DoP) for their kind assistance to obtain the necessary secondary data for my research.

I would like to acknowledge with appreciation and thanks to my colleagues, special gratitude to Ma Aye Aye Tun and all the staff members from the Department of Agricultural Economics for their helps, kindness, valuable suggestions and assistance throughout my study period.

Last but not the least, my deepest and greatest dedication is to my beloved parents, U Tin Soe and Daw Ni for their never-ending love, encouragement, kind understanding, moral support, a lot of help and especially generous financial support whenever I need.

ABSTRACT

This study was attempted to explore the detailed information about marketing performance of fertilizer markets. The overall objective of the study was to analyze the fertilizer supply chain and fertilizer market structure in Tatkon Township. The specific objectives are to identify marketing activities of market participants including end users (farmers) in Tatkon Township, to examine fertilizer market structure including marketing channel, marketing cost and marketing margin in Tatkon Township and, to study the fertilizer price integration during 2010 to 2014 period.

The survey was conducted in January, 2015 with marketing intermediaries. A total of 33 market intermediaries were personally interviewed in which 6 local wholesalers, 5 village retailers from Nwe Yit, Kyae Chaung and Moe Hnan Khone villages, 2 company agents (Diamond Star Co., Ltd and Golden Lion High Tech Agricultural Resources Co., Ltd) and 20 farmers in New Yit, Kyae Chaung and Moe Hnan Khone villages were collected. On the other hand, market integration analysis was carried out by applying time series data. Fertilizer monthly prices for selected markets covered from January 2010 to December 2014 with a total of 60 observations in this study.

Based on the research findings, it was found that imported registered urea fertilizer from China was the main fertilizer supply in Tatkon Township, followed by registered and unregistered compound fertilizers. Among many fertilizers, urea fertilizer was largely utilized by farmers. Supply of domestically produced urea fertilizer did not influence well in the fertilizer market. Several registered compound fertilizers such as Awba, Armo, Golden Cock and Mahkota were the most popular brands. In fertilizer market structure, Mandalay was the major fertilizers supply to Tatkon Township. There were three main fertilizer marketing channels in Tatkon Township. The marketing channel (1) was the major channel which sold the largest amount of fertilizers in the study area. In this channel, marketing links were existed among all market participants and local wholesalers were the main players. Village retailers and company agents were the major players in the marketing channel (2) and (3).

According to the market integration analysis in this study, all the fertilizer price series in the first difference were stationary and co-integrated in the long - run relationship. The finding of price causality showed that Mandalay market was a leading market for price formation in the fertilizer market. Although Myanmar is an absolute fertilizer importer, T-super and compound fertilizer prices did not disseminate well among domestic and international markets. Therefore, the causes of price distortion which reduce the competitiveness of fertilizer markets should be investigated more as further research to facilitate the efficiency of Myanmar fertilizer market.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
Cfr.SE Asia	Council on Foreign Relations. Southeast Asia
CSO	Central Statistical Organization
DoA	Department of Agriculture
DoP	Department of Planning
FAO	Food and Agriculture Organization
IFA	International Fertilizer Association
IFDC	International Fertilizer Development Center
Kg	Kilogram
LW	Local Wholesaler
MIS	Market Information Service
MMK	Myanmar Kyat
MOAI	Ministry of Agricultural and Irrigation
MPE	Myanma Petrochemical Enterprise
MT	Metric Ton
SOE	State Own Enterprise
VR	Village Retailer
YAU	Yezin Agricultural University

LIST OF CONVERSION FACTORS

1 Hectare	2.471 Acres
1 Metric ton	1000 Kilograms

CHAPTER I
INTRODUCTION

1.1 Background of the Study

Increased productivity and profitability of farming is an important pathway to reduce poverty in rural area of Myanmar. After land, water and human resources, fertilizer is undoubtedly one of the agricultural inputs to increase the high yield when used in proper time and proper nutrient balance. It is one of the agricultural technologies that have huge potential for raising the productivity of poor smallholders, enabling them to increase income, accumulate assets, and set themselves economically on a pathway out of poverty.

Fertilizer inputs in general have increased greatly with the advent of the green revolution (Bumb and Carlos 1996). Fertilizer helps to replenish nutrients and enhance soil fertility. Fertilizer is used in the low fertility soils of the tropics to increase crop yields. The high-yielding varieties require large inputs of fertilizer to achieve the target yields. After 1978, like in developing countries, Myanmar farmers widely used chemical fertilizer because of the proven good response to the applied chemical fertilizer by high yielding rice varieties and fulfill food self- sufficiency. Therefore, fertilizer mutually related with agricultural production and food security.

After adoption of market economy system in 1989, the size and structure of fertilizer distribution and marketing system in Myanmar have changed significantly. Proper and adequate access of fertilizer is very crucial to enhance the agricultural productivity. An efficient fertilizer distribution system requires to access fertilizer at the right time and the right form of nutrient for farmers. Compared to the vast land resources in Myanmar, the level of agrochemicals use in the agricultural sector are considerably low. Thus, government encouraged the farmers to use the chemical fertilizer by subsidizing the prices and by constructing urea processing plants (Hnin Yu Lwin et al. 2013).

Fertilizer supply chain and market structure are evolving rapidly to meet farmers' demand. Supply of input including fertilizer is needed one of the most important factors for increasing yield. In Myanmar, the supply of chemical fertilizers is less than the required amount and demand is increasing (MOAI 2008). This declining of fertilizer supply comes mainly from the decreasing of urea fertilizer production. There is no private fertilizer manufacture in Myanmar not only for urea fertilizer but also for compound fertilizers. As Myanmar does not have enough fertilizer production, the government attempts to boost private imports by providing import duty exemption, and private sector continued to be the main importer.

1.2 Roles of Fertilizer in Developing Countries

1.2.1 Fertilizer production, consumption and prices

Inorganic fertilizers are an expensive resource in a developing country. They may be the only input for which the farmer requires hard currency. It is thus crucial that fertilizer should be used in the most effective manner so that each unit will produce additional food. In developing countries, Anderson (1974) estimated that fertilizers contributed 55-57% of the rise in average yield per hectare and 30-31% of the total increase in production. Nitrogen is the main macronutrient produced worldwide, followed by phosphate and potash.

The world's fertilizer production rose from 8 million tons at the end of the Second World War to 113 million tons in 1978. Fertilizer consumption (% of fertilizer production) in World was last measured at 92.12% in 2011, according to the World Bank. An analysis of production indicates that the global production of fertilizers is characterized by a high and increasing level of concentration and consolidation. This trend basically explained by the fertilizer industry being a capital-intensive industry with economies of scale in production and a high requirement of raw materials, such as natural gas, phosphate rock, and potassium salts, which constitute 70–90 % of cash production costs (Gregory and Bumb 2006).

World fertilizer consumption increased steadily from the early 1960s through the mid 1980s and then declined through the mid 1990s before starting to rise again (Roberts 2009). In 1999, fertilizer consumption in the developing countries amounts to some 83 million tons nutrient or 61% of the world total, compared with 12% in 1960. The increase is particularly strong in the case of nitrogen. In 1991, fertilizer consumption in developing countries for the first time exceeded that of the developed countries (FAO and IFA 1999).

World total fertilizer nutrient consumption measured at 161.7 million tons in 2009 was 169.7 million tons in 2010. In 2010, the world demand for nitrogen, phosphate and potash was forecasted to grow by 2, 6 and 16 percent. World demand for total fertilizer nutrients was 2.6% per annum from 2010 to 2014. The demand for nitrogen, phosphate and potassium was forecasted to grow annually by 1.8, 2.9 and 5%, respectively during the period (FAO 2010).

The Asian fertilizer industry has majorly been driven by Chinese and Indian economy during 2006-2012 and these two countries remained the leading producers of fertilizer with a contribution of 55.5% and 29.3% in the overall consumption of Asian fertilizer industry in 2012 respectively. Total fertilizer nutrient consumption in Asia is 60% of the world total (www.newskenresearch.com). The East Asia is now the largest fertilizer producing and consuming region in the world. Southern Asia is in second place and North America in third

place. The share of East Asia, Southern Asia and America in global fertilizer consumption is 39%, 19% and 12% respectively (Vital Signs 2011). Nitrogen, phosphate and potassium consumption in East Asia was expected to grow at 1.2, 1.7 and 5.6%, respectively per annum during 2010 to 2014 (FAO 2010).

Since the early 1980s, fertilizer prices have been declining and were not high enough to attract additional investment in fertilizer production. But recent increases in fertilizer use in North America, reduced supplies from Eurasia, and increased imports by China and India forced fertilizer prices to rise rapidly in 1994 and 1995. Increased grain prices also contributed to this unexpected surge in fertilizer prices. Although this phenomenon has engendered some alarm about potential fertilizer shortages, the structural parameters do not support a long-run trend to higher prices. Nevertheless, restoring the fertilizer sector to viable operating conditions in Eurasia is essential for sustaining stability in the global pricing environment (Bumb and Carlos 1996). According to World Bank 2014, fertilizer prices continued in 2014 by falling 6.5%. The fertilizer price index was expected to decline almost 15% in 2014 and an additional 1.5% in 2015—this came on top of the 17% declined in 2013.

1.3 Roles of Fertilizer in Myanmar

1.3.1 Fertilizer production

Chemical fertilizers were first introduced to Myanmar in 1956, but widespread use did not occur until 1978 when the government encouraged fertilizer use by subsidizing fertilizer prices. Therefore, fertilizer prices were heavily subsidized by the government before 1990s. Since then, the government had removed the subsidies on all. Subsequently, the market prices have risen to international level and the government has also allowed the private sector to import and distribute fertilizers. Despite the increases in prices, few private companies were willing to import and distribute fertilizer because of uncertain domestic demand and unclear importing procedures. Therefore, the fertilizer price was totally free market price based on the international fertilizer price, transportation cost and exchange rate between currency of Myanmar and trade partners after 2003 (Hnin Yu Lwin et al. 2013).

Since 2002, the government has attempted to boost imports by providing import duty exemptions; this has increased private sector trade in the fertilizer sector. In 1st October 2002 the government created the Fertilizer Law that explains the laws and regulations for fertilizer utilization, production, and distribution. The objectives of this Law were (a) to enable supporting the development of agricultural sector which is the basic economy of the State; (b) to enable supervision and control the fertilizer business systematically; (c) to enable growers

to use fertilizer of quality in conformity with the specifications; (d) to support the conservation of soil and environment by utilizing suitable fertilizer; (e) to enable carrying out of educative and research works extensively for the systematic utilization of fertilizer by the agriculturalist; and (f) to cooperate with government departments and organizations, international organizations and local and foreign non-governmental organizations regarding fertilizer business (http://laws.myanmars.net).

The domestic fertilizer industry in Myanmar is concentrated around the production of urea fertilizer from the abundant sources of natural gas in the country. Fertilizer plants in Myanmar are scattered in Salay, Kyunchaung and Kyaw Swa**,** and another production of urea fertilizer from two new fertilizer plants, Myaung Daga in Hmawbi Township and another in Kan Gyi Dauk of Pathein Township, will support domestic requirements in future (Tin Maung Shwe 2011). Those are all State Owned Enterprises (SOEs).

Myanmar produced only 100,000 tons of fertilizer annually at home and another 900,000 tons are needed to meet the heavy demand of 1 million tons of it for crop cultivation (en.trend.az/capital/business/1386274.html). Domestic production depends mainly on imported raw materials such as rock phosphate, anhydrous ammonia, sulfuric acid and other finished fertilizer grades which are needed in the blending process of fertilizer production (Briones 2014).

In 2012 and 2013 years 208,615 and 156,586 MT of urea fertilizer could be produced (MOAI 2014). The domestic fertilizer industries in Myanmar mostly produce urea fertilizer. Myanma Petrochemical Enterprise (under the Ministry of Energy) has five state-owned fertilizer factories (Table 1.1), but only three of these are operational and production has been stagnant due to the limited availability of natural gas which is primarily exported to generate foreign exchange. Thus, supplies of gas to the urea plants have been decreasing. The total production of urea fertilizer was fluctuated year by year as a result of the availability of natural gas. Smaller amounts of compound fertilizer, bio-fertilizer and foliar fertilizers are produced by both SOEs and private companies from imported materials. Fertilizer production is not enough to meet local demand because of a lack of raw material. The deficit fertilizer supply has encouraged increase of imports. In other words, the demand for fertilizer exceeds domestic production, large quantities of fertilizer were imported (Moe Thida Kyaw 2012).

1.3.2 Fertilizer importation, consumption and distribution

In Myanmar, there are several importing fertilizer companies such as Awba, Golden Lion, Golden Key, Armo and so on. Chemical fertilizers are mainly imported from Middle

Eastern and Asian countries, including United Arab Emirates, Kuwait, China, Bangladesh and Malaysia. Fertilizer imported from Thailand and China is mostly urea, compound and phosphate fertilizer (Hnin Yu Lwin et al. 2013). Myanmar imported 125,000 tons of fertilizer through border trade in the year 2008-09. Import of urea fertilizer was annually increased about 20% in 2008 and 2009. In 2012, urea fertilizer imports in Myanmar were 26.190 MT (www.factfish.com/.../Burma). Fertilizer imports in 2009 were about 16,523 MT for nitrogen fertilizer, 250 MT for phosphate fertilizer, 603 MT for potassium fertilizer and 11,884 MT for compound fertilizer (CSO 2011). In 2012, fertilizer imports in Myanmar were 35,858 tons in nitrogen fertilizer, 21,750 tons in phosphate fertilizer, potassium fertilizer was 16,547 tons (FAO online database). Thus, the country relies on foreign markets for the provision of most fertilizers.

Domestic total fertilizer consumption can be estimated by the summation of domestic urea fertilizer production and imported fertilizer amounts. Fertilizer consumption measures the quantity of plant nutrients used per unit of arable land. Ministry of Agriculture and Irrigation (MOAI) observed that the rate of fertilizer use in 2008/09 reduced slightly further compared to the previous year, due to higher input prices. However, the slight reduction in fertilizer use may not affect the crop yield significantly (MOAI 2008).

Fertilizer consumption (% of fertilizer production) in Myanmar was last measured at 177.22 % as of 2012 (www. indexmundi.com/…/Myanmar/fertilizer-consumption). In 2012, the total consumption of fertilizer in Myanmar was 131,769 tons in nitrogen fertilizer, 21,750 tons in phosphate fertilizer and 16,547 tons in potassium fertilizer (FAO online database). Myanmar's fertilizer consumption is constrained by heavy dependence on rain fed crops and moderate levels of irrigation. Myanmar has an irrigation potential of up to 5 million hectares but only around 2 million hectares are currently irrigated (Irrigation department). As a result, Myanmar experiences two main cropping seasons that runs from May to October and the end of October to April every year. Within this period, fertilizer use is mostly concentrated in the irrigated areas and within the months of monsoon (May through September). The use of fertilizer fluctuated according to the cropping season. After reducing the government control on input market since 1990s, it is difficult to find out the actual picture of fertilizer consumption in Myanmar (Hnin Yu Lwin et al. 2013).

Before 1990s, the Ministry of Agriculture and Irrigation (MOAI) was mainly responsible for the distribution of domestically produced urea fertilizer and imported fertilizer to farmers and State owned farms with the cheap price. After liberalized the fertilizer market, the MOAI distributed less proportion of domestically produced fertilizer

and imported fertilizer to the State owned farms and enterprises with the market price. Domestically produced fertilizers can be purchased directly from the three operational fertilizer factories by local traders and farmers with a buying permit from the Myanma Petrochemical Enterprise (MPE) headquarters. This method of distribution avoids price manipulation by traders and increases direct distribution to farmers, which reduces transaction costs. Also to ensure availability and efficient delivery of fertilizer products to farmers, fertilizer importing companies open fertilizer depots in most major cities to provide local storage and services.

The amount of fertilizer distributed by MOAI was less than the total amount of utilized fertilizer. Farmers are able to procure fertilizers on the open market from private traders. Table 1.2 shows that the distribution of fertilizer by MOAI was 13,612 metric ton in 2006-07, and it was decreased to 5,707 metric ton in 2010-11 (CSO 2011).

Table 1.1 Capacity of domestic fertilizer producing factories

Plant	Year of operation started	Design capacity (MT/day)	
		NH_3	Urea
Salay	1970	120	465
Kyunchaung	1971	120	207
Kyaw Swa	1985	360	600
Myaung Daga	2010	350	500
Kan Gyi Dauk	2011	350	500
Total		1,300	2,272

Source: Ministry of Energy, 2013

Table 1.2 The distribution of major agricultural inputs by MOAI (MT)

Particular	2006-07	2007-08	2008-09	2009-10	2010-11
Fertilizers	**13,612**	**7,687**	**10,570**	**6,866**	**5,707**
Urea	8,953	6,254	6,622	4,770	4,588
T-Super	863	304	234	208	171
Potash	316	208	205	140	182
Compound	3,480	921	3,509	1,748	766

Source: CSO, 2011. Myanmar Agricultural Statistics (1997-2011). MNPED, Myanmar.

1.4 Research Problem

The use of inorganic fertilizer is seen as an important way to potentially improve productivity and increase agricultural output, and therefore bring substantial improvements to their incomes, lives, and well-being (Feder et al. 1985). Lack of sufficient incentives, lack of subsidies, and inappropriate technical support services constrain farmers' ability to use the optimal level of fertilizer. Input use of chemical fertilizers in crop production of Myanmar was estimated to be very low according to Hossain and Singh (2000), and the rate of total fertilizer consumption in Myanmar was the lowest among all major cereal producing countries in Asia.

Fertilizer needs to formulate and implement several measures to improve fertilizer use, but improved access to fertilizers at the village level will be the critical one. Accordingly it will be ensured adequate access of fertilizer at the affordable price for farmers. The major problem in fertilizer sector of Myanmar is marketing management along the supply chain. In the domestic fertilizer marketing, price uncertainty can decrease market efficiency, response and productivity. The performance of market participants in the fertilizer marketing can influence the marketing efficiency.

In Nay Pyi Taw Council area, Tatkon Township is one of the largest agricultural production areas and income from agricultural sector mainly influenced the households' income. Consequently, Tatkon Township is one of the most fertilizer marketing Townships in Mandalay regions. In order to improve agricultural productivity, well- functioning fertilizer markets are also necessary to be carried out in Tatkon Township. Investigating fertilizer supply chain and market structure to develop well fertilizer marketing system is crucial in this township.

On the other hand, fertilizer prices are varied and fluctuated according to the seasons and spatial differences. In this sense, market integration testing methods are important because empirical findings elucidate market conditions, which in turn are central to the modeling of an economy. Market integration concerns the free flow of goods and information- and thus prices- over form, space, and time and is thus closely related to concepts of efficiency. With the present situation, it has become necessary for the country to know adequate information on the current fertilizer market especially on activities and functions of market participants, and fertilizer marketing channels. The domestic market should be integrated with international market for the development of fertilizer market that implies the prices movements in two markets tie together in the long run and commodities arbitrage could be working between the two markets.

Therefore, market integration between domestic and international fertilizer markets play very important role to know the effects of different fertilizer marketing and fluctuation of fertilizer price in Myanmar. Thus, price integration is one of several necessary conditions for market integration and the economic study on the supply of fertilizer and price integration are needed to be carried out with the following objectives.

1.5 Objectives of the Study

The general objective of this study is to investigate the fertilizer supply chain and market structure in Tatkon Township. The specific objectives of this study are-

1. To identify marketing activities of market participants along the fertilizer supply chain including end users (farmers) in Tatkon Township
2. To examine fertilizer market structure including marketing channel, marketing cost and marketing margin in Tatkon Township and
3. To study the fertilizer price integration during 2010 to 2014 period.

CHAPTER II

LITERATURE REVIEW

2.1 Fertilizer Supply Chain and Market Structure

Fertilizer supply chain starts at the port of the fertilizer factory and ends with the farmer. Supply chains (SC) trace the transformation and value added at each stage of a process leading from raw materials to final products. The fertilizer supply chain links together fertilizer producers, traders/distributors, wholesalers/dealers, retailers and farmers (Wanzala, Bumb and Groot 2009).

Fertilizer market structure is defined as characteristics of the organization of a market, which seems to influence strategically the nature of competition by pricing behavior within the market. Structural characteristics may be used as a basis for classifying markets. Markets may be perfectly competitive, monopolistic, or oligopolistic. The four salient aspects of market structures include the degree of seller concentration, the degree of buyer concentration, the degree of product differentiation, and the condition of entry. Fertilizer market structure indicates all the firms engaged in a particular fertilizer marketing channel (Scott 1995).

Fuentes et al. (2012) stated the marketing/ distribution networks and cost structure of the domestic supply chain in the Nigerian fertilizer market. Each of the stages along the supply chain in Nigeria had a significant effect on cost as a result of associated factors that influence their cost, such as: (a) poor infrastructure and market coordination inefficiencies related to inadequate ports and poor road conditions (especially rural roads); (b) weak and underdeveloped marketing and retail networks; (c) weak institutional and regulatory environment; (d) lack of knowledge and technical assistance, etc. Fertilizer prices paid by farmers were the result of high transaction costs along the domestic supply chain (in addition to soaring international prices and transportation). This was perhaps due to an inefficient distribution structure and ineffective marketing. Improving these factors will positively affect the functioning of Nigeria's fertilizer supply chain and reduce transaction costs.

Fuentes et al. (2012) mentioned that Senegal in West African having a natural resource base for producing fertilizer (mainly phosphate rock), the country imported the bulk of fertilizer consumed, while its resource base was being used to produce intermediate products such as phosphoric acid (P_2O_5) for exportation and then use in the elaboration of compound fertilizer products abroad. Part of the reasoning for this process was that the country's small market size, with estimated imports of 73,000 MT during the 2008‑09

season, may not justify investing in production and fertilizer blending facilities to meet the domestic demand and consumption.

Chianu et al. (2008) investigated that the number of agro-inputs dealers in Western Kenya had been growing. This study interviewed 130 agro-input dealers in Kenya to analyze challenges and opportunities in input delivery. Results indicated that there had been a steady annual growth (2-22%, with mean of 16%) in their number. Other services provided by agro-inputs dealers were input information (75%) respondents, credit (13%), bulk breaking (8%) and spraying (4%). Inputs selling price increased with distance to markets; long distances to market disconnect villages from input supply chain. High transport cost (53%), low demand (30%), lack of market information (21%), lack of storage facilities (13%), and limited business knowledge (12%) were the most important constraints faced by agro-dealers. Policies and institutional frameworks suggested by dealers to streamline input trade were associated.

The fertilizer sold by the fertilizer company in Vietnam in 1999 was mainly from suppliers in Indonesia and Qatar. Urea was used for the production of rice. The distribution of fertilizer to the Mekong Delta for the rice production was mainly done through about 20 dealers in Ho Chi Minh City (HCMC) that works as intermediaries between the importers and the local wholesale networks. These dealers kept stocks and speculated in rise and fall in fertilizer prices. They also traded among each other, and a pile of fertilizer could occasionally changed owner several times without moving from the warehouse. In the provinces of the Mekong Delta there were some big wholesalers that bought fertilizer from the dealers in HCMC and transported it up the rivers. These wholesalers usually had a network of retail shops and smaller wholesalers. They might also have a retail outlet themselves where they sold directly to the farmers (Viswanadham et al. 2000).

Cambodia is a net fertilizers' importer. It has no fertilizer manufacture plant, but until recently a blending fertilizer plant was constructed in 2009 and started to operate in late 2012 or early 2013 by Vietnam's Five Star International Group. The annual blending capacity was around 350,000 tons of NPK fertilizers in its first phase of operation, and the full capacity was around 500,000 tons per annum. According to the Cambodian Prime Minister, it was estimated that Cambodia needed about 617,000 tons per annum. Therefore, the local production still did not respond to the local market demand. The Five Star Group produced NPK fertilizers with international standard quality and thus could be competed with import products by Cambodia importers. Normally, the local country factory faced serious

challenges with import products, and thus it needed appropriate strategy to compete in the market (Penh 2013).

Briones (2014) stated that fertilizer marketing in Philippine passed through three levels, namely: importers/manufacturers; distributors/wholesalers; and dealers/retailers. Distributors typically operated in one province and sold to dealers, and dealers sold to end users, i.e. farmers. Distributors could also sell directly to farmers or large plantations, and might also have a dealer's license. In some areas there might be area distributors whose operations spanned multiple provinces and who supplied distributors. As of 2012 there were 483 licensed handlers in the fertilizer industry, spanning importation, distribution, repacking, export, and manufacturing. Of these, 150 were listed as importers; 8 handlers were also listed as end-users (e.g. large plantations). Many more handlers were farmer cooperatives or associations (e.g. sugar planter organizations) who distributed fertilizer to their members. Hence, even if there were entry barriers to fertilizer marketing, these were not so high as to limit the number of players.

Bumb et al. (2011) investigated that four key importers in Ghana dominate the fertilizer supply chain: Yara/Wienco, Chemico, Golden Stork, and Dizengoff. They accounted for 95 percent of fertilizers imported in 2009. In 2009, Ghana imported and used 218,000 tons of fertilizer products; yet its fertilizer use intensity was very low at 4 kg ha^{-1} of nutrients in 2008. The main products imported and used were urea, Ammonium Sulfate (AS), Diammonium Phosphate (DAP), NPK 15-15-15, and other NPK products and blends. Among them, Yara/Wienco seems to have the longest and most dominant presence in the country in terms of market share. These importers are supported by 20 to 25 wholesalers (the distinction between importer and wholesaler is blurred as importers also act as wholesalers) and 2,700 retailers and stockists, spread across 107 districts. Importers provided 30-day consignment credit to wholesalers, and wholesalers to retailers, but most wholesalers and retailers used their own resources to purchase and sell fertilizer. This supply chain dominated the country’s fertilizer market.

Ariga and Jayne (2011) found that no private traders imported fertilizer in Uganda for sale to smallholders in 1994. Since then a wholly private-sector-managed fertilizer supply system has been put in place. The government had not subsidized fertilizer supply for smallholder farmers since the reforms of the 1990s. Importers generally also served as the main fertilizer wholesalers in Uganda, while often having a retail side to their business as well. In Uganda used fertilizer just as these reforms were gaining speed, argued that the noncompetitive, government-managed system of fertilizer importation and distribution in

place then restricted access of smallholders to fertilizer and, consequently, virtually no use of fertilizer by smallholders was seen. In 2010 Kenya imported an estimated 480,000 metric tons (MT) of fertilizer—10 times the amount brought into Uganda.

Gregory and Bumb (2006) mentioned that the market structure prevailed in many markets, several variants of the fertilizer supply chain exist in West Africa. In some supply chains, estate crop owners, SOEs, or government departments imported fertilizer products directly from the global market or regional markets and distribute inputs to farmers (in exchange for crop produce—an interlocked arrangement), thereby bypassing importers, wholesalers, and retailers. In others, non-governmental organizations and producer organizations deal directly with wholesalers and supply inputs to farmers, thereby bypassing retailers.

The fertilizer market in Mozambique started with importation by three main operators, namely: private inputs companies; sugar companies; and tobacco companies. There were three entry points for fertilizers in Mozambique including: Beira Port; Nacala Port; and South Africa (by truck). However, rural areas were not yet well-served by the input retail network (agro-dealers who sell seed, fertilizer and crop protection products) which results in poor access to these inputs. In fact, in many zones, farmers had to travel 30-40 or more kilometers (km) to buy inputs. These long distances not only increased the cost of fertilizers but also discouraged or impeded farmers to utilize these inputs. The importation of fertilizers by the private sector was generally in small amounts from South Africa and was transported by road, resulting in high transaction costs. The development of a fertilizer market required demand stimulation and development of a distribution value chain (Pitoro et al. 2007).

Alam et al. (2009) mentioned that there were six urea fertilizer factories and one TSP fertilizer factory under Bangladesh Chemical Industries Corporation (BCIC) in Bangladesh. The country has achieved self-sufficiency in urea, but in case of Triple Super Phosphate (TSP) and Single Super phosphate (SSP) (powder) Bangladesh has not yet achieved self-sufficiency and thus the country has have to import a portion of TSP, SSP and total quantity of Muriate of Potash (MOP) and other chemical fertilizer. There were 140 importers in Bangladesh. Recently, importers imported Diammonium Phosphate (DAP) from USA, TSP from China, MOP from Commonwealth of Independent States (CIS), SSP from India, Gypsum from India, Zinc from USA and Ammonium Sulfate (AS) from Korea. Dealers either lifted their fertilizer from local factories or imported from abroad. In case of urea and TSP they only collected the Delivery Order (DO) for receiving fertilizer from factory and sold it to sub dealers. The sub dealers were the small traders. They purchased fertilizer

mainly from wholesale dealers. Occasionally they collected fertilizer from the factories or imported by joint venture. It was found in the study areas that on an average sub dealers purchased 80 percent from dealers. They sold fertilizer to the farmer at fixed price.

Akter and Jaim (2012) showed that during the regime of liberalized fertilizer marketing system in Bangladesh, the farmers found the adulterated fertilizer sacks contained less than the specified quantities. The farmers thus paid higher prices for lower quantities. They were of the opinion that the fertilizer market was hostage to low quality fertilizers, imported mainly from India and China for higher rate of return by the importers. Prior to 2007 fertilizers were sold and distributed by some 4500 dealers registered with the Bangladesh Chemical Industries Corporation (BCIC). Fertilizer distribution was made on the basis of information recorded and recommendations of the Sub-Assistant Agricultural Officers (SAAOs). Farmers cannot be purchased fertilizer in excess of their requirements. The prices were fixed by the government and selling fertilizer outside the union was prohibited.

Fertilizers in India were generated only at chosen places and imported fertilizers arrive at seaports. The marketing system had to perform the transportation, selling and storage functions to farmers spread in the entire country. For fertilizers the marketing system has undergone vast alteration in terms of its mode of operation and capacity. Fertilizer marketing is a part of the agricultural development process that is used to ensure that the right products are available to the farmer at the right time and at the optimum price, consistent with the provision of a reliable service (Acharya 2004).

Qiao et al. (2003) stated that the importers benefit from input market and trade liberalization of fertilizer in China. They explored whether input markets had emerged to spread the benefits of increased production and more open access to international sources of fertilizer and analyze the extent to which fertilizer prices were burdened by transaction costs and the extent of price integration in fertilizer markets.

Huang and Chen (2003) investigated that the case of urea fertilizer in south China in 1997-1999, the estimated result showed that only 57% of markets showed signs that prices were moving together, while the number increased to 67% for the 2000-2002. They also founded that the falling prices for inputs, fertilizer had increased profits and provided incentive to increase production.

According to Capon and Hulbert (2007), after partial decontrol of potassium and phosphate fertilizers in New York, several fertilizer companies have entered the fertilizer imports field and fertilizer imports volumes have also increased substantially. Prior to

decontrol entire fertilizer imports were furnished. Nowadays there were dozens of big fertilizer companies managing imports of Muriate of Potash (MOP) and Diammonium Phosphate (DAP) directly. In 1994-1995 the imports volume of these two fertilizers was 15 and 16 lakhs tons respectively and during 2000-2001 has increased up to 30 and 35 lakhs tons.

2.2 Fertilizer Marketing Channel and Marketing Margin

Evaluation of fertilizer marketing system lies on the concept of marketing efficiency. Efficient market is defined as the transfer of goods from the producers to consumers at the least possible cost consistent with provision for services consumers desire which also requires a normal rate of return on equity for optimal resource allocation. Marketing channels are the alternative routes of product flows from producers to consumers.

The most direct market channel is from the producers straight to the consumers. The chain of intermediaries or middlemen through which the transaction of goods takes place between producers and consumers is known as a marketing channel. Marketing channel plays an important role in achieving the marketing objectives of any manufacturing enterprise (Alam et al. 2009).

Many researchers have studied the market performance by measuring the extent in order to fulfill the conditions required for a perfect competition. Literally, market access, concentration, and information are the limiting factors for perfect competition. However, markets are always less than perfect and it is a very rare case to fulfill simultaneously all the conditions for a perfectly competitive market. A marketing channel is an organized network of agencies and institutions which, in combination, perform all the activities required to link producers with users to accomplish the marketing task (Bennett 1988).

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 Uhi (2002) defined 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.

Alam et al. (2009) stated fertilizer marketing channel of Bangladesh. The results showed that 18 fertilizer dealers in Hatiya and Subarnachar of Noakhali district. They either took delivery of their fertilizer from factories or purchased from importers. To get delivery of fertilizer from the factory, they had to collect a delivery order. Dealers carried their fertilizer to their local sales centre by Sea truck. They sold fertilizer to sub-dealers and farmers. In case of Hatiya upazilla dealers purchased 80 percent fertilizer from factory and 20percent from importer. In Subarnachar upazilla dealers purchased 75 percent fertilizer from factory and25 percent from importer. Fertilizer marketing margin and net margin of Hatiya upazila were higher than that of Subarnachar upazila. Average gross margin of dealers and sub dealers for urea was Tk.147.00 and Tk 57.00 per quintal. On the other hand, average gross margin of fertilizer dealers and sub dealers for TSP was Tk. 169.00 and Tk. 64.00 per quintal respectively. Net marketing margin or profit was the highest for dealers for both urea and TSP.

Hossain and Haq (2010) found that the Private Sector Importers (PSIs) in Bangladesh were supposed to sell/ distribute the National Fertilizer Distribution Coordination Committee (NFDCC) allocated non-urea imported fertilizers through the Bangladesh Chemical Industries Corporation (BCIC) Dealers. But, they sold these to different agents. The PSI also gets supply from different unknown sources. Dealers reported that, to control the fertilizer market sometimes they sold fertilizers even at lower prices than the government fixed prices. Dealers had no idea, how they sold fertilizers at a lower price than the government fixed price. The mechanism identified was that, the empty bags of original fertilizers were refilled with lower quality fertilizers. Thus the whole fertilizer market remained volatile over the year due to PSIs control of fertilizer markets.

According to Theng (2012), the volumes of fertilizer in Cambodia handled by the main provincial dealers varied depending on the planting season. Transport costs varied according to the distance from the main warehouse to the distribution points; haulage costs were about USD 0.25 per bag per 100 km. District and village shops, being generally smaller with limited storage (less than 100 tons), usually ordered fertilizers during the planting seasons. Village retailers typically purchased fertilizers from the representatives of a main provincial dealer, although some also used different suppliers depending on the prices and services. Retailers' transactions were conducted in cash or on credit. Some provincial distributors and district retailers resold fertilizers to seasonal village traders who

sold directly to farmers. Seasonal traders generally resold fertilizer on credit to farmers, who repaid the loan at harvest time (3- 6 months).

Gross margins on fertilizer sales were estimated for three areas: Masaka, Kampala, and Mbale in Uganda. Retail gross margins were estimated to be 10.8% in Masaka, 14.18%in Kampala, and 37% in Mbale. For sales on a wholesale basis, gross margins were estimated to be 7.2% in Masaka, 8.9% in Kampala, and 24% in Mbale. The gross margins in Masaka and Kampala are reasonable due to the early stage of market development in Uganda. The gross margins in Mbale are too high; this can be explained to some extent by the risks associated with importation. The close proximity of the firms in Mbale to Kenyan suppliers should be resulted in a significant decline in gross margins as the market develops in terms of both sales volume and competitive pressures (IFDC 2003).

According to Kotler and Armstong (2003), marketing costs and margins are required to understand for all who involved with agricultural marketing. Formally, a marketing channel is a business structure of interdependent organizations that reach from the point of product or origin to the consumer with the purpose of moving products to their final consumption or destination. This channel may be short or long depending on kind and quality of the product marketed, available marketing services, and prevailing social and physical environment.

Marketing margin is studied to measure efficiency of markets. It is an attempt to evaluate economic or price efficiency. Generally, it refers to the difference between the retail price and the producer price. The marketing margin shows the fraction of the consumer expenditure on a commodity that is received by the producer and each of the marketing agents (Olukosi and Isitor 1990).

The marketing margin is difference between different levels of marketing channels. It captures 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 (Guvheya et al. 1998). Finally, the structure of market will play a role in determining the distribution of welfare as a result of changes in the market.

2.3 Market Integration

The background idea of the analysis of market integration is to study the degree of co-movement of price in spatially separated markets. The measure of price integration based on

the time series data shows that the presence of connection of markets and changes in the degree of integration should reflect changes in efficiency or transportation cost or both.

The notion of market integration measures the degree to which changes in market conditions in one market affect those in other markets (separated by time or space). Market integration analysis may include simple evaluation of whether or not there is physical trade between markets, evaluation of whether the difference in prices between two markets is about equal to the cost of transporting goods between the markets, or whether the prices in the markets tend to move together over time. Market integration typically is the result of traders moving product across markets when the price differential between those markets exceeds the costs of moving the product.

Barret (1996) mentioned that vertical market integration involves stages in marketing and processing channels, spatial integration relates spatially distinct markets, and inter-temporal integration refers to arbitrage across periods. If two markets are integrated, a shock to the price in one market should be manifest in the other market's price as well. Among perfectly segmented markets, price series should be independent. Co-movement of prices has thus become synonymous with market integration.

Movements in time series were normally classified into three components: first was a secular trend over time, cyclical changes within the trend is the second and last, residual movements of individual elements in the series away from the trends and cycles. Cyclical variations are often caused by seasonal influences which may include just one peak and through a year (Alexandar and Wyueth 1995). Therefore, price series should be tested for its seasonal movement in the long run.

Measures of integration have not advanced much, however. There have been several attempts to apply regression analysis to market integration but perhaps the best known was by Ravallion (1986), who used it to analyze the relationship between prices in different markets around the time of the 1984 famine in Bangladesh. By permitting each local price series to have its own dynamic structure (and allowing for any correlated local seasonality or other characteristics) as well as an inter linkage with other local markets, the main inferential dangers of the simpler bivariate model can be avoided.

The Ravallion introduced has been extended by several others since then, most notably by Timmer (1987) who applied it to the corn market of Indonesia and used it to construct an 'Index of Market Connection' (IMC) which provides an easily understood measure of short-run integration levels between two markets. Faminow and Benson (1990) applied it to hog prices in Canada, although stressing the importance of a prior understanding

of both market structure and institutions in order to interpret results and avoid coming to misleading conclusions about market integration.

Spatial market integration reflects the effects of price change in one market on another market. Theoretically, under the assumption of competitive market, when two markets trade, the product price in the import market equals to the price of export market plus transportation cost. At this case, the price change in the export market will induce a price change in the import market in the same direction and of the same degree. Therefore, the two markets are completely integrated. Spatial market integration has long-run market integration and short-run market integration. The former refers to such cases in which there exists a long run and stable price relationship between two markets. Short-run integration shows that the price change in one market in some period will bring "in the next period" (i.e. immediately) the price change in another market. Lack of spatial integration are basically, also those that cause market failures, such as (1) inadequate provision of public goods (such as infrastructure), (2) inefficient flow of information, (3) imperfect competition, and (4) incomplete or missing institutions for risk management like credit and insurance (Mendoza and Rosegrant 1995).

In integrated markets, an operated arbitrage process is limited by the price differences in time, form and space to the marketing costs. Markets that are not integrated may convey inaccurate price information, distorting the marketing decisions of rice producers and contributing to inefficient product movements (Tomek and Robinson 1990).

Sexton et al. (1991) explained a lack of market integration by three factors: (a) markets are autarkic, i.e., no arbitrage is possible because, for example, transaction costs are too high in relation to price differences or because of public market protection; (b) there are impediments to efficient arbitrage, e.g., trading barriers, imperfect market information, or risk aversion; (c) there is imperfect competition because of, for example, collusion or preferential access to scarce resources (e.g., transport, credit) that may lead to higher price differences between markets than transaction costs can justify.

According to Baulch (1997), studies on market integration provided information on market performance which is necessary for proper policy formulation and macroeconomic modeling. If markets are not spatially or inter-temporally integrated, it could be indicative that market inefficiencies exist as a result of, amongst others, collusion and market concentration which result in price fixing and distortions in the market. In such cases cross-sectional or inter- temporal aggregation of demand and supply loses its logical foundation. The result was that agricultural producers failed to specialize according to long run

comparative advantages and gains from trade would not be realized. This implied that if the assumptions of marketing integration hold, optimal allocation of scarce resources could be attained.

Lutz (1995) said that market integration among two or more markets is a multidimensional concept implying similarity in price variation (price integration), standardization of measures and common trade habits. Price integration is, therefore, one of several necessary conditions for market integration. In a competitive price market, price integration is the outcome of an arbitrage process: exchange (trade) between actors in different markets who aim to take advantage of price differences that exceed transaction costs.

CHAPTER III
RESEARCH METHODOLOGY

3.1 General Description of the Study Area

Tatkon Township was situated between latitude 20˚20' north and east longitudes 96˚ 30'. The area of Tatkon Township was 180,237 hectares and the cultivated area was 43,780 hectares, 24.3% of total area. The area of paddy land (Le) was about 21,145 hectares and dry land (Ya) was about 22,627 hectares (DoA 2014). Paddy and various kinds of vegetable were grown by most of the farmers in Tatkon Township. Therefore, the demand for fertilizer is increasing. Tatkon Township is one of the most fertilizer marketing Townships in Mandalay region. There are about 12 agrochemical fertilizer shops in Tatkon Township. Thus, to precisely examine the existence, performance and distribution of market intermediaries along fertilizer marketing channel, Tatkon Township was selected as the study area.

3.2 Data Source and Data Collection

3.2.1 Primary data collection

Primary data were gathered by using structured questionnaire in the study area. Field survey was conducted from the last week of January, 2015 to the first week of February, 2015. Primary sources included market intermediaries such as local wholesalers, village retailers, company agents and farmers. A total of 33 market intermediaries were personally interviewed in which 6 local wholesalers, 5 village retailers, 2 company agents and 20 farmers or end users (10 farmers from New Yit village, 5 farmers from Kyae Chaung village and the rest 5 farmers from Moe Hnan Khone village) were included. The detailed description is described in Table 3.1.

Demographic questionnaires investigated the socio-economic conditions of market participants, types of fertilizer in the market (registered and unregistered products), fertilizer distribution system, transport facilities, access to market information, constraints associated with marketing of fertilizer, cost and margin, marketing channel and profit. For farmers, demographic questionnaires investigated the socio-economic condition of sample farmers such as age, education level and farming experience. And also cultural practices such as their land type, crop production area, cropping pattern, various brands of fertilizer utilization were collected. In addition, sources and types of buying fertilizer and constraints associated with utilization of fertilizer were explored.

Table 3.1 Local wholesalers, village retailers, company agents and farmers in the fertilizer market, Tatkon Township

Item	Number	Description of market participants
Local wholesalers	6	(LW_1), (LW_2), (LW_3), (LW_4), (LW_5) and (LW_6)
Retailers in villages	5	(VR_1), (VR_2), (VR_3), (VR_4) and (VR_5)
Company agents	2	Diamond Star Company Limited
		Golden Lion High Tech Agricultural Resources Company Limited
Farmers	20	Nwe Yit village (10 farmers)
		Kyae Chaung village (5 farmers)
		Moe Hnan Khone village (5 farmers)

3.2.2 Secondary data collection

Monthly fertilizer prices of Yangon, Mandalay and International markets are officially released from Market Information Service (MIS) which is under of Department of Planning (DoP), Ministry of Agriculture and Irrigation (MOAI). The monthly fertilizer prices of urea, T-super and compound fertilizers from the period of January 2010 to December 2014 were collected. In total, 60 observations of monthly fertilizer prices were available. The secondary sources of data were applied to estimate fertilizer price integration between domestic markets and international market for the long term.

3.3 Methods of Analysis

3.3.1 Marketing channel, cost and margin analysis

The chain of intermediaries through which the transaction of goods takes place between producers and consumers is known as a marketing channel. Marketing channel plays an important role in achieving the marketing objectives of any manufacturing enterprise. For the marketing of the inputs such as fertilizer marketing costs and margins are required to understand for all who involved in the inputs marketing. Wholesalers, retailers, companies and importers of agro-chemical fertilizer must be fully aware of their costs if they want to trade profitably. At a particular stage of commodity flow marketing margin considered to be the difference between the purchase price and selling price of the commodity. According to Tomek and Robinson (1979), marketing margin may be defined alternatively as: (1) a difference between the price paid by the consumers and that obtained by producers or (2) the price of a collection of marketing services which is the outcome of the demand for and supply of such services.

Primary data were collected to estimate marketing cost and margin of market intermediaries in fertilizer marketing channel. In this analysis marketing margins of wholesalers and retailers were estimated by deducting the purchase price of fertilizer from its sale price. The net margin (profit) was calculated by deducting marketing cost from the marketing (gross) margin.

Marketing margins reflected both the cost of marketing and the profits of marketing agents. Thus, marketing margins were differences between prices at different events in the marketing channel. Marketing margin was examined for a common means of measuring market efficiency. This was an attempt to evaluate economic or price efficiency. Total Gross Marketing Margins (TGMM) of input market was differences between farm gate price and

wholesaler price of fertilizer. The following equations commonly used indicators were applied in the analysis.

Total Gross Marketing Margin (TGMM)

TGMM = (Farm Gate Price- Wholesale/Retail Price)/Farm Gate Price*100

Margin of Wholesaler = (Wholesale Selling Price-Wholesale Buying Price)/Farm Gate Price*100

Margin of Retailer = (Retail Selling Price-Retail Buying Price)/Farm Gate Price *100

3.4 Time Series Data Analysis

3.4.1 Stationary and non- stationary

An economic time series is either stationary or non-stationary. A stationary stochastic series has a constant mean, variance and covariance. It is time invariant, mean reverting, and fluctuations around its mean have constant amplitude. Non-stationary stochastic series have varying mean, or time varying variance. Perron (1989) reported that most macroeconomic time series are non-stationary stochastic processes and are not characterized by the presence of a unit root. Fluctuations are indeed stationary around a deterministic trend function. Statistical testing of unit root is crucial in the evaluation of the non-stationary that most time series data exhibit. If simply taking the first difference of the series can eliminate the non-stationary, it is known as a difference stationary process (DSP). The use of first differences to eliminate a linear trend will result in a residual that may be stationary but which is not white noise with a first lag negative autocorrelation.

In practice, it is more usual to deal with weak sense stationary, restricting attention to the means, variances and covariance of the process. Then, a stochastic process $\{P_t\}$ is said to be stationary if:

$E(P) = \text{constant} = \mu$; $Var(P) = \text{constant} = \sigma^2$; and: $Cov(X_t X_{t+j}) = \sigma_j$

Thus the means and the variances of the process are constant over time, while the value of the covariance between two periods depends only on the gap between the periods, and not the actual time at which this covariance is considered. If one or more of then conditions above are not fulfilled, the process is non-stationary (Harvey 1990).

3.4.2 Unit root test

Gujarati (2003) explained that most of time series variables are non stationary, with mean and variance non constant (unit root). If the data contained unit root, the data are called non stationary, which lead to spurious regression result. Therefore, the unit root test checks for stationary of the data series. It is very important to check the stationary for the time series data in order to avoid the spurious regression problem. The stationary variables are already qualified to enter the regression analysis, but the non-stationary variables are differenced to become stationary. Mean, variance and covariance of the series are constant over time in a stationary series. If a variable contains a unit root then it is non-stationary, regressions involving the series can falsely imply the existence of a meaningful economic relationship.

In principle it is important to test the order of integration of each variable in a model, to establish whether it is non-stationary and how many times the variable needs to be differenced to result in a stationary series. We used the unit root testing techniques to identify whether variables were stationary or not. Both the dependent and independent variables are stationary and that the errors have mean zero and constant variance, a common concern in standard regression models is the presence of unit roots in the series since most economic time series normally behave with stochastic trends. With evidence of unit roots, the series are said to be intergraded of order one I(1), meaning that they must be modeled in first differences ($\Delta y_t = y_t - y_{t-1}$) to make them stationary. A time series is stationary if it does not change overtime, which implies that its values have constant variability. Therefore, unit root tests account for possible correlation of unit roots in the first differences in the time series.

3.4.3 Co-integration test

Co- integration is a statistical tool for describing the co-movement of economic data measured over time, that is, co- integration attempts to measure common trends in series over the long run. Two (or more) non-stationary time series are said to be co- integrated if a linear combination of the terms results in a stationary time series. Prices movement from time to time and their margins are subject to various shocks such as market mechanism and government intervention. When long run linear relation exists among different price series, these series are said to co-integrate. Moreover, price changes would eliminate common trends that introduce spurious correlation (Engle and Granger 1987).

Co-integration analysis is an alternative procedure for evaluating spatial market linkage by taking the presence of stochastic trends in the price series into account. It was developed and applied in earlier work by Engle and Granger (1987). Co-integration analysis

ensures that deviations from equilibrium conditions between two economic variables which are individually stationary in the short-run should be stationary in the long-run. Intuitively, the concept of co-integration implies that economic forces should prohibit persistent long-run deviations from equilibrium, even though short-run deviations may be observed (Goodwin and Schroeder 1991 and Negassa et al. 2003). Co-integration thereby admits instability in market margins, which needs only to be stable in the long-run, but not fixed (Barrett 1996). Therefore, if market prices are co-integrated, thus, the markets concerned are integrated (Alexander and Wyeth 1994, Goletti and Babu 1994, Goletti, Ahmed and Farid 1995, Dercon 1995, Goodwin and Schroeder 1991, Negassa et al. 2003). In other words, market integration is an indication of interdependence.

Co-integration analysis involves several steps. The first step is to determine the order of integration of the univariate price series using appropriate unit root tests. Second, if both prices are integrated of the same order, run a co- integrating regression of one series on the other. Third, apply unit root tests to the residuals from the co integration regression. The absence of a stochastic trend in the residual from the co-integration regression indicates that there is a co-integrating (long-run equilibrium) relationship between the two price series. Fourth, if co-integration is accepted, error correlation models can be developed to study the short-run relationships (Engle and Granger 1987).

Co-integration has been regarded by many researchers as unabsolute but a measure of degree of market integration (Goodwin and Schroeder 1991). Spatial market prices that diverge from each other for a long time would have a weak long run relationship while two prices that co-move are likely to be co-integrated. Co-integration may be assumed unnecessary, because price can be co-integrated without the market being integrated or efficient (Baulch 1997, Negassa et al. 2003, and Barrett 1996).

According to Baulch (1997), a co-integration test may be deemed as being both an unnecessary and insufficient condition for a measure of spatial market integration. It is an unnecessary condition because if transfer costs are non-stationary, arbitrage between two markets may be efficient even when their price series are not co-integrated. It is an insufficient condition, because the price series may be co-integrated but their price differentials may be too small to offset the transfer cost. The practical importance of co-integration is not as a test for market integration but as a pre-test for other tests of market integration (Alexander and Wyeth 1994).

Johansen (1988) developed a multivariate method of co-integration analysis, which uses maximum likelihood to test the hypothesis of co-integrating relationships among several

economic time series. Generally speaking, the different methods for market integration discussed above depend on the assessment of the co-movement of price series, or the long run relationship between prices, and were found to have several weaknesses.

Co-integration among series may be used to test for long-run equilibrium relationship. Although prices may vary in the short-run, they will move closer to each other or towards a common "equilibrium" value (Ardeni 1989). Since the major assumption in co-integration tests is that transaction costs are stationary, we can say that spatial prices will move close to each other in an efficient market.

The Granger co-integration approach assumes a stationary marketing margin for markets to be integrated. However, if transaction costs are non-stationary lack of co integration can also be consistent with market integration. Also, if the markets are subject to co-integration supply and or demand shocks, macroeconomic shocks (for example, money supply or interest rates), speculation or overreaction, then price can be co-integrated without market integration or market efficiency (Pindyck and Rotemberg 1990).

3.4.4 Augmented Dickey- Fuller (ADF) test

While analyzing time series data, it is important to check the order of integration of the variables. Augmented Dickey-Fuller (ADF) unit root test are used at level form and first difference of each series. The Augmented Dickey Fuller (ADF) test is a valuable tool whenever the time series is generated by stochastic difference equation with a couple of suspected unit roots along with the roots that are stationary (or no explosive) roots. The Dickey- Fuller test (DF) was constructed on the assumption of an independently normally distributed error term. Based on the criticism of the DF test, Dickey and Fuller augmented the test by adjusting it to take care of possible serial correlation in the error term. The augmented Dickey-Fuller test (ADF) includes lagged difference terms of the regress (Gujarati 2003). Engle and Granger (1987) recommended ADF test statistics based on its performance and showed that the ADF test and other proposed tests are similar when the data set follows a vector random walk by independently and identically normally distributed innovations. This phenomenon has been criticized, based on assumptions of error being independently and normally distributed with zero mean and constant variance.

3.4.5 Granger causality test

The Granger causality test is a technique for determining whether one time series is useful in forecasting another time series. Granger-causality can go in one direction between

two variables, both ways, or there is no Granger-causality at all. In time series data, events happen dynamically as time goes by. If event A happened before B, we may say A is a causal factor for event B. In econometric analysis, we usually define variables as dependent (Y) and explanatory variables (X_i). In time series analysis, we can test the long-term relationship between variables of interest.

The Granger causality test can be conducted not only for level stationary but also for differenced stationary series. If the Granger causality test holds, it suggests X Granger causes Y. We can then interpret that the past values of X have explanatory power for Y, or X might be causing Y. Checking causality for the differenced stationary series, we may conduct more complicated two step procedures (Engle and Granger 1987).

The methodological and analytical problems associated with correlation coefficient as a test of market integration analysis gave rise to the popularity of regression based causality test methods. The series X_t is said to cause Y_t if it is possible to obtain better predictions of Y_t when using all available information than if only the information apart from X_t had been used (Granger 1969, 1988). Further, X_t causes Y_t directly if the predictability of Y_t is improved by considering the current value of X_t in addition to all past Y_t and X_t. Granger causality may be unidirectional or bi-directional. If X_t Granger cause Y_t and Y_t Granger also cause X_t, then bi-directional Granger causality (a simultaneous feedback relationship) is said to exist. If the causality relation only runs in one direction, unidirectional Granger causality holds; and if the null hypothesis of no Granger causality cannot be rejected in both directions, the markets are said to be independent or segmented. Several causality test methods have been formulated (Sims 1972, Haugh 1976, Horowitz 1981, Geweke 1984, Wu 1983, Holmes and Hutton 1990).

If two market regions are integrated for a commodity, a disturbance in price in one region will spill over into the other and the interdependence of price formation should not be rejected by the data. In contrast, if the two regions are sufficiently distinct, there should be no feedback from price shocks across regions and the interdependence should be rejected by the data. The causality tests using regression formulations were very popular in early 1980s for testing of market integration (Bessler and Brandt 1982, Gupta and Muller 1982, Slade 1986).

A significant innovation in the application of the causality concept in the study of market integration came from Ravallion's (1986 - 1987) dynamic model. His formulation allows for long-run price adjustment between markets to take time but nests within it a test for short-run market integration. The Ravallion model postulates a redial configuration of markets in which each regional market is directly linked in trade with the central market. The

Ravallion's dynamic model has all the property of the earlier developed causality models and at the same time is capable of distinguishing between different forms of market integration. Recently, the model has been applied in the co-integration framework to test for exogeneity as well as indicating the direction and strength of causality in price formation between markets (Palaskas and Harriss 1993, Alexander and Wyeth 1994 and 1995, Dercon 1995, Mendoza and Rosegrant 1995).

Causality reflects the fact that price changes in the location towards which causation moves, occur both after, and in a way which is related to price changes in the location from which the causation comes. To test for Granger causality, runs bivariate regressions in the form

$$y_t = \alpha_0+\alpha_1 y_{t-1}+---+\alpha_i y_{t-i}+\beta_1 x_{t-1}+---+\beta_i x_{t-i} \quad (1)$$

$$x_t = \alpha_0+\alpha_1 x_{t-1}+---+\alpha_i x_{t-i}+\beta_1 y_{t-1}+---+\beta_i y_{t-I} \quad (2)$$

for all possible pairs of (x,y) series in the group. The reported F-statistics are the Wald statistics for the joint hypothesis

$$\beta_1 = --- = \beta_i = 0$$

for each equation. The null hypothesis is therefore that *x* does not Granger-cause *y* in the first equation and *y* does not Granger-cause *x* in the second equation. For instance, if we cannot reject the hypothesis that *x* does not Granger cause *y*, then the F-value is insignificant ($P<0.1$). Conversely, if the null hypothesis is that y does not Granger-cause x, and the F-value is significant ($P<0.1$), then we reject the null hypothesis that *y* does not Granger-causes *x*. The two tests showed that the Granger causality runs one-way, from *y* to *x* and not the other way.

CHAPTER IV
RESULTS AND DISCUSSION

This section described the socio-economic and demographic characteristics of the market participants such as local wholesalers, village retailers, company agents and farmers along the fertilizer marketing channel in Tatkon Township. In this study, attempts were also endeavored to determine the marketing functions and channels of fertilizer market in the study area.

4.1 General Characteristics of the Fertilizer Market Participants in Tatkon Township

According to the market survey, there were three main fertilizer market participants along the fertilizer marketing channel in Tatkon Township. They were local wholesalers, village retailers and company agents who were actively involved in the fertilizer market. Among them, local wholesalers were the most prominent market participants in the market. The socio-economic characteristics of local wholesalers, village retailers and company agents such as age, experience, education and other business are shown in Table 4.1. The average age was found orderly as 40.5, 42.4 and 29.5 years for local wholesalers, village retailers and company agents. Local wholesalers were in middle – aged group (35-48 years) and village retailers composed of young to aged group (25-58 years). The company agents were young between 28-31 years. The business experience of local wholesalers was 10.83 years which ranged from 3 to 23 years and that of the village retailers was 4.4 years which ranged from 2 to 7 years. For company agents, working experience was 8 years ranged from 7 to 9 years. Therefore, business experience of local wholesalers was the highest among the market participants. About 75% of local wholesalers were in high school level education and the rest 25% was in graduate level. The 25% each of village retailers were in primary, secondary, high school and graduate education level respectively. And all sampled company agents got the bachelor degree. The surveyed market participants, except in the case of company agents, carried out not only fertilizer marketing but also other business. The 50% of local wholesalers worked farming activities as a secondary occupation and the rest 50% were in other commodity marketing. On the other hand, 75% of village retailers had farming activities and the rest 25% were doing other commodity marketing activities.

Table 4.1 Socio-economic characteristics of the fertilizer market participants in Tatkon Township

Characters	Local wholesalers (N=6)	Village retailers (N=5)	Company agents (N=2)
Age(year)			
Mean	40.5	42.4	29.5
Range	35-48	25-58	28-31
Standard Deviation	4.76	12.97	2.12
Experience (year)			
Mean	10.83	4.4	8
Range	3-23	2-7	7-9
Standard Deviation	9.47	2.07	1.41
Education level (% of respondents)			
Primary level	-	25	-
Secondary level	-	25	-
High school level	75	25	-
Graduate level	25	25	100
Other Business (% of respondents)			
Farming	50	75	-
Other commodity marketing	50	25	-

4.2 Marketing Functions of Local Wholesalers in Tatkon Township

4.2.1 Business size of local wholesalers

In this study, six local wholesalers were interviewed to determine the fertilizer marketing functions and marketing channels in Tatkon Township. Business sizes of local wholesalers were distinguished according to the annual sale amounts of fertilizers (Table 4.2). In the fertilizer market, Tatkon Township, local wholesalers were marketing only registered urea fertilizers, and additional selling of both registered and unregistered compound fertilizers. Based on the survey data, the amounts of total annual sale by the sampled local wholesalers were (2,934.04) MT in which the sales of registered urea fertilizers, registered compound fertilizers and unregistered compound fertilizers were 60%, 32% and 8% respectively.

Local wholesalers (LW_1) and (LW_2), the largest local wholesalers mostly sold registered urea fertilizers which were 64% and 70% of total annual sale. About half of total annual sale of local wholesalers (LW_3) and (LW_5) were registered compound fertilizers. Local wholesaler (LW_4) was distinctly handling the registered and unregistered compound fertilizers which were 36% each of total annual sale. The smallest local wholesaler (LW_6) mainly sold registered urea fertilizer which accounted for 67% of the total annual sale. According to this result, registered urea fertilizers was one of the most supplies in the fertilizer market and the registered compound fertilizers was the second most important fertilizers in the study area. The supplies of unregistered compound fertilizers were the lowest among the fertilizers in the study area.

4.2.2 Business cycle and peak sale months of local wholesalers

The business cycle is the periodic but irregular up-and-down movements in economic activity. All local wholesalers except the local wholesaler (LW_6) sold their fertilizers throughout the whole year. The local wholesaler (LW_6) sold their fertilizers from April to October because they mainly sold to rice farmers. The peak sale months of local wholesalers were different among them. The peak sale months of local wholesaler (LW_1) were the months of July and August. Both local wholesalers (LW_2 and LW_3) mostly sold from August to September. The peak sale months for local wholesaler (LW_4) were from June to October. The months, April and May were peak sale months for local wholesaler (LW_5). Local wholesaler (LW_6) mostly sold from June to August. August and September were the common peak sale months for all local wholesalers except for local wholesaler (LW_5) who sold fertilizer to summer rice growing farmers (Table 4.3).

4.2.3 Marketing activities of local wholesalers

The local wholesalers were the main intermediaries and usually operated large-scale business activities in the study area. Marketing activities of local wholesalers developed a market or demand for fertilizer, and then sold to the potential buyers such as village retailers, retailers in Tatkon Township and farmers. The following Table 4.4 showed annual sale of registered urea fertilizers in terms of trading brands by local wholesalers in Tatkon Township. All local wholesalers sold registered urea fertilizers imported from China and domestically produced urea. As the urea fertilizer is the most important nitrogenous fertilizer, there are several reasons for urea fertilizer to be the king of fertilizers. Firstly, it has high nitrogen content about 46 percent. Secondly, it is a white crystalline organic chemical compound. It is neutral and can adapt to almost all the land. Thirdly, urea is widely used in the agriculture sector as a fertilizer.

In the urea fertilizers market, there were four trading brands sold by local wholesalers Shwe Taung (97%), Shwe Nagar-1 (2%), Shwe Nagar-2 (0.8%) and domestically produced urea (0.2%). One bag of urea fertilizers contained different weight in kilogram (kg). Shwe Taung and domestically produced urea fertilizers included the weight of 50 kg per bag while Shwe Nagar-1 and Shwe Nagar-2 had 40 and 25 kg per bag. Imported from China, locally named, Shwe Taung was the most popular urea fertilizer among urea fertilizers in the market. All local wholesalers sold mainly Shwe Taung urea fertilizer which occupied 85 to 100% of the urea fertilizer annual sale. The local wholesalers (LW_1 and LW_3) sold Shwe Nagar-1urea fertilizer which accounted 0.7% and 15% of total annual sale. On the other hand, Shwe Nagar-2 accounted for 3% and 3.8% of total annual sale was sold by LW_2 and LW_5. Domestically produced urea fertilizer which occupied 0.3% to 0.2% of total annual sale respectively was sold by LW_1 and LW_5. Therefore, the most popular brand Shwe Taung urea fertilizer occupied (97%) of the amounts of total annual sale 1,766.04 MT.

In case of the marketing of compound fertilizers, there were many trading (locally named) brands in the study area such as Awba, Armo, Golden Cock, Pender, Kie Mie Yar (MC), Golden Key, Golden Lion, Zar Ma Ni, Mahkota and other brands etc. Compound fertilizer, here refers to at least any two kinds of nutrients among nitrogen, phosphorus, potassium which has good features of high nutrient, less sub-component, good chemical physical properties and so on. Compound fertilizers have great important function to balancing fertilizer, increasing fertilizer efficiency and high production. Those compound fertilizers were imported and registered by companies such as products of Awba by Myanma Awba Group Company Limited, Armo by Diamond Star Company Limited, Golden Cock by

TPT Yee Shin Company Limited, Pender by Hlyan Lone Company Limited, Kie Mie Yar (MC) by Thai Central Chemical Public Company Limited, Golden Key by Golden Key Company Limited, Golden Lion by Golden Lion High Tech Agricultural Resources Company Limited, Zar Ma Ni by Mandalay Distribution and Mining Company Limited, and Mahkota by Resources Group Trading Company Limited.

The following Table 4.5 mentioned the types of available fertilizer in terms of nutrient (N, P, K) content of each trading brand by each imported company. The types of fertilizer product were varied according to the nutrient content and the price of fertilizer. Although several types of fertilizer were available in the Tatkon market, the nutrient (N, P, K) ratio (10:10:5) and (15:15:15) were the most popular compound fertilizer products in each trading brand because those products were reasonable price to farmers and effective on their crops.

The marketing of registered compound fertilizers by the sampled local wholesalers in Tatkon Township was investigated as shown in Table 4.6. The local wholesaler (LW_1) was a dealer of Awba product therefore mainly sold products of Awba (65.7% of total annual sale). Armo and Kie Mie Yar (MC) compound fertilizers were the second top sale commodities for local wholesaler (LW_1). And local wholesaler (LW_3) was a main dealer of products of Golden Cock (53%) and Zar Ma Ni (31%). The top sales of local wholesaler (LW_2) were products of Armo, Golden Key and Golden Lion which were 29%, 20% and 15% of total annual sale respectively. Local wholesalers (LW_4 and LW_5) mostly sold Awba and Armo products which were almost one third of total sale. Products from Awba again occupied big share 62% of total annual sale by the smallest local wholesaler (LW_6).

Table 4.2 Annual sale amount of fertilizers by local wholesalers in Tatkon Township

Local wholesalers	Annual sale amount (MT)			
	Registered urea fertilizers	Registered compound fertilizers	Unregistered compound fertilizers	Total
LW_1	1,010 (64)	433.5 (28)	126 (8)	1,569.5 (100)
LW_2	513 (70)	170 (23)	50 (7)	733 (100)
LW_3	159 (40)	238 (60)	-	397 (100)
LW_4	38(28)	50 (36)	50 (36)	138(100)
LW_5	26.04 (39)	34.5 (52)	6 (9)	66.54 (100)
LW_6	20 (67)	7 (23)	3 (10)	30 (100)
Total	1,766.04 (60)	933 (32)	235 (8)	2,934.04 (100)

Note: Figures in the parentheses represent percentage.

Table 4.3 Business cycle and peak sale months of local wholesalers in Tatkon Township

Local wholesalers	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
LW_1	←											→
LW_2	←											→
LW_3	←											→
LW_4	←											→
LW_5	←											→
LW_6				←						→		

Note: ←→ = Business cycle, ▬ = peak sale months

Table 4.4 Annual sale of registered urea fertilizers by local wholesalers in Tatkon Township

Local wholesalers	Registered urea fertilizers(MT)				Total (MT)
	Shwe Taung	Shwe Nagar-1	Shwe Nagar-2	Domestic urea	
LW_1	1,000 (99)	7 (0.7)	-	3 (0.3)	1,010 (100)
LW_2	500 (97)	-	13 (3)	-	513 (100)
LW_3	135 (85)	24 (15)	-	-	159 (100)
LW_4	38 (100)	-	-	-	38 (100)
LW_5	25 (96)	-	1 (3.8)	0.04 (0.2)	26.04 (100)
LW_6	20 (100)	-	-	-	20 (100)
Total	1,718 (97)	31 (2)	14 (0.8)	3.04 (0.2)	1,766.04 (100)

Note: Figures in the parentheses represent percentage.

Table 4.5 The trading compound fertilizer brands in Tatkon Township

No.	Imported and registered companies	Trading brands	Types of available fertilizer (N,P,K content)
1	Myanma Awba Group Co., Ltd	Awba	(10:10:5), (15:15:15),(15:10:20), (20:10:10)
2	Diamond Star Co., Ltd	Armo	(10:10:5), (15:15:15), (16:16:16), (19:9:19)
3	TPT Yee Shin Co., Ltd	Golden Cock	(10:10:5), (15:15:15), (20:0:5), (31:9:sulphur), (16:16:8:13)
4	Hlyan Lone Co., Ltd	Pender	(15:15:15)
5	Thai Central Chemical Public Co., Ltd	Kie Mie Yar	(15:15:15)
6	Golden Key Co., Ltd	Golden Key	(10:10:5), (15:15:15)
7	Golden Lion High Tech Agricultural Resources Co., Ltd	Golden Lion	(15:7:8), (13:13:21), (18:12:6)
8	Mandalay Distribution and Mining Co., Ltd	Zar Ma Ni	(10:10:5), (15:15:15), (13:5:7)
9	Resources Group Trading Co., Ltd	Mahkota	(15:15:15)

Table 4.6 Annual sale of registered compound fertilizers by local wholesalers in Tatkon Township

Local wholesalers	Annual sale of registered compound fertilizers (MT)										Total (MT)
	Awba	Armo	Golden Cock	Pender	Kie Mie Yar (MC)	Golden Key	Golden Lion	Zar Ma Ni	Mahkota	Other brands	
LW_1	285 (65.7)	50 (12)	-	20 (5)	50 (12)	12 (2)	-	-	1.5 (0.3)	15 (3)	433.5 (100)
LW_2	15 (9)	50 (29)	-	15 (9)	20 (12)	35 (20)	25 (15)	-	-	10 (6)	170 (100)
LW_3	-	5 (2)	125 (53)	25 (11)	-	8 (3)	-	75 (31)	-	-	238 (100)
LW_4	14 (27)	10 (20)	-	8 (16)	5 (10)	5 (10)	2 (5)	-	6 (12)	-	50 (100)
LW_5	10 (29)	10 (29)	-	1 (3)	3 (9)	10 (29)	-	-	0.5 (1)	-	34.5 (100)
LW_6	4(62)	1 (15)	-	-	2 (23)	-	-	-	-	-	7 (100)
Total	328 (35)	126 (14)	125 (13)	69 (7)	80 (9)	70 (7)	27 (3)	75 (8)	8 (1)	25 (3)	933 (100)

Note: Figures in the parentheses represent percentage.

In the case of selling of unregistered compound fertilizers, there were only two trading brands (local name), Butterfly and Lu Yine Khaung compound fertilizers. Those compound fertilizers were supplied from Myingyan market. According to the survey data, Butterfly was the top sale (51%) followed by Lu Yine Khaung (49%) of total annual sale of unregistered compound fertilizers (Table 4.7).

Fertilizer repackaging was occurred in the study area. One bag of fertilizer in which contained the weight of 50 kg was sold by the sampled local wholesalers in Tatkon Township. In addition, all local wholesalers also sold small amount or small bag by repackaging from 50 kg bag. In repackaging, the sizes of fertilizer bag were varied one pyi (about 2.2 kg) which was minimum amount to sell, and from (1) viss to maximum (15) viss. The smallest local wholesaler (LW_5 and LW_6) repackaged 10.51% and 16.67% of their total annual sale. About 0.95% and 1.36% of total annual sale were repackaged by the largest local wholesalers (LW_1 and LW_2). According to this survey, the largest local wholesalers mostly sold as the original bag of 50 kg. Even though, the smallest local wholesalers largely sold as smaller amount of repackage because of their small scale business. Therefore, the smaller their business size, the more practice of repackaging system were found (Table 4.8).

Figure (4.1) showed the commodities flow of local wholesalers in Tatkon Township. The local wholesalers mostly purchased fertilizers from other markets such as 87% of total commodities from Mandalay market, 8% from Myingyan market and 4% from Yangon market. Only 1% of total sale bought from local company agents. And then the local wholesalers directly sold 73% of total annual sale of their fertilizers to the farmers, 19% to village retailers and 8% to retailers in Tatkon Township.

A large amount of fertilizer including urea and compound fertilizers utilized in Myanmar were imported from China through border point, Muse. In addition, because of sale promotion by the fertilizer importing companies, wholesalers from Mandalay market who handled large amount of fertilizer purchased and sold with cheaper price and consequently became big dealers in fertilizer market. Therefore, all local wholesalers in Tatkon Township purchased fertilizers mainly from Mandalay market and then followed by Myingyan market, Yangon market and company agents for fertilizer distribution. Low transportation costs from Mandalay to Tatkon were the main reason why they bought from Mandalay market. Mandalay which is the nearest market to China border becomes the major suppliers of China fertilizer.

The local wholesalers purchased not only China urea but also domestically produced urea fertilizers from Mandalay market by cash down payment transaction. And they also used

cash down payment transaction in selling urea fertilizer. Mode of transportation system was especially by truck in the study area (Table 4.9).

The transactions of imported compound fertilizers by local wholesalers in Tatkon Township were mostly cash down payment. About 66% of local wholesalers purchased fertilizers by cash down payment transaction, 17% of them utilized both cash down and credit system and the rest 17% purchased by credit system. When they purchased by credit system, an interest rate of 3% per month has to be paid. About 50% of local wholesalers sold fertilizer by cash down payment transaction and the rest 50% sold by credit system. Credit-based sales applied an interest rate of 5 percent per month. They used truck as a means of transport. About 17% of local wholesalers stored about 2 months at their home shop (Table 4.10).

All local wholesalers paid several taxes for fertilizer marketing in the study area. The types of taxes were fertilizer license fees, revenue tax, municipal fees and signboard fees which accounted 50,000 MMK, 65,000 MMK, 20,000 MMK, and 5,000 MMK per year (Table 4.11).

4.2.4 General constraints of local wholesalers

In this study, some constraints were faced by the local wholesalers in fertilizer marketing. About 83% of local wholesalers faced difficulty in fertilizer marketing because farmers delayed to pay the debt to the local wholesalers when their production output was low. In addition, 67% of them met high price fluctuation particularly in urea fertilizer which was depending upon Myanmar and China currency exchange rate. About 50% of them met problems in domestically produced urea because of its fertilizer granule inconsistency, dissolved and poor packaging. Therefore, marketing of domestically produced urea fertilizer was not successful. Furthermore, 33% of them suffered from high tax payment and consequently high investment and less profit were faced. Additionally, each 17% of local wholesalers faced high price, fertilizer shortage at the peak sale period, and high transportation cost when purchased from Yangon market (Table 4.12).

Table 4.7 Annual sale of unregistered compound fertilizers by local wholesalers in Tatkon Township

Local wholesalers	Annual sale of unregistered compound fertilizers (MT)		Total (MT)
	Butterfly	Lu Yine Khaung	
LW_1	63(50)	63(50)	126(100)
LW_2	25(50)	25(50)	50(100)
LW_3	-	-	-
LW_4	25(50)	25(50)	50(100)
LW_5	3(50)	3(50)	6(100)
LW_6	3(100)	-	3(100)
Total	119(51)	116(49)	235(100)

Note: Figures in the parentheses represent percentage.

Table 4.8 Annual sale of repackaged urea fertilizer and compound fertilizers by local wholesalers in Tatkon Township

Local wholesalers	Total annual sale amount (MT)	Repackages (MT)	
		Amount	% of total sale
LW_1	1,569.5	15	0.95
LW_2	733	10	1.36
LW_3	397	15	3.78
LW_4	138	8	5.80
LW_5	66.54	7	10.51
LW_6	30	5	16.67

Note: Figures in the parentheses represent percentage.

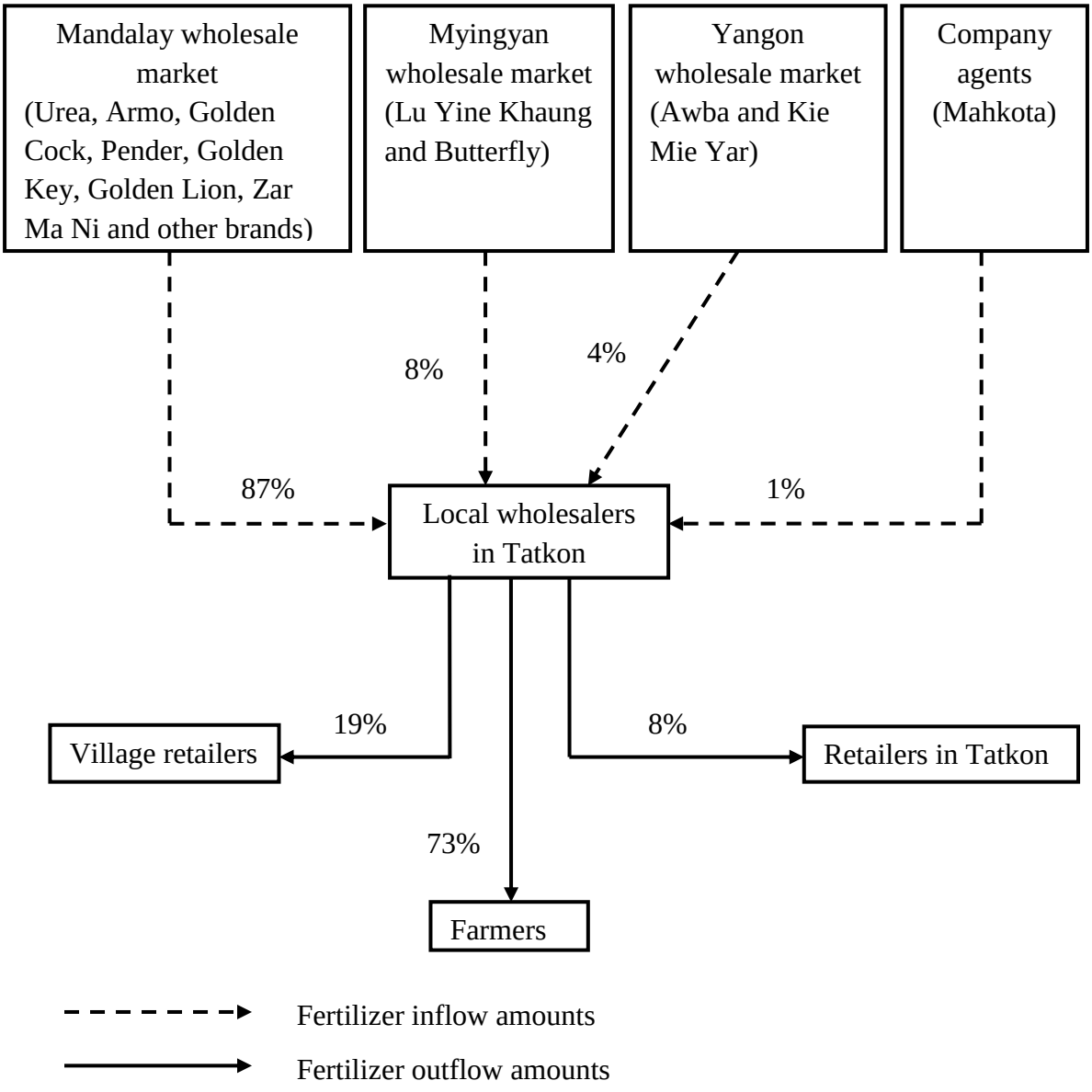


Figure 4.1 Fertilizer inflow and outflow of local wholesalers in Tatkon Township

Table 4.9 Marketing activities of the local wholesalers for urea fertilizer in Tatkon Township (N=6)

Marketing Activities	% of urea fertilizer
Type of transaction	
Purchasing	
-Cash down payment	100
Selling	
-Cash down payment	100
Mode of transport	
-By truck	100

Table 4.10 Marketing activities of the local wholesalers for compound fertilizers in Tatkon Township (N=6)

Marketing Activities	% of local wholesalers
Type of transaction	
Purchasing	
-Cash down payment	66
-Cash down and credit	17
-Credit system	17
Selling	
-Cash down payment	50
-Credit system	50
Mode of transport	
-By truck	100
Type of storage	
-At home	17

Table 4.11 Miscellaneous cost of fertilizer markets

Type of payment	Cost (MMK/ year)
Fertilizer license fees	50,000
Revenue tax	65,000
Municipal fees	20,000
Sign Board fees	5,000

Table 4.12 General constraints of local wholesalers in fertilizer marketing

Item	% of local wholesalers
Delayed payment from farmers	83
High price fluctuation	67
Low quality of domestically produced urea	50
High tax payment	33
High price in purchasing	17
Fertilizer shortage	17
High transportation cost	17

4.3 Marketing Functions of Retailers in the Selected Villages

4.3.1 Business size of village retailers

Village retailers were the second most important intermediaries in the fertilizer marketing channel through which fertilizers were reached to the final users or farmers. They reported that fertilizers were purchased mostly from the local wholesalers in Tatkon Township, from other markets and sometimes from company agents in Tatkon Township.

Compared to business sizes of local wholesalers, village retailers' business sizes were also varied according to their annual sale amounts of fertilizers (Table 4.13). In the selected villages of Tatkon Township, two out of five village retailers were selling registered urea fertilizers. Furthermore registered compound fertilizers were marketing by all village retailers and unregistered compound fertilizer was sold by one out of five village retailers. According to the survey outcome, total annual sale of fertilizer by the sampled village retailers were 192.5 MT in which the sales of registered urea fertilizer, registered and unregistered compound fertilizers were 64.9%, 35% and 0.1% respectively.

Among the sampled village retailers; (VR_1 and VR_2) were the largest retailers who mostly sold registered urea fertilizer which were 72% and 63.3% of total annual sale. Only registered compound fertilizers were sold by village retailers (VR_3), (VR_4) and (VR_5). According to this finding, registered urea fertilizer especially Shwe Taung was one of the most supplies and registered compound fertilizers was in second.

4.3.2 Business cycle and peak sale months of village retailers

The largest (VR_1 and VR_2) and the smallest village retailers (VR_5) sold fertilizer for the whole year. The months, February, July and August were the sale months for village retailer (VR_3) because he mainly sold to summer and monsoon rice growing farmers. The village retailer (VR_4) sold from June to October. The peak sale months of the largest village retailer (VR_1) were the months of October and December. The peak sale months for village retailer (VR_2) were from October to January. Village retailers (VR_3) and (VR_4) mostly sold from July and August. The months, from March to August were the peak sale months for the smallest village retailer (VR_5). Based on the result, November and December were the common peak sale months for the largest village retailers (VR_1 and VR_2) because they mainly sold to vegetable growing (cabbage and cauliflower) farmers. And village retailers (VR_3, VR_4 and VR_5) mainly sold to monsoon rice growing farmers. Therefore, July and August were the peak sale months for them (Table 4.14).

4.3.3 Marketing activities of village retailers

Table 4.15 presented annual sale of registered urea fertilizers in terms of trading brands by village retailers in Tatkon Township. Only the largest village retailers (VR_1 and VR_2) sold registered urea fertilizers imported from China, locally named, Shwe Taung. The rest village retailers did not sell because farmers in those villages purchased mainly from the local wholesalers in Tatkon Township.

In case of selling of registered compound fertilizers, there are several trading (local name) brands in the selected villages such as Golden Cock, Mahkota, Armo, Golden Lion and Awba and so on. Those compound fertilizers were imported and registered by companies which were already mentioned in marketing activities of local wholesalers.

The type of fertilizer product was diverse according to the nutrient content and the price of fertilizer varied according to nutrient (N, P, K) content ratio. In the selected villages, although numerous types of fertilizer were available, the nutrient (N, P, K) ratio (10:10:5) and (15:15:15) were the most popular fertilizer products in each trading brand because those products were reasonable price to farmers and effective on crops (Table 16).

The marketing of registered compound fertilizers by the sampled retailers in selected villages at Tatkon Township was investigated as shown in Table 4.17. The largest village retailer (VR_1) mainly sold products of Golden Cock which occupied 69% of total annual sale. The second top sale commodities for village retailer (VR_1) were Mahkota and Golden Lion which took 14% for each. The total annual sale 86% was products of Mahkota which was the majority commodity for the second largest village retailers (VR_2). Only the products from Golden Cock and Armo were the major sale by village retailer (VR_3). Village retailer (VR_4) was a dealer of products of Golden Cock. Furthermore, the smallest village retailer (VR_5) sold Armo because of a dealer of Armo product. Unregistered compound fertilizer was not much deal in the marketing. Only Lu Yine Khaung unregistered compound fertilizer was sold by village retailer (VR_2)

Two out of five village retailers sold small fertilizer bags by repackaging from the weight of 50 kg per bag. The largest village retailers ($VR_1$and VR_2) repackaged 4.58% and 4.22% of total annual sale. In repackaging, the size of fertilizer bag was only pyi (about 2.2 kg) in marketing. The rest village retailers sold as the weight of 50 kg (Table 4.18).

Table 4.19 presented the marketing activities of the village retailers in the selected villages of Tatkon Township. Only two out of five village retailers sold urea fertilizer. For urea fertilizer market, the entire village retailers purchased by cash down payment

transaction, and they also used to sell by cash down payment transaction. They used truck for transportation. And 50% of village retailers stored about 2 months at their shops.

About 40% of village retailers purchased by cash down payment transaction and 60% of them used to purchase by credit system. When they purchased by credit system, they have to pay an interest rate of 3% per month. All village retailers utilized credit system to sell fertilizer with an interest rate of 5% per month. They especially used truck in mode of transport. About 20% of village retailers stored about 2 months at their shops (Table 4.20).

4.3.4 General constraints of village retailers

Markets constraints were faced by retailers in the selected villages at Tatkon Township were investigated as shown in the following Table 4.21. About 60% of village retailers faced delayed payment from farmers when their production output was low. In addition, 40% of them indicated poor quality of domestically produced urea because of its fertilizer granule inconsistency, dissolved and poor packaging. Therefore, marketing of domestically produced urea fertilizer was not successful and farmers did not prefer it. Moreover, fertilizer shortage was faced by 20% of village retailers at the peak sale period.

Table 4.13 Annual sale amount of fertilizers by village retailers in Tatkon Township

Village retailers	Annual sale amount (MT)			
	Registered urea fertilizers	Registered compound fertilizers	Unregistered compound fertilizers	Total
VR_1	95(72)	36.1(28)	-	131.1(100)
VR_2	30(63.3)	17.3(36.5)	0.1(0.2)	47.4(100)
VR_3	-	8(100)	-	8(100)
VR_4	-	3(100)	-	3(100)
VR_5	-	3(100)	-	3(100)
Total	125 (64.9)	67.4(35)	0.1(0.1)	192.5(100)

Note: Figures in the parentheses represent percentage.

Table 4.14 Business cycle and peak sale months of retailers in selected villages in Tatkon Township

Village retailers	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
VR_1	←										▰	→
VR_2	← ▰									▰		→
VR_3		↔					← ▰	→				
VR_4						←	▰			→		
VR_5	←		▰					▰				→

Note: ↔ = Business cycle, ▰ = peak sale months

Table 4.15 Annual sale of registered urea fertilizers by retailers in selected villages

Village retailers	Annual sale of registered urea fertilizer (MT)	Total (MT)
VR_1	95(100)	95(100)
VR_2	30(100)	30(100)
Total	125(100)	125(100)

Note: Figures in the parentheses represent percentage.

Table 4.16 The trading fertilizer brands in the selected villages

No.	Imported and registered companies	Trading brands	Types of available fertilizer (N,P,K content)
1	TPT Yee Shin Co., Ltd	Golden Cock	(15:15:15), (20:0:5), (10:6:12), Phosphate only
2	Resources Group Trading Co., Ltd	Mahkota	(15:15:15)
3	Diamond Star Co., Ltd	Armo	(10:10:5), (19:9:19)
4	Golden Lion High Tech Agricultural Resources Co., Ltd	Golden Lion	(15:7:8), (13:13:21)
5	Myanma Awba Group Co., Ltd	Awba	(10:10:5), (15:10:20), (20:10:10)

Table 4.17 Annual sale of registered and unregistered compound fertilizers by retailers in the selected villages

Village retailers	Annual sale of compound fertilizers (MT)						
	Registered					Unregistered	Total (MT)
	Golden Cock	Mahkota	Armo	Golden Lion	Awba	Lu Yine Khaung	
VR_1	25(69)	5(14)	0.1(0.3)	5(14)	1(2.7)	-	36.1(100)
VR_2	2(11)	15(86)	-	0.1(1)	0.2(1)	0.1(1)	17.4(100)
VR_3	4(50)	-	4(50)	-	-	-	8(100)
VR_4	3(100)	-	-	-	-	-	3(100)
VR_5	-	-	3(100)	-	-	-	3(100)
Total	34(50.3)	20(29.6)	7.1(10)	5.1(8)	1.2(2)	0.1(0.1)	67.5(100)

Note: Figures in the parentheses represent percentage.

Table 4.18 Annual sale of repackages for imported urea fertilizer and compound fertilizers by village retailers in Tatkon Township

Village retailers	Total (MT)	Repackages (MT)	
		Amount	% of total sold
VR_1	131.1	6	4.58
VR_2	47.4	2	4.22
VR_3	8	-	-
VR_4	3	-	-
VR_5	3	-	-

Note: Figures in the parentheses represent percentage.

Table 4.19 Marketing activities of the retailers of urea fertilizer in selected villages in Tatkon Township (N=2)

Marketing Activities	% of village retailers
Type of transaction	
Purchasing	
-Cash down payment	100
Selling	
-Cash down payment	100
Mode of transport	
-By truck	100
Type of storage	
-At shop	50

Table 4.20 Marketing activities of the retailers of compound fertilizers in selected villages in Tatkon Township (N=5)

Marketing Activities	% of village retailers
Type of transaction	
Purchasing	
-Cash down payment	40
- Credit	60
Selling	
-Credit system	100
Mode of transport	
-By truck	100
Type of storage	
-At shop	20

Table 4.21 General constraints of village retailers in fertilizer marketing

Item	% of village retailers
Delayed payment from farmers	60
Low quality of domestically produced urea	40
Fertilizer shortage	20

4.4 Information of Fertilizer Importing Companies

Among the 254 fertilizer importing companies, Diamond Star, Golden Lion, and Myanma Awba are the largest fertilizer importing companies. To import and register fertilizer, companies must receive approval from MOAI and an import license from the Ministry of Commerce. Most licensed fertilizer companies import NPK compounds by sea for CIF Yangon prices (Hnin Yu Lwin et. al 2013).

4.4.1 Information of Diamond Star Company Limited

4.4.1.1 Fertilizer marketing flow

Based on the findings of the market survey, Diamond Star Company Limited were mostly imported fertilizer brands from China, Korea, Vietnam and Thailand. Imported fertilizer from China was mostly consigned from China border area through Muse border gate. Fertilizer imported from Korea, Vietnam and Thailand was brought in via Yangon Sea port. Yangon market was the primary market for Diamond Star Company Limited to distribute fertilizers to the whole nation. Imported compound fertilizers were distributed to all over Myanmar particularly to Yangon, Bago, Magway, Ayeyarwaddy, Shan, Sagaing, Mandalay and Mawlamyaing. Among these regions, Sagaing and Mandalay were the higher fertilizer demanded regions in the last year 2013-2014. The fertilizer marketing flow of Diamond Star Co., Ltd was shown in (Figure 4.2).

4.4.1.2 Marketing strategy

Marketing strategy and practices were different among the marketing participants. The marketing strategy and practices included staffing for expanding the fertilizer marketing over the nation and sale promotion activities such as providing bonus to the staffs when the target sale was achieved and supplying sale discounts to the customers such as extra fertilizer bags for large amount of purchase. In this section, the marketing practices of Diamond Star Company Limited were explored. The Diamond Star Company Limited allotted about 350 staffs in the country. About 70 staffs each were assigned in the highly fertilizer demanded regions such as Sagaing and Mandalay in 2013-2014. Among these two regions, Mandalay was the most fertilizer demanded Township. In order to promote the sale by encouraging staffs, the Diamond Star Company Limited offered sale promotion service or bonus service to the staffs. If the staffs can sale more than target amounts of fertilizer in the respective region, they can receive the bonus which is 10 times of monthly salary in a year.

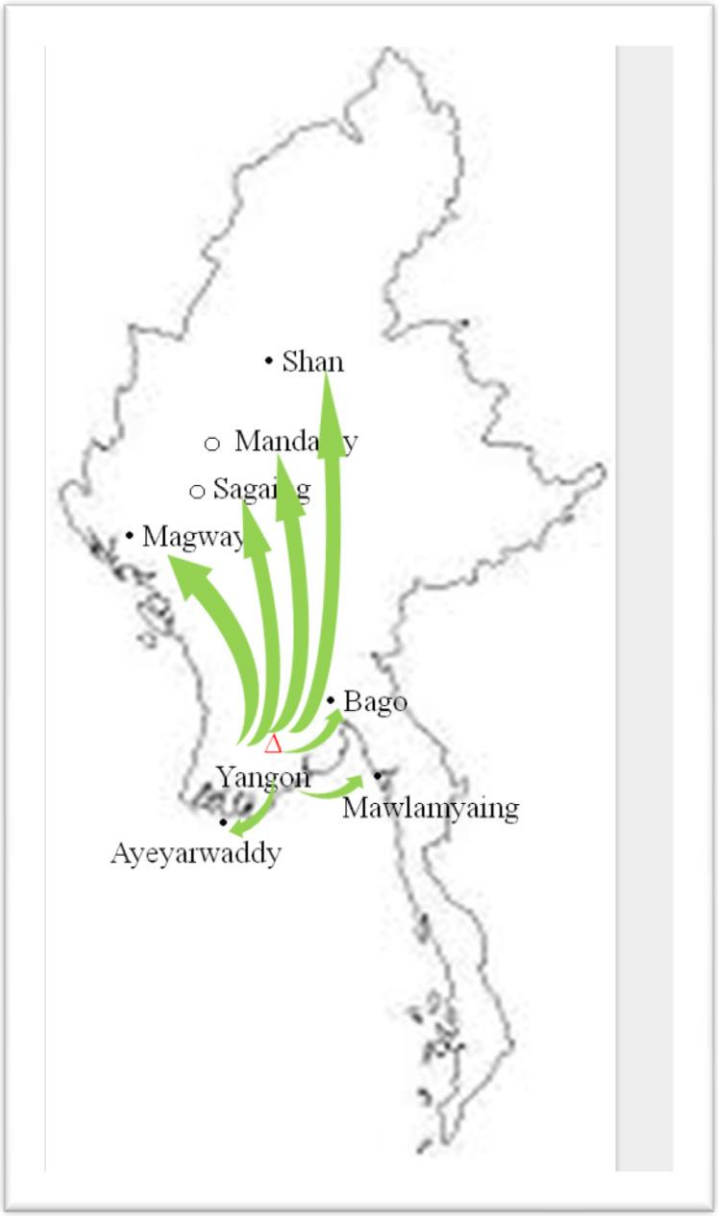
In addition, fertilizer companies specified sale promotion opportunity to the customers to be more demanded to their products. Promotion service was carried out depended upon large amount of purchase to market intermediaries especially in rainy season (from May to June) and winter season (from October to November). Therefore, if the customers especially local wholesalers purchased large amount of 50 bags or 100 bags, they could collect extra one or three bags. Most farmers did not purchase large amount due to lack of capital. Sometimes, Diamond Star Company Limited supplied as discount 2,000 MMK per bag to the farmers. Additionally, if the farmers bought 1 bag, they could get small gifts such as T-shirt and soap etc. In this study, farmers and market intermediaries obtained bonus service.

4.4.1.3 Marketing behavior

The fertilizer marketing behavior of company agents from Diamond Star Company Limited in Tatkon Township were classified in this section. Tatkon Township was one of the most fertilizers demanded in Mandalay region. And trading fertilizer brands [(15:15:15), (10:10:5), (19:9:19), (potash only) and (phosphate only)] from Diamond star Company Limited were the most popular in the study area. The company agents mainly served as field staffs and marketing extension agents for their commodities in Tatkon Township. Therefore, company agents usually provide extension education lectures on effective fertilizer usage depend on type of crops, 3 times per year to the farmers to introduce the fertilizer products from Diamond Star Company Limited.

The company agents mainly distributed their products about 97% of total annual sale to local wholesalers and local retailers, and 3% of total annual sale flowed to the farmers. The following Table 4.22 showed the amounts of annual sale from Diamond Star company agents in Tatkon Township. Imported five trading brands were marketing in the study area. Among them, the nutrient (N, P, K) ratio (15:15:15) (65%) and (10:10:5) (20%) of total annual sale were the top sale brands in the market. In fertilizer marketing, the company agent mostly sold by cash down transaction type but sometimes sold with credit system which was paid about one week with no interest rate depending upon the relationship with market participants.

There was a lot of market competition in domestic fertilizer marketing. Therefore, the company faced some marketing constraints. Occasionally, fertilizer shortage was met by Diamond Star Company Limited when boosted selling amounts in domestic market. Sometimes the company faced difficulty in marketing because of competitive with each other fertilizer companies in domestic market.



Δ = Primary port

○ = Highly fertilizer demanded regions

Figure 4.2 Fertilizer marketing flow of Diamond Star Company Limited

Table 4.22 Amounts of annual sale of fertilizer by Diamond Star Company Limited in Tatkon Township

Type of (N, P, K) content	Amounts of annual sale (MT)
15:15:15	50(65)
10:10:5	15(20)
19:9:19	10(13)
Potash only	1(1)
Phosphate only	1(1)
Total	77 (100)

Note: Figures in the parentheses represent percentage.

4.4.2 Information of Golden Lion High Tech Agricultural Resources Company Limited

4.4.2.1 Fertilizer marketing flow

Golden Lion High Tech Agricultural Resources Co., Ltd. were regularly imported their fertilizer brands from China and India. Imported fertilizer from China and India were mostly transported through Muse port. Therefore, the primary market for Golden Lion High Tech Agricultural Resources Co., Ltd was Mandalay market from which distributed fertilizers to the whole country. Imported compound fertilizers were spread to all over Myanmar particularly to Mandalay, Sagaing, Shan state, Magway, Bago, Yangon and Ayeyarwaddy. Among these regions, Sagaing, Magway and Ayeyarwaddy were the extremely fertilizer demanded regions in the previous year 2013-2014. The fertilizer marketing flow of Golden Lion High Tech Agricultural Resources Co., Ltd was shown in Figure 4.3.

4.4.2.2 Marketing strategy

In this section, the marketing practices of Golden Lion High Tech Agricultural Resources Co., Ltd were observed. The Golden Lion High Tech Agricultural Resources Co., Ltd allotted about 260 staffs in the country. About 50 staffs were assigned in each top fertilizer demanded regions such as Sagaing, Magway and Ayeyarwaddy in 2013-2014. Pyawbwe, Yamethin and Ayelar were also the top demanded Townships in Mandalay region. In order to promote the sale by encouraging staffs, the Golden Lion High Tech Agricultural Resources Co., Ltd also offered sale promotion service or bonus service to the staffs. If the staffs can sale more than target amounts of fertilizer in the particular region, they will receive bonus, that is, an extra of monthly salary in a year.

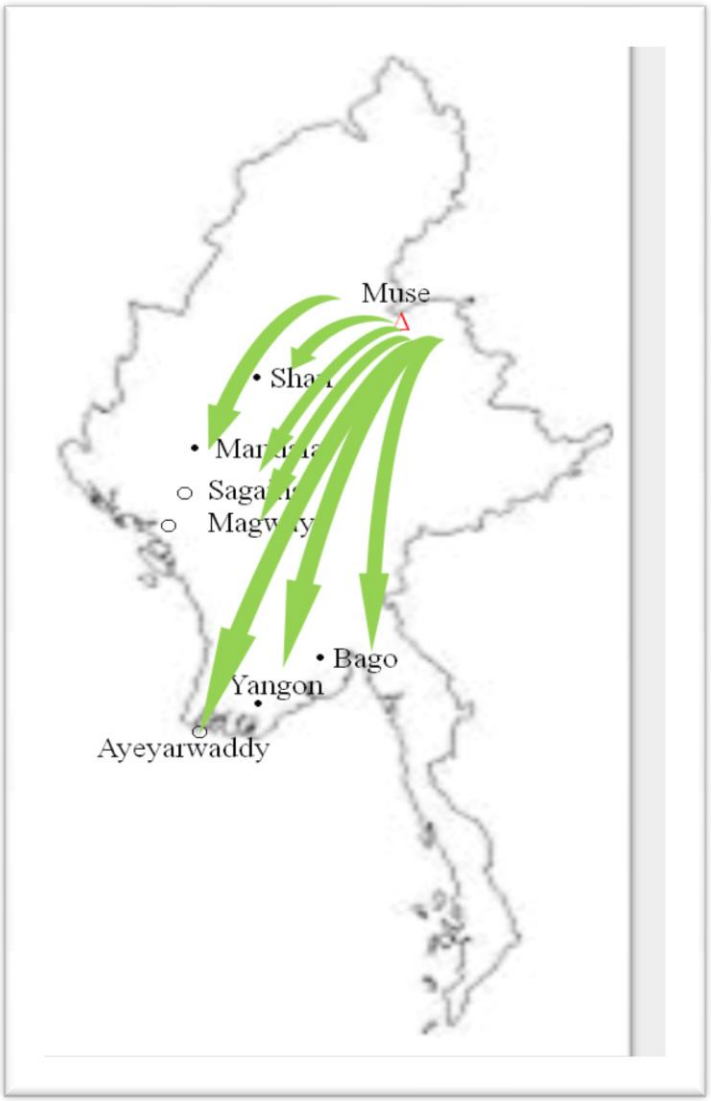
Promotions activities or bonus service depended upon amount of purchased by the market intermediaries especially in rainy season (from June to September) and summer season (from November to February). If market intermediaries purchased large amounts 30 bags, 50 bags or 100 bags, they could get extra 1 bag, 3 bags or 4 bags. Sometimes, Golden Lion High Tech Agricultural Resources Co., Ltd supplied sale discount to the farmers, 500 MMK per bag at low fertilizer usage season. In addition, the bonus service to farmers was that if they purchased 1 bag, they could obtain a T- shirt. Therefore, various kinds of bonus service can be offered to customers by Golden Lion High Tech Agricultural Resources Company Limited.

4.4.2.3 Marketing behavior

Based on the marketing survey with the company agent, it can be said that Tatkon Township was one of the most fertilizers demanded area. Trading fertilizer brands [(15:7:8), (10:10:5), (4:18:18) and (15:15:15)] from Golden Lion High Tech Agricultural Resources Company Limited were also the most popular in the study area. The company agents mainly served as field staffs and marketing extension for their commodities in Tatkon Township. Therefore, company agents usually provide extension education lectures on effective fertilizer usage depend on type of crops, 3 times per year to the farmers to introduce the fertilizer products from Golden Lion High Tech Agricultural Resources Company Limited.

The company agents mainly distributed their products about 61% of total annual sale to marketing intermediaries such as wholesalers and retailers in Tatkon Township. About 39% of total annual sale were spread to the retailers in villages. The following Table (4.23) explained the amounts of annual sale from Golden Lion company agents in Tatkon Township. Four imported trading brands were selling in the study area. The nutrient (N, P, K) ratio (15:7:8) which was 49% of total annual sale, the rest trading brands (10:10:5) and (4:18:18) which were 24% each of total annual sale were the peak sale brands in the local market. In fertilizer marketing, the company agents mostly used by cash down transaction type but occasionally sold with credit system to pay back within about one week or one month with no interest rate depending upon the relationship with market participants.

There was a lot of competition in domestic fertilizer marketing. Occasionally, fertilizer shortage was met by Golden Lion Company Limited when boosted selling amounts in domestic market. But the company faced low demanded fertilizer frequently when crop price was low.



Δ = Primary port

○ = Highly fertilizer demanded regions

Figure 4.3 Fertilizer marketing flow of Golden Lion High Tech Agricultural Resources Company Limited

Table 4.23 Amounts of annual sale of fertilizer by Golden Lion High Tech Agricultural Resources Company Limited in Tatkon Township

Type of (N, P, K) content	Amounts of annual sale (MT)
15:7:8	10 (49)
10:10:5	5 (24)
4:18:18	5 (24)
15:15:15	0.5 (3)
Total	20.5 (100)

Note: Figures in the parentheses represent percentage.

4.5 Information of Sample Farmers and Agricultural Characteristics

4.5.1 Socio – economic characteristics of the sample farmers in the study area

In this section, the socio-economic characteristics of the final users or farmers were described in Table 4.24. In the study area, average age of the sample farmers was around 48 years, ranging from 29 to 72 years old. Farmers' working experience also plays an important role in agricultural farming activities. The average farming experience was around 27 years ranging from 5 to 50 years. Most of the sample farmers were in primary education level; average schooling year was 1.45 years ranging from 1 to 3 years. By investigating average farm size, average lowland (Le) area was 2.36 hectares and ranging from 0.81 to 4.86 hectares while average upland (Ya) area was 1.31 hectares and ranging from 0.61 to 3.24 hectares. In terms of cultivated land type of the sample farmers, 51% and 49% of sample farmers respectively owned lowland and upland (Figure 4.4).

4.5.2 Cropping patterns and fertilizer utilization in the study area

4.5.2.1 Cropping patterns of the sample farmers

Table 4.25 showed the existing cropping patterns of the sample farmers in the study area. In Tatkon Township, farmers grew various crops such as monsoon rice, summer rice, green gram, cabbage, cauliflower, corn, cotton and sesame etc. About 50% of farmers mainly grew both monsoon and summer rice. And sometimes they cultivated green gram, cotton and sesame. Monsoon rice was grown from August to December and summer rice was cultivated from February to July. Green gram was grown from May to July, cotton grown from July to December and sesame cultivated from May to August.

However, the rest 50% of farmers cultivated green gram and corn as the first crop in monsoon season. After harvesting green gram and corn, farmers grew vegetables especially cabbage and cauliflower. In monsoon season, green gram and corn were cultivated from May to July and winter crops (cabbage and cauliflower) were grown from October to December. According to the survey, monsoon rice, summer rice, cabbage and cauliflower were the dominant crops among the cropping patterns in Tatkon Township.

4.5.2.2 Fertilizer utilization of the sample farmers in the study area

Majority of sample farmers applied organic and chemical fertilizers in their production. This study emphasized utilization of chemical fertilizers or inorganic fertilizers of the farmers. Urea and compound fertilizers were used as inorganic fertilizers. All sample

farmers used urea fertilizer imported from China. Different brands of compound fertilizer utilized by the sample farmers were products of Golden Cock (44%), Armo's product (30%), products of Mahkota (13%) and Thailand's products (13%) (Figure 4.5). Most of the green gram, cotton and sesame farmers did not apply fertilizers (urea and compound) because they could get high production output by applying pesticides.

4.5.3 Sources and types of buying fertilizers

Farmers could get fertilizers easily in their villages and in Tatkon Township. Therefore, farmers bought from different sources of fertilizer dealers. As shown in the Figure 4.6, 50% each of farmers bought urea fertilizer from village retailers and local wholesalers in Tatkon Town. In the case of compound fertilizers, 65% of sample farmers purchased from village retailers whereas 35% of them purchased from local wholesalers.

There were two types of transaction in buying fertilizers in the study area. In the case of urea fertilizer, 50% of farmers bought in cash down transaction type and the rest 50% purchased by credit system transaction. About 40% of farmers bought compound fertilizers in cash down system and the rest 60% of them used credit system (Figure 4.7). Credit-based system transaction had an interest rate of 5 % per month. Even though the price of fertilizer in credit system was higher than cash down system, most farmers chose buying fertilizers with credit system probably due to lack of capital for fertilizer demand.

4.5.4 General constraints faced by the sample farmers

Some constraints faced by the sample farmers in utilization of fertilizer were described in Table 4.26. About 30% of the sample farmers faced the soil condition problem by using fertilizer. Some farmers complained that they did not recognize the nutrient (N, P, K) content in compound fertilizer (25%), high fertilizer price (25%), and no adequate knowledge or information to apply fertilizer (10%).

Table 4.24 Socio-economic characteristics of the sample farmers in Tatkon Township

Items	Unit	Mean	Range	Standard deviation
Age	Year	47.65	29-72	12.93
Experience	Year	27.35	5-50	13.33
Education	Year	1.45	1-3	0.69
Farm size				
-Lowland	ha	2.36	0.81-4.86	1.27
-Upland	ha	1.31	0.61-3.24	0.68

N=20

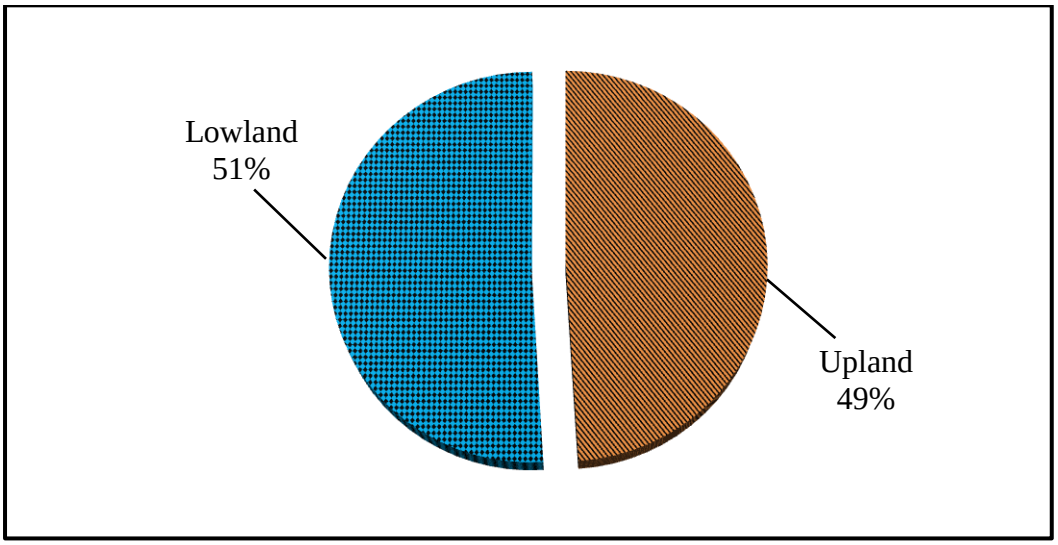


Figure 4.4 Cultivated land types of the sample farmers in the study area

Table 4.25 Cropping patterns of the sample farmers in Tatkon Township

Crops	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Monsoon rice								←	—	—	—	→
Summer rice		←	—	—	—	—	→					
Green gram					←	—	→					
Cabbage	↔									←	—	→
Cauliflower	↔									←	—	→
Corn					←	—	→					
Cotton							←	—	—	—	—	→
Sesame					←	—	→					

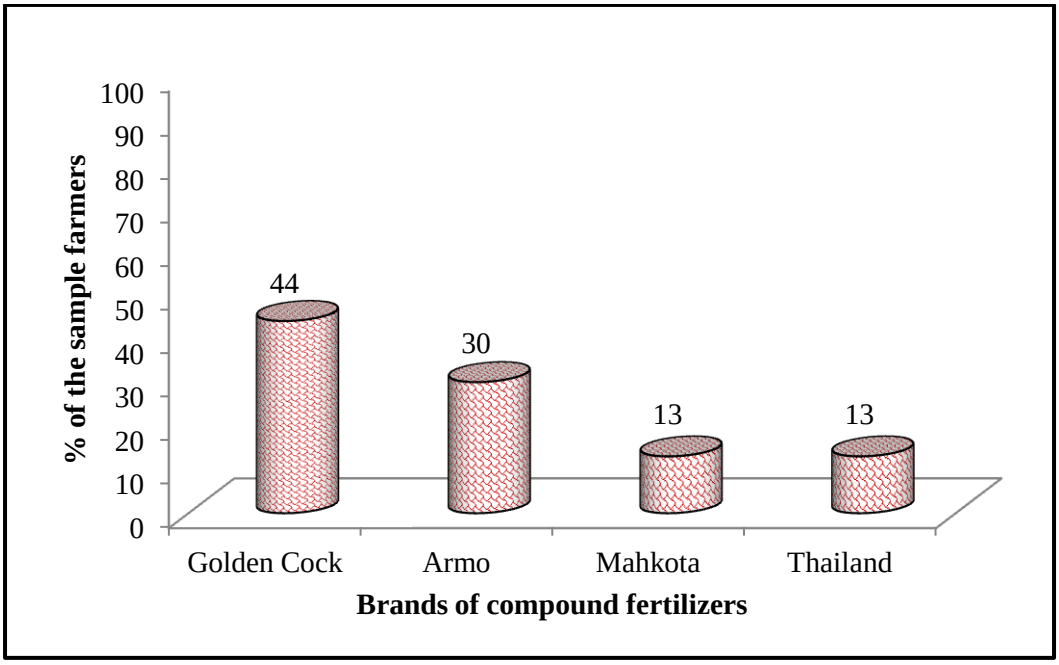


Figure 4.5 **Different brands of compound fertilizer used by the sample farmers**

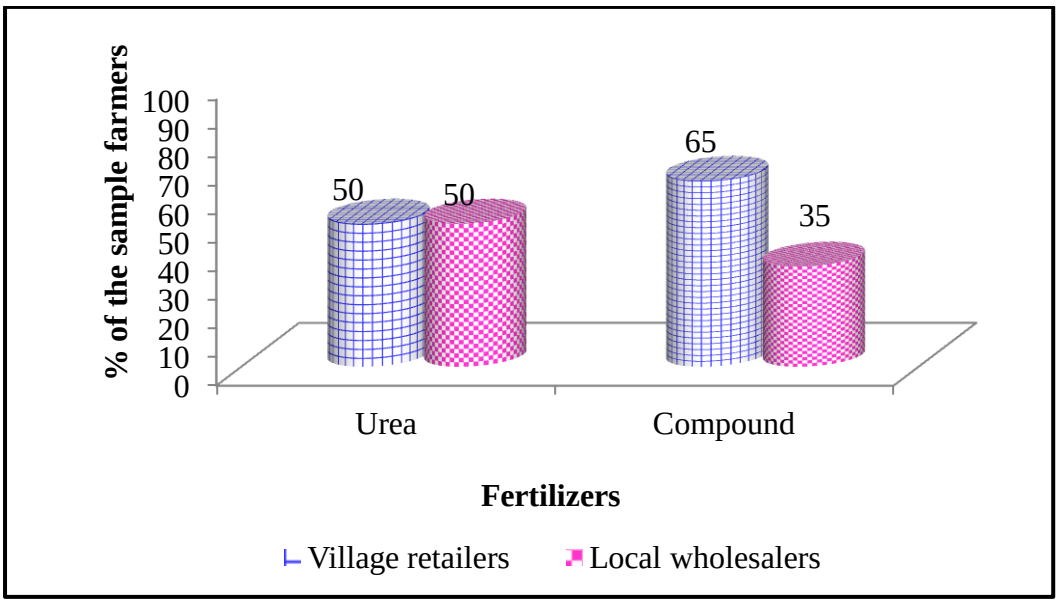


Figure 4.6 **Sources of fertilizers suppliers for the sample farmers**

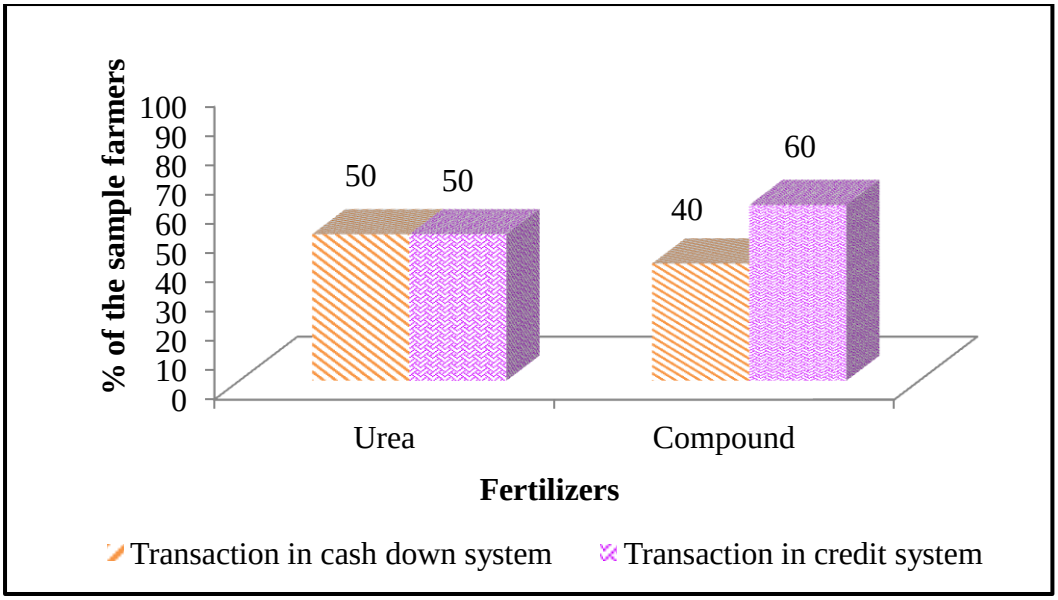


Figure 4.7 Types of transaction in buying fertilizers by the sample farmers

Table 4.26 General constraints faced by the sample farmers

Items	% of sample farmers
Soil condition problem	30
Not recognized the nutrient (N, P, K) content	25
High price	25
No adequate knowledge to apply fertilizer	10
No constraint	10

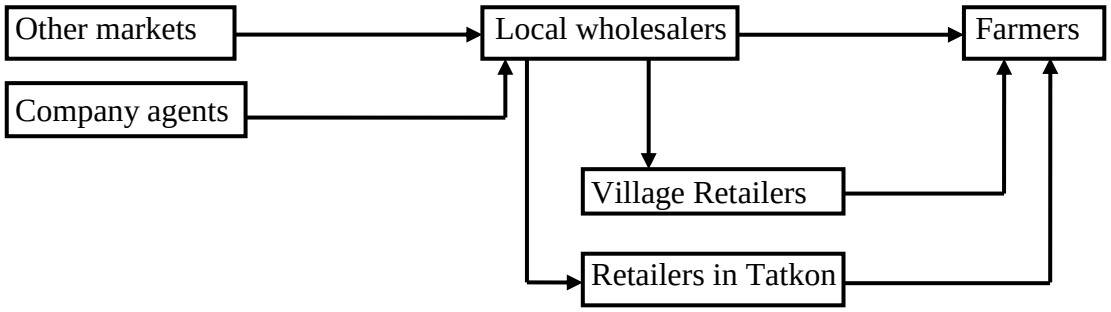
4.6 Marketing Channels of Fertilizer in Tatkon Township

Marketing channels are set of interdependent organizations involved in the process of making a product or service available for use (Kolter 2003). Marketing intermediaries link producers to other participants or to ultimate users. There is a role of channel to fulfill the gap between production to utilization specifically time, place, quantity and quality. Market intermediaries perform various functions in order to bridge these gaps. Fertilizer marketing channels were observed for understanding the commodity flow from other markets or company agents to market intermediaries and to final user farmers. Figure 4.8 showed the fertilizer marketing channels in the study area. According to the market survey, most of the fertilizers were imported from foreign countries such as China. The imported fertilizers flowed via domestic companies to the major markets such as Mandalay market, Yangon market and Myingyan market.

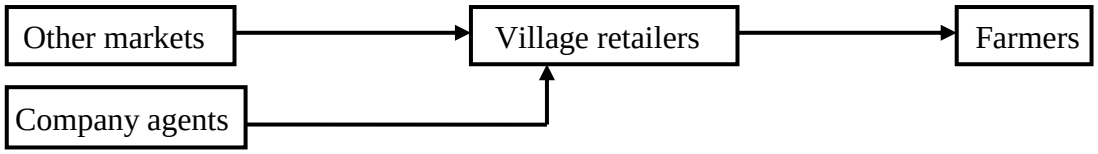
There were three main marketing channels of fertilizer in Tatkon Township. The fertilizer marketing channel (1) was the major channel and marketing the largest amount of fertilizer which flowed from other markets and company agents to local wholesalers and resold to final user farmers. In addition, local wholesalers sold to village retailers and then to end user farmers. Another way, retailers in Tatkon Township also purchased from local wholesalers and then traded to end users or farmers. In this channel local wholesalers were the main players and had market power.

In fertilizer marketing channel (2), fertilizer flowed from other markets and company agents directly to village retailers and then sold to the farmers. Compared to channel (1) and (2), the marketing channel (3) was marketing the lowest amounts of fertilizer which reached only directly from company agents and then to local wholesalers and village retailers and afterward finally to farmers.

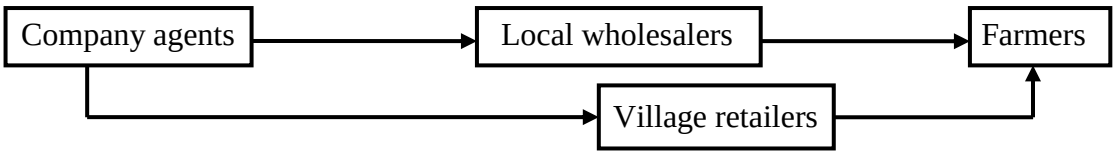
According to the survey results, in channel 1, marketing links were existed all market participants (wholesalers from other markets, company agents, local wholesalers, village retailers, retailers in Tatkon and farmers). The channel 2 showed marketing links between wholesalers from other markets, company agents, village retailers and farmers. The channel 3 also showed company agents made direct marketing link with local wholesalers and village retailers. Therefore, among these three marketing channels, channel (1) and channel (2) which had more market participants were selected for calculating the marketing margin, cost and profit of fertilizer marketing in the study area.



Channel (1)



Channel (2)



Channel (3)

Figure 4.8 Marketing channels of fertilizers in Tatkon Township

4.7 Marketing Margin, Cost and Profit of Fertilizer Market

The services of various agencies constituting a marketing channel are remunerated out of the marketing "margin". This term is used to denote the difference between the price paid to the first seller and that paid by the final buyer (Kohls and Uhi 2002). Marketing margins is defined as the price of a collection of marketing services which is the outcome of the demand for and the supply of such services. The amount can be interpreted as the cost of providing a mix of marketing services (Tomek and Robison 1981).

The study attempted to evaluate the role of the intermediaries such as local wholesalers and village retailers and to estimate detail marketing margin, cost and profit from different markets of the all market participants along the agrochemical fertilizer marketing channel in the study area. The objective of the analyzing costs and margins is to understand the relative efficiency and the performance of market participants from companies of agrochemical to final users (farmers). Marketing margin reflects the cost of marketing and profits of market agents. A common means of measuring market efficiency is to examine marketing margins. The overall marketing margin is simply the difference between the farm-gate price and the price received on company/ main market sale.

In the first channel, urea, Armo (10:10:5) and Golden Lion (15:7:8) fertilizers from Mandalay market were calculated to investigate costs and profits of local wholesalers along the fertilizer market in the study area. Average farm gate price or farmers' purchasing price of urea, Armo and Golden Lion were (372,000 MMK/MT), (346,000 MMK/MT) and (486,000 MMK/MT) while average buying price of wholesaler for urea, Armo and Golden Lion were (342,000 MMK/MT), (299,000 MMK/MT) and (430,000 MMK/MT) respectively. Therefore, the total gross marketing margin for urea, Armo and Golden Lion were 30,000 MMK/MT (8.06% of farm gate price), 47,000 MMK/MT (13.58% of farm gate price) and 56,000 MMK/MT (11.52% of farm gate price). Average marketing margin, cost and profit of local wholesaler for urea, Armo and Golden Lion fertilizer market were shown in Table 4.27.

In this channel, average margin of local wholesalers was 24,000 MMK/MT (6.45% of farm gate price) for urea, 41,000 MMK/MT (11.85% of farm gate price) for Armo and 50,000 MMK/MT (10.29% of farm gate price) for Golden Lion. Total marketing cost included transportation and labor costs. Those two costs from Mandalay market were 10,000 MMK/MT for transportation and 2,000 MMK/MT for labor. Total marketing cost of urea, Armo and Golden Lion were 12,000 MMK/MT (3.23% of farm gate price), 12,000 MMK/MT (3.47% of farm gate price) and 12,000 MMK/MT (2.47% of farm gate price) respectively. Average profits of local wholesalers were 12,000 MMK/MT (3.23% of farm

gate price) in urea, 29,000 MMK/MT (8.38% of farm gate price) in Armo and 38,000 MMK/MT (7.82% of farm gate price) in Golden Lion. Therefore, local wholesalers obtained the average profit for Armo was relatively higher than that profit for urea and Golden Lion fertilizers in the study area.

In the case of Myingyan market, average buying price of farmers for Butterfly and Lu Yine Khaung were 66,000 MMK/MT and 106,000 MMK/MT. Local wholesalers' average buying price was for Butterfly and Lu Yine Khaung were 38,000 MMK/MT and 72,000 MMK/MT. The total gross margin was 28,000 MMK/MT (42.42% of farm gate price) of Butterfly and 34,000 MMK/MT (32.08% of farm gate price) of Lu Yine Khaung.

Average margin of local wholesalers for Butterfly was 22,000 MMK/MT (33.33% of farm gate price) and Lu Yine Khaung was 28,000 MMK/MT (26.42% of farm gate price). Total marketing cost included transportation cost (14,000 MMK/MT) from Myingyan market and labor cost (2,000 MMK/MT). The total marketing cost for Butterfly was 16,000 MMK/MT (24.24% of farm gate price) and Lu Yine Khaung was 16,000 MMK/MT (15.09% of farm gate price). In addition, average profit for Butterfly and Lu Yine Khaung which accounted 6,000 MMK/MT (9.09% of farm gate price) and 12,000 MMK/MT (11.32% of farm gate price) respectively. As a result, the average profit of Lu Yine Khaung was approximately twice that of Butterfly profit which was occupied by local wholesalers (Table 4.28).

The following Table 4.29 offered costs and profits of the local wholesalers for Awba (15:15:15) and Kie Mie Yar (15:15:15) compound fertilizers. Those two compound fertilizers flowed to local wholesalers from Yangon market. In the first channel (1), average farm gate price or farmers' purchasing price for Awba was 886,000 MMK/MT and Kie Mie Yar was 686,000 MMK/MT. Average buying price of local wholesalers for Awba and Kie Mie Yar were 820,000 MMK/MT and 640,000 MMK/MT. Hence, the total gross marketing margin for Awba was 66,000 MMK/MT (7.45% of farm gate price) and Kie Mie Yar was 46,000 MMK/MT (6.71% of farm gate price).

Average margin of local wholesalers for Awba and Kie Mie Yar were 60,000 MMK/MT (6.77% of farm gate price) and 40,000 MMK/MT (5.83% of farm gate price). Total marketing cost involved transportation cost from Yangon market (30,000 MMK/MT) and labor cost (2,000 MMK/MT). Total marketing cost was 32,000 MMK/MT (3.61% of farm gate price) and 32,000 MMK/MT (4.66% of farm gate price) for Awba and Kie Mie Yar compound fertilizers. The average profit for Awba was 28,000 MMK/MT (3.16% of farm gate price) while Kie Mie Yar was 8,000 MMK/MT (1.17% of farm gate price). Therefore,

average profit for Awba was rather higher than that of Kie Mie Yar which was occupied by local wholesalers.

In the case of channel (2), village retailers purchased urea fertilizer from Mandalay market. Farm gate price was 380,000 MMK/MT and average buying price of village retailer was 342,000 MMK/MT. The total gross marketing margin for urea was 38,000 MMK/MT (10% of farm gate price). It included the costs and profits of village retailers. Average marketing margin, cost and profit of the urea fertilizer market in selected villages were shown in Table 4.30.

The average margin of village retailers was 38,000 MMK/MT (10% of farm gate price). Total marketing cost consisted of transportation cost (10,000 MMK/MT) from Mandalay market and labor cost 6,000 MMK/MT. Total marketing cost was 16,000 MMK/MT (4.21% of farm gate price) and average profit was 22,000 MMK/MT (5.79% of farm gate price). As a result, in urea fertilizer market, village retailers in the channel (2) got higher profit than local wholesalers in the channel (1).

Table 4.27 Marketing margin, cost and profit for fertilizer marketing channel (1) from Mandalay market

Composition of marketing margin	Urea		Armo (10:10:5)		Golden Lion (15:7:8)	
	Average value (MMK/MT)	Percent	Average value (MMK/MT)	Percent	Average value (MMK/MT)	Percent
Farm gate price	372,000	100.00	346,000	100.00	486,000	100.00
Wholesaler's buying price	342,000	91.94	299,000	86.42	430,000	88.48
Total gross marketing margin	30,000	8.06	47,000	13.58	56,000	11.52
Total gross marketing margin composition						
(1) Average margin of wholesaler	24,000	6.45	41,000	11.85	50,000	10.29
Marketing cost of wholesaler (including transportation cost and labor cost)	12,000	3.23	12,000	3.47	12,000	2.47
Average profit of wholesaler	12,000	3.23	29,000	8.38	38,000	7.82
(2)Marketing cost of farmers (transportation cost)	6,000	1.61	6,000	1.73	6,000	1.23

Table 4.28 Marketing margin, cost and profit for fertilizer marketing channel (1) from Myingyan market

Composition of marketing margin	Butterfly		Lu Yine Khaung	
	Average value (MMK/MT)	Percent	Average value (MMK/MT)	Percent
Farm gate price	66,000	100.00	106,000	100.00
Wholesaler's buying price	38,000	57.58	72,000	67.92
Total gross marketing margin	28,000	42.42	34,000	32.08
Total gross marketing margin composition				
(1) Average margin of wholesaler	22,000	33.33	28,000	26.42
Marketing cost of wholesaler (including transportation cost and labor cost)	16,000	24.24	16,000	15.09
Average profit of wholesaler	6,000	9.09	12,000	11.32
(2) Marketing cost of farmers (transportation cost)	6,000	9.09	6,000	5.66

Table 4.29 Marketing margin, cost and profit for fertilizer marketing channel (1) from Yangon market

Composition of marketing margin	Awba (15:15:15)		Kie Mie Yar (MC) (15:15:15)	
	Average value (MMK/MT)	Percent	Average value (MMK/MT)	Percent
Farm gate price	886,000	100.00	686,000	100.00
Wholesaler's buying price	820,000	92.55	640,000	93.29
Total gross marketing margin	6,6000	7.45	46,000	6.71
Total gross marketing margin composition				
(1) Average margin of wholesaler	60,000	6.77	40,000	5.83
Marketing cost of wholesaler (including transportation cost and labor cost)	32,000	3.61	32,000	4.66
Average profit of wholesaler	28,000	3.16	8,000	1.17
(2) Marketing cost of farmers (transportation cost)	6,000	0.68	6,000	0.87

Table 4.30 Marketing cost, profit and marketing margin for fertilizer marketing channel (2) from Mandalay market

Composition of marketing margin	Urea	
	Average value (MMK/MT)	Percent
Farm gate price	380,000	100.00
Retailer's buying price	342,000	90.00
Total gross marketing margin	38,000	10.00
Total gross marketing margin composition		
(1)Average margin of retailer	38,000	10.00
Marketing cost of retailer (including transportation cost and labor cost)	16,000	4.21
Average profit of retailer	22,000	5.79
(2) Marketing cost of farmers (including labor cost)	-	-

CHAPTER V

DESCRIPTION OF TIME SERIES PRICE DATA

5.1 Seasonal Fertilizer Price Movement

Seasonality is a seasonal fluctuation or cycle forming a progression or trend. The month by month movement of supplies into market channels indicates some of the reasons for price fluctuations. The difference between the highest and lowest prices showed a measure of seasonal fluctuation. In this study, seasonal movements of fertilizer price series were demonstrated in urea price from Mandalay market, Armo price from Yangon market and Golden Lion price from Mandalay market in Figures 5.1, 5.2 and 5.3. The fertilizer prices for the same month of every year during the years 2012 to 2014 were calculated.

In the years 2012 to 2014, urea fertilizer price was fluctuated in bimodal manner depended on the main cropping seasons (rainy and summer rice cultivation) (Figure 5.1). Urea price in Mandalay market was increased in May and September in all year 2012 to 2014. The lowest price was observed in March, August and November in a year 2012. However, the lowest price was occurred in August and October, 2013. Again, the lowest price in 2014 was April and November. Therefore, the lowest price for the common months was August and November in 2012 to 2014.

In the case of Armo price for Yangon market (Figure 5.2), seasonal movements in all price series during the years 2012 to 2014 were not so much pronounced. The price of Armo remained static throughout the year 2012 with little fluctuation. The price of Armo was the highest in the month of April 2013, began to fall in October 2013. The lowest price in March, April and May occurred in 2014, began to rise from July to December.

Seasonal price movement was found in Golden Lion price for Mandalay market in the early year 2012, and 2013 (Figure 5.3). The price of Golden Lion in a year 2012 was the lowest in January and rose in April and May when urea price increased. Then price fell with static again from June to December. In a year 2013, the price of seasonal movement was constant during the months from January to April. The peak price occurred from June to October and the lowest price was in December. Golden Lion's seasonal price movement was started static throughout the year 2014 with no variation.

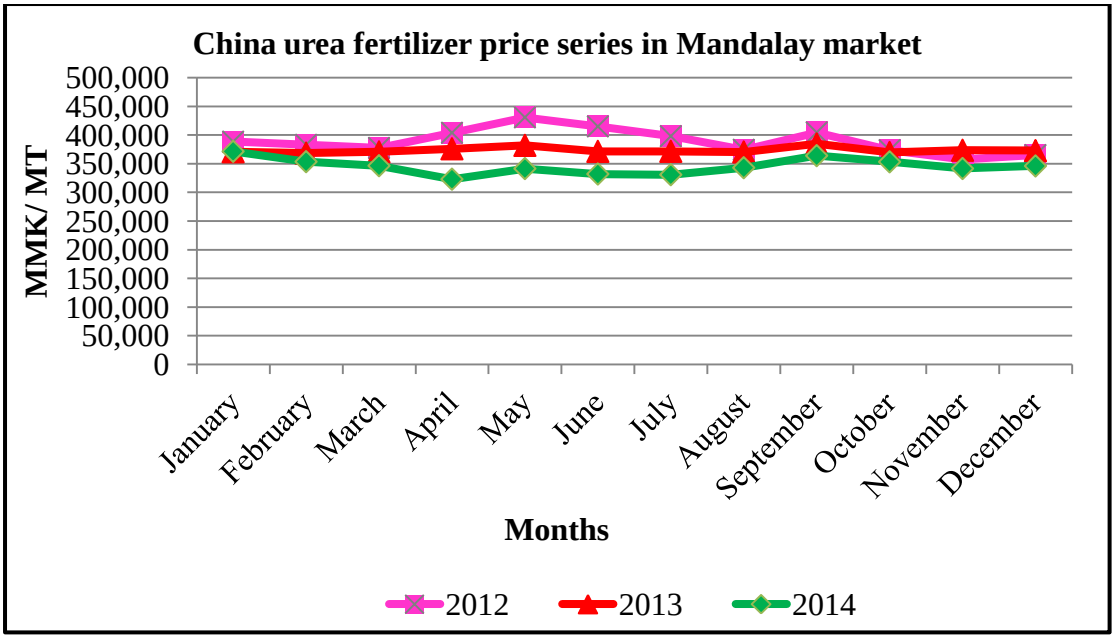


Figure 5.1 **Seasonal price movements of urea fertilizer in Mandalay market (2012-2014)**

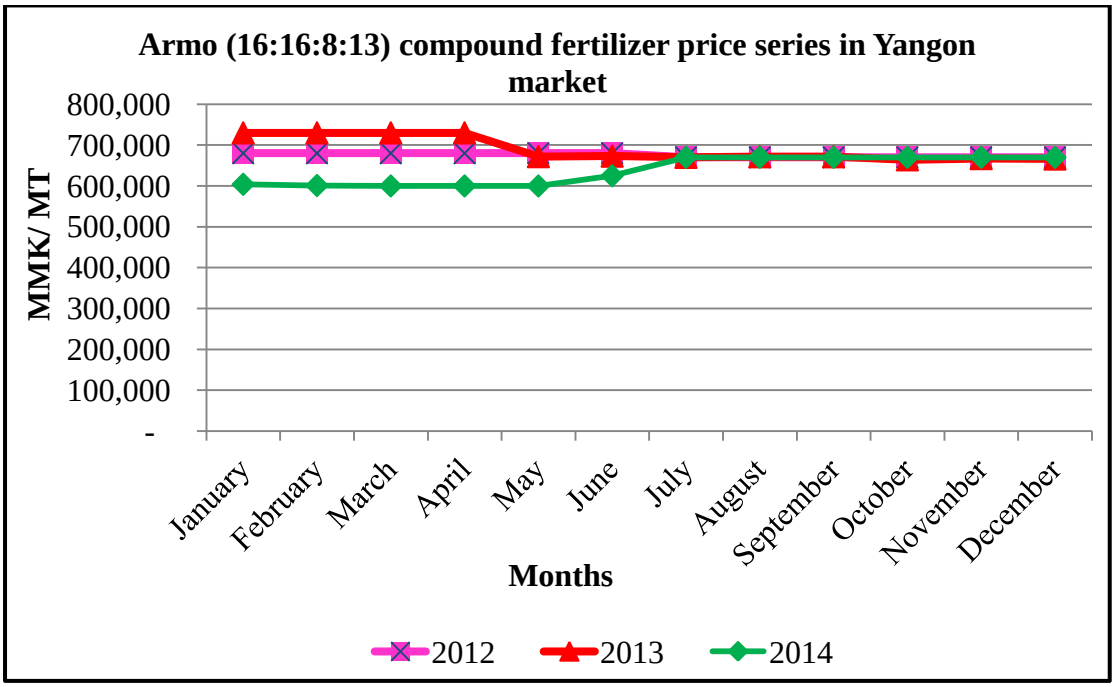


Figure 5.2 **Seasonal price movements of Armo fertilizer in Yangon market (2012- 2014)**

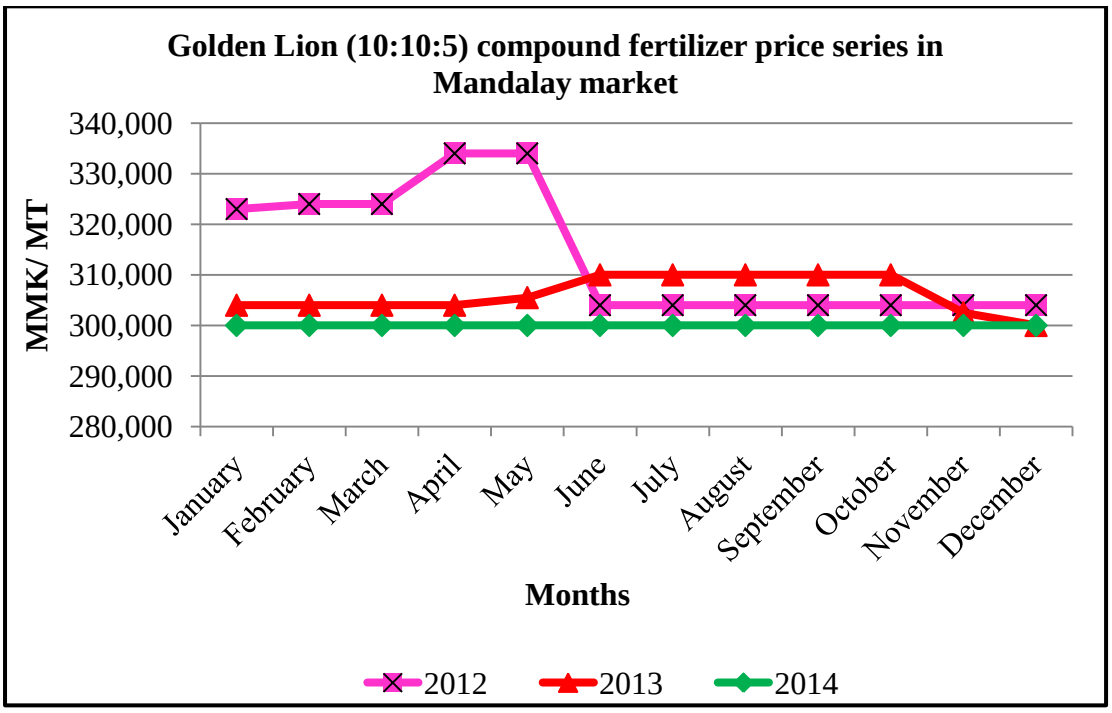


Figure 5.3 Seasonal price movements of Golden Lion fertilizer in Mandalay market (2012- 2014)

5.2 Monthly fertilizer price fluctuation

In a year 2014, monthly prices of fertilizer in the selected domestic markets measured in MMK per MT and foreign markets also measured in US$ per MT, were presented in Figures 5.4, 5.5 and 5.6. In urea fertilizer market, the prices of Yangon market were the highest in May and June than prices in Mandalay and Arab Gulf markets. Mandalay market was the nearest China border area and thus urea fertilizer from Mandalay market was supplied to Yangon market. The lowest fertilizer prices were found in April and July in the selected markets. The highest price was occurred in September. According to the figure, all urea fertilizer price series were in similar trend fluctuation (Figure 5.4).

All price series of the selected T-super fertilizer markets in a year 2014 were described in Figure 5.5. All domestic market price series were decreasing in April and Tunisia market prices was decreasing in June. Then, an increasing price trend in Mandalay and Tunisia markets were occurred in May. The highest price was found in June in Yangon market. Generally, these figures indicated that all price series in Yangon and Mandalay markets were moving almost the same pattern except Tunisia market. Figure 5.6 illustrated monthly compound fertilizer price series in 2014 in the studied markets. All local market price series commonly showed same trend and moved almost parallel while Cfr.SE Asia market price series was differentiated with domestic price series pattern.

5.3 Co-integration Analysis

In market economy, prices are the main incentives for the agricultural production and marketing and the signal for decision making process of all participants. The study of price behavior is, therefore, critical to understand the market performance. Price signals are transmitted over time and over space, also affect the allocation of resources, welfare of consumer, producer as well as market participants. If the transmission of price signal is imperfect, then the performance of marketing system will be inefficient.

Co- integration analysis allows a detailed study of price co-movements. This study used co-integration analysis to study in domestic and foreign fertilizer markets integration. The co-integrated series are stationary, that is, they have no trend of any sort. The extent to which a series is integrated depends on how many times a difference has to be taken before it becomes stationary. If the series is to be differenced once before it is stationary, then the first difference is stationary, and the series is itself integrated of order one.

First, each price series is determined for order of integration. The Augmented Dickey Fuller (ADF) test is used to investigate the order of integration in each individual series. The first stage is to test whether each series is stationary i.e. I(0). If the null hypothesis of non-stationary cannot be rejected, that is the absolute value of the ADF statistic is smaller than the critical ADF value, then the next stage is to test whether the first differences are stationary. If the null hypothesis of non -stationary cannot be rejected, then the series is still not stationary. Therefore, continue differencing until the series becomes stationary and note the order of integration.

Second, the integrated series are tested for co-integration. If the series to be investigated are both integrated with the same order, the next stage is to investigate whether they are co-integrated with each other and this is done either through the Johansen's multivariate framework. The Johansen procedure is based on the maximum likelihood estimation of the error correction model.

The third step involves determination of causality and exogeneity. If two price series are integrated and they are also 'co-integrated of order I(1), then there must be some causality in one direction or the other between the two price series. If event A happened before B, we may say A is a causal factor for event B. In econometric analysis, we usually define variables as dependent (Y) and explanatory variables (Xi). If OLS suggests the significance for probability, we could say that X has explanatory power to Y. The Granger causality test can be conducted not only for level stationary but also for differenced stationary series. If the Granger causality test holds, it suggests X Granger causes Y. We can then interpret that the past values of X have explanatory power for Y, or X might be causing Y.

5.4 Data and Empirical Model for Fertilizer Market Integration

Co-integration analysis and Granger Causality were applied to monthly fertilizer price data. Mandalay, Yangon and Arab Gulf were selected for urea markets. Three T-super markets such as Mandalay, Yangon and Tunisia were selected. Mandalay [Armo (16:16:8:13) and Golden Lion (10:10:5)], Yangon [Armo (16:16:8:13) and Golden Lion (10:10:5)] and Cfr.SE Asia (16:16:16) were selected for compound fertilizer markets. Monthly price covered from January 2010 to December 2014 with a total of 60 observations was used in this study. The market integration results were presented with the following steps: (1) testing for stationary, (2) testing the co-integration results and (3) testing Granger causality.

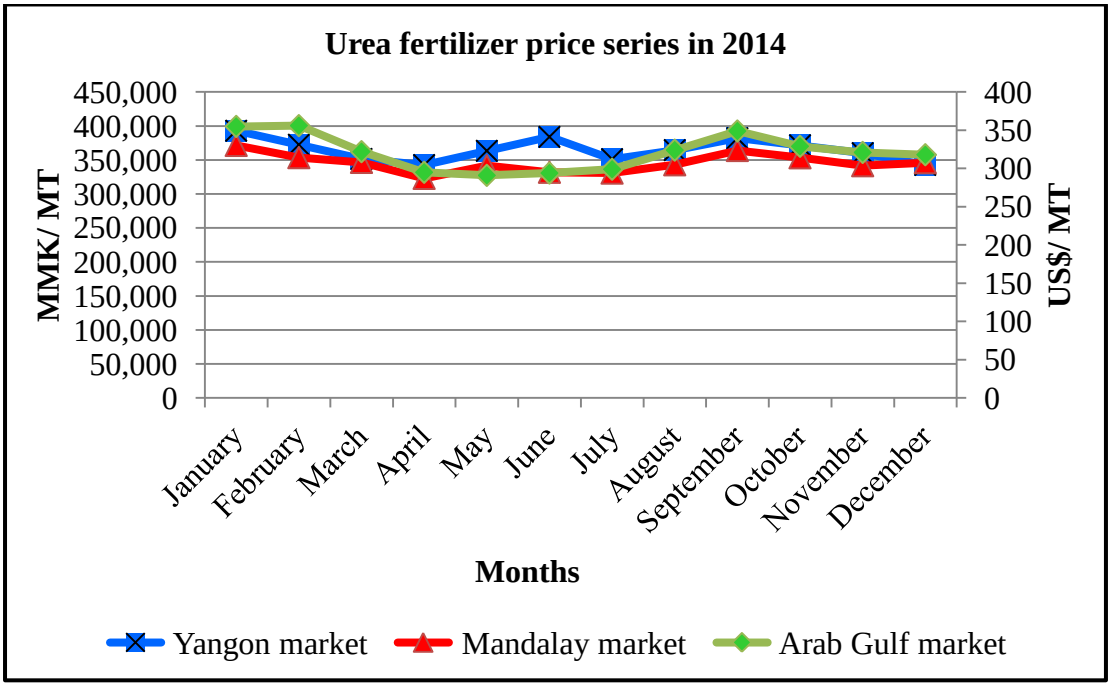


Figure 5.4 Fluctuation of monthly urea fertilizer price series in a year 2014

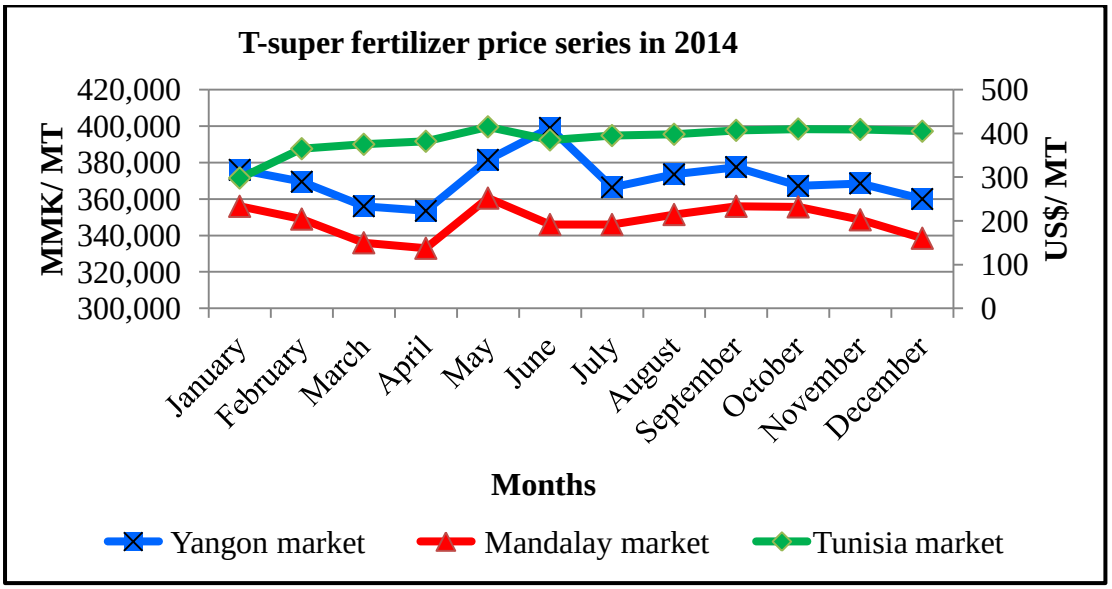


Figure 5.5 Fluctuation of monthly T-super fertilizer price series in a year 2014

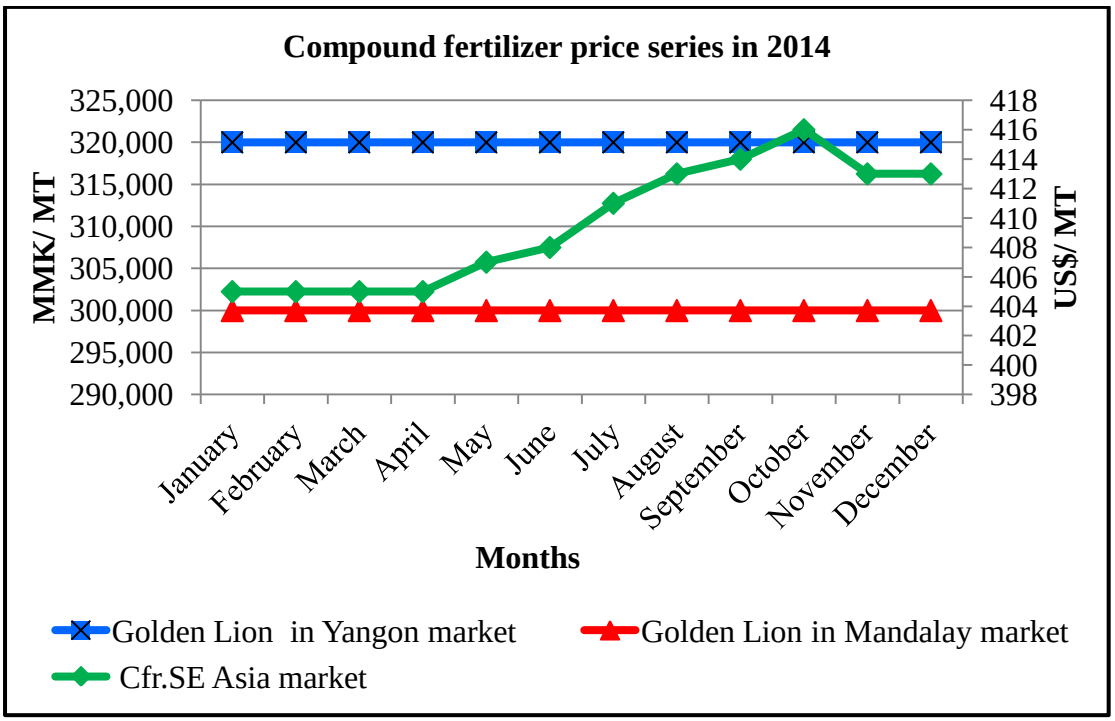


Figure 5.6 Fluctuation of monthly compound fertilizer price series in a year 2014

5.5 Results and Discussion

5.5.1 Step 1: Testing for stationary

Checking for the stationary of time series is the first step to especially deal with macroeconomic variables. However, macroeconomists have been awared that many macroeconomic time series are non-stationary in their levels and that are most adequately represented by first differences. This study conducted the unit root tests hypothesizing that the series has unit roots. Before applying the co-integration tests, Augmented Dickey–Fuller (ADF) unit root tests were applied to each price series and their first differences to determine the stationary of each individual price series. The null hypothesis of unit root was not rejected for all variables indicating that all-time series were non-stationary. And then the data series was used in the first difference form. The first difference of the variables was examined and the hypothesis of unit root was rejected. Thus, all variables were integrated of order one I(1).

Using the ADF test, the results were presented in the following tables. The price series for all markets of urea, T-super and compound fertilizers were I(1). All of the tests in price level showed that the statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. Hence none of the price series was stationary. This indicated that it had a unit root. Moreover, the unit root test on first differences indicated that the statistic t_α value was smaller than the critical values so that we rejected the null hypothesis at 1% in all cases and all the price series were I(1) process and are stationary at first difference level. This indicated that it did not have a unit root.

According to the Table 5.1, the ADF statistic value of level form for Ln urea price in Yangon market was -1.27. In addition, the critical values at 1%, 5% and 10% levels were -4.13,-3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.88, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln urea price in Yangon market was -7.20. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln urea price in Mandalay market was -1.62. In addition, the critical values at 1%, 5% and 10% levels were -4.13, 3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null

hypothesis. The ADF test statistic value had a probability value of 0.77, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln urea price in Mandalay market was -6.48. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln urea price in Arab Gulf market was -2.39. In addition, the critical values at 1%, 5% and 10% levels were -4.13,-3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.38, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln urea price in Arab Gulf market was -4.88. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The results of T-super fertilizer price series were represented in Table 5.2. The ADF statistic value of level form for Ln T-super price in Yangon market was -2.48. In addition, the critical values at 1%, 5% and 10% levels were -4.13,-3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.34, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln T-super price in Yangon market was -5.44. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln T-super price in Mandalay market was -2.10. In addition, the critical values at 1%, 5% and 10% levels were -4.13,-3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null

hypothesis. The ADF test statistic value had a probability value of 0.53, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln T-super price in Mandalay market was -5.63. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln T-super price in Tunisia market was -2.24. In addition, the critical values at 1%, 5% and 10% levels were -4.13,-3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.46, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln T-super price in Tunisia market was -6.51. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The following Table 5.3 mentioned that the ADF statistic value of level form for Ln Armo (16:16:8:13) fertilizer prices in Yangon market was -2.53. In addition, the critical values at 1%, 5% and 10% levels were -4.13, -3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.31, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln Armo (16:16:8:13) fertilizer prices in Yangon market was -6.67. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln Armo (16:16:8:13) fertilizer prices in Mandalay market was -1.98. In addition, the critical values at 1%, 5% and 10% levels were -4.13, -3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did

not reject the null hypothesis. The ADF test statistic value had a probability value of 0.29, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln Armo (16:16:8:13) fertilizer prices in Mandalay market was -7.77. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln Golden Lion (10:10:5) fertilizer prices in Yangon market was -2.62. In addition, the critical values at 1%, 5% and 10% levels were -4.13, -3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.27, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln Golden Lion (10:10:5) fertilizer prices in Yangon market was -8.00. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln Golden Lion (10:10:5) fertilizer prices in Mandalay market was -1.42. In addition, the critical values at 1%, 5% and 10% levels were -4.13, -3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.85, providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln Golden Lion (10:10:5) fertilizer prices in Mandalay market was -8.21. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we did reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

The ADF statistic value of level form for Ln compound (16:16:16) fertilizer prices in Cfr.SE Asia market was -1.45. In addition, the critical values at 1%, 5% and 10% levels were -4.13, -3.49 and -3.17. The statistic t_α value was greater than the critical values so that we did not reject the null hypothesis. The ADF test statistic value had a probability value of 0.84,

providing evidence that we might not reject the null hypothesis of a unit root. This indicated that it had a unit root. The ADF statistic value of first difference level for Ln compound (16:16:16) fertilizer prices in Cfr.SE Asia market was -8.60. In addition, the critical values at 1%, 5 % and 10% levels were -4.13, -3.49 and -3.17 respectively. The statistic t_α value was smaller than the critical values so that we must reject the null hypothesis. The ADF test statistic value had a probability value of 0.00, providing that we might reject the null hypothesis of a unit root. This indicated that it did not have a unit root and it had stationary.

Table 5.1 Unit root test on urea fertilizer price series (Augmented Dickey-Fuller, ADF test)

Variables	ADF test (level form)		ADF test (first difference)		Order of integration
	Test statistics	Probability	Test statistics	Probability	
Ln urea price in Yangon market	-1.274	0.884	-7.201	0.000	I(1)
Ln urea price in Mandalay market	-1.621	0.772	-6.484	0.000	I(1)
Ln urea price in Arab Gulf market	-2.394	0.379	-4.876	0.001	I(1)
Test critical values:		1% level		-4.127	
		5% level		-3.491	
		10% level		-3.174	

Source: Monthly price series (2010 - 2014) from MIS. ADF analysis was carried out in EVIEWS @ 7.

Table 5.2 Unit root tests on T-super fertilizer price series (Augmented Dickey-Fuller, ADF test)

Variables	ADF test (level form)		ADF test (first difference)		Order of integration
	Test statistics	Probability	Test statistics	Probability	
Ln T-super price in Yangon market	-2.480	0.337	-5.441	0.000	I(1)
Ln T-super price in Mandalay market	-2.103	0.533	-5.627	0.000	I(1)
Ln T-super price in Tunisia market	-2.237	0.460	-6.511	0.000	I(1)
Test critical values:		1% level		-4.127	
		5% level		-3.491	
		10% level		-3.174	

Source: Monthly price series (2010 - 2014) from MIS. ADF analysis was carried out in EVIEWS @ 7.

Table 5.3 Unit root test on compound fertilizers price series (Augmented Dickey-Fuller, ADF test)

Variables	ADF test (level form)		ADF test (first difference)		Order of integration
	Test statistics	Probability	Test statistics	Probability	
Ln Armo fertilizer prices in Yangon market	-2.531	0.313	-6.665	0.000	I(1)
Ln Armo fertilizer prices in Mandalay market	-1.981	0.294	-7.772	0.000	I(1)
Ln Golden Lion fertilizer prices in Yangon market	-2.620	0.273	-8.001	0.000	I(1)
Ln Golden Lion fertilizer prices in Mandalay market	-1.415	0.846	-8.207	0.000	I(1)
Ln compound (16:16:16) fertilizer prices in Cfr.SE Asia market	-1.447	0.836	-8.603	0.000	I(1)
Test critical values:		1% level		-4.127	
		5% level		-3.491	
		10% level		-3.174	

Source: Monthly price series (2010-2014) from MIS. ADF analysis was carried out in EVIEWS @ 7.

5.5.2 Step: 2 Testing for co-integration

After testing the ADF, the next step involved checking for co-integration among the price series. This study traced out whether data series are in co-integration or non co-integration by using Johansen's test to identify long-term equilibrium relation(s) among the variables. Co-integration required the variables to be integrated of the same order. This trace test clearly indicated that there is co-integration at the 0.05 level. All variables become stationary at 0.05 level. The economic interpretation of co-integration was that if two (or more) series were linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e, be non-stationary) they will nevertheless move closely together over time and the difference between them will be stable (i.e., stationary).

Using Akaike Information Criterion (AIC), a lag length of 1 was chosen and used in the co-integration test estimated with a linear deterministic trend. The results of the co-integration tests summarized in the following Tables 5.4, 5.5 and 5.6 indicated that there was co-integration among the price series. Two types of test statistics are reported. The first block reported the so- called trace statistics and the second block reported the maximum eigenvalue statistics. These trace and maximum eigenvalue tests clearly indicated that there is co-integration at the 0.05 level.

The values of computed (λ trace) and (λ max) statistics were found to be greater than the critical values. Therefore, both the (λ trace) and (λ max) statistics supported the hypothesis of co-integration among the variables. In the co-integration tables, both trace statistics and maximum eigenvalue statistic indicated co-integration at the 0.05 level of significance, suggesting that there was co-integration (or long run) relationship.

Table 5.4 Results of co-integration test on urea fertilizer price series

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.521	88.938	29.797	0.000
At most 1 *	0.368	46.954	15.495	0.000
At most 2 *	0.306	20.836	3.841	0.000
Trace test indicates 3 co-integrating eqn(s) at the 0.05 level				

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 Critical value	Prob.**
None *	0.521	41.983	21.132	0.000
At most 1 *	0.368	26.119	14.265	0.000
At most 2 *	0.306	20.836	3.841	0.000

Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Monthly price series (2010 - 2014) from MIS. Co-integration analysis was carried out inEVIEWS @ 7.

Table 5.5 Results of co-integration test on T-super fertilizer price series

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.439	74.053	29.797	0.000
At most 1 *	0.379	41.095	15.495	0.000
At most 2 *	0.217	13.944	3.841	0.000
Trace test indicates 3 co-integrating eqn(s) at the 0.05 level				

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 Critical value	Prob.**
None *	0.439	32.958	21.132	0.000
At most 1 *	0.379	27.152	14.265	0.000
At most 2 *	0.217	13.944	3.841	0.000

Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKin non-Haug-Michelis (1999) p-values

Source: Monthly price series (2010 - 2014) from MIS. Co-integration analysis was carried out in EVIEWS @ 7.

Table 5.6 Results of co-integration test on compound fertilizer price series

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.636	166.682	69.819	0.000
At most 1 *	0.526	109.005	47.856	0.000
At most 2 *	0.392	66.456	29.797	0.000
At most 3 *	0.312	38.129	15.495	0.000
At most 4 *	0.256	16.844	3.841	0.000
Trace test indicates 5 co-integrating eqn(s) at the 0.05 level				

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 Critical value	Prob.**
None *	0.636	57.677	33.877	0.000
At most 1 *	0.526	42.549	27.584	0.000
At most 2 *	0.392	28.326	21.132	0.004
At most 3 *	0.312	21.286	14.265	0.003
At most 4 *	0.256	16.844	3.841	0.000

Max-eigenvalue test indicates 5 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Monthly price series (2010 - 2014) from MIS. Co-integration analysis was carried out in EVIEWS @ 7.

5.5.3 Step: 3 Testing for Granger causality

If the series are stationary, it is useful to run the Granger causality test. Granger causality is a useful approach in determining whether price movements follow with well defined paths, that is, start around demand or production centers and then spread around the country. Six pair-wise Granger causality tests for urea fertilizer prices were conducted. Results were reported in Table 5.7. The hypotheses are: urea fertilizer prices in Yangon market does not Granger cause urea fertilizer prices in Arab Gulf market, urea fertilizer prices in Arab Gulf market does not Granger cause urea fertilizer prices in Yangon market, urea fertilizer prices in Mandalay market does not Granger cause urea fertilizer prices in Arab Gulf market, urea fertilizer prices in Arab Gulf market does not Granger cause urea fertilizer prices in Mandalay market, urea fertilizer prices in Mandalay market does not Granger cause urea fertilizer prices in Yangon market, urea fertilizer prices in Yangon market does not Granger cause urea fertilizer prices in Mandalay market.

The null hypothesis that urea fertilizer prices in Arab Gulf market does not Granger cause urea fertilizer prices in Yangon market, therefore will reject the null hypothesis at the 10 percent significant level, which means that Arab Gulf market prices might be a causal factor for Yangon market prices. The F test statistics will reject the null hypothesis of which urea fertilizer prices in Arab Gulf market does not Granger cause urea fertilizer prices in Mandalay market at the 1 percent significant level, which means that Arab Gulf market prices might also be a causal factor for Mandalay market prices. The F-statistics is significant, therefore the null hypothesis of which urea fertilizer prices in Mandalay market does not Granger cause urea fertilizer prices in Yangon market is rejected at the 5 percent level, it means that Mandalay market prices might be a causal factor for Yangon market prices.

By the other way, the directions of Granger causality for urea fertilizer markets were illustrated in the Figure 5.7. For urea fertilizer markets, Arab Gulf market caused all markets prices with unidirectional movements. And price occurred in Mandalay market also caused Yangon market with unidirectional movements.

Table 5.7 Results of Granger causality test on urea fertilizer price series

No	Hypothesis	F-statistic	Prob.
1	Urea fertilizer prices in Yangon market does not Granger cause urea fertilizer prices in Arab Gulf market	0.448	0.641 (ns)
2	Urea fertilizer prices in Arab Gulf market does not Granger cause urea fertilizer prices in Yangon market	2.868	0.066 (*)
3	Urea fertilizer prices in Mandalay market does not Granger cause urea fertilizer prices in Arab Gulf market	1.792	0.177 (ns)
4	Urea fertilizer prices in Arab Gulf market does not Granger cause urea fertilizer prices in Mandalay market	5.081	0.009 (***)
5	Urea fertilizer prices in Mandalay market does not Granger cause urea fertilizer prices in Yangon market	4.747	0.013 (**)
6	Urea fertilizer prices in Yangon market does not Granger cause urea fertilizer prices in Mandalay market	0.136	0.873 (ns)

Note: *** = significant at 1% level, ** = 5% level, *= 10% level and ns= not significant.
Source: Monthly price series (2010 - 2014) from MIS. Granger causality test was carried out in EVIEWS @ 7.

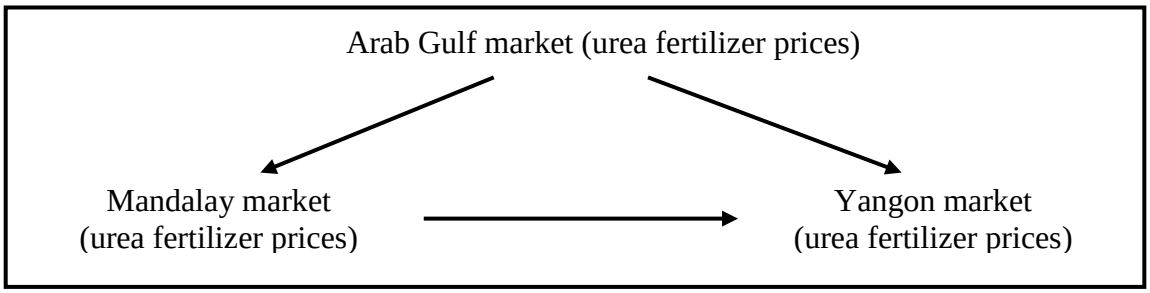


Figure 5.7 Direction of Granger causality on urea fertilizer price

For T-super fertilizer market, six pair-wise Granger causality tests on price series were also conducted. Results were reported in Table 5.8. The hypotheses are follows:

- T-super fertilizer prices in Tunisia and Mandalay markets do not Granger cause on each other
- T-super fertilizer prices in Yangon and Mandalay markets do not Granger cause on each other, and
- T-super fertilizer prices in Yangon and Tunisia markets do not Granger cause and verse versa.

The result of the Granger causality tests indicated that T-super fertilizer prices in Mandalay market Granger cause changes T-super fertilizer prices in Yangon market with significant at the 1 percent level, which means that Mandalay market prices might be a causal factor for Yangon market prices.

By the other way, the direction of Granger causality for T-super fertilizer markets was illustrated in Figure 5.8. For T-super fertilizer markets, Mandalay market caused Yangon market prices with unidirectional movements. There was no influence of price movement from foreign market (Tunisia).

Twenty pair-wise Granger causality tests for compound fertilizer prices were also performed. Results were reported in Table 5.9. By means of Granger causality tests, the result indicated that Golden Lion fertilizer prices in Mandalay market Granger cause changes Golden Lion fertilizer prices in Yangon market, therefore the null hypothesis is rejected at the 1 percent level, which means that Mandalay market prices of Golden Lion fertilizer might be a causal factor for Yangon market prices.

By the other way, the direction of Granger causality for compound fertilizer markets was illustrated in Figure 5.9. For compound fertilizer markets, Mandalay market caused Yangon market prices with unidirectional movements. There was no influence of price movement from Cfr.SE Asia market.

Table 5.8 Results of Granger causality test on T-super fertilizer price series

No.	Hypotheses	F-statistic	Prob.
1	T-super fertilizer prices in Tunisia market does not Granger cause T-super fertilizer prices in Mandalay market	0.844	0.436 (ns)
2	T-super fertilizer prices in Mandalay market does not Granger cause T-super fertilizer prices in Tunisia market	1.258	0.293 (ns)
3	T-super fertilizer prices in Yangon market does not Granger cause T-super fertilizer prices in Mandalay market	0.044	0.957 (ns)
4	T-super fertilizer prices in Mandalay market does not Granger cause T-super fertilizer prices in Yangon market	7.137	0.002 (***)
5	T-super fertilizer prices in Yangon market does not Granger cause T-super fertilizer prices in Tunisia market	1.374	0.262 (ns)
6	T-super fertilizer prices in Tunisia market does not Granger cause T-super fertilizer prices in Yangon market	1.242	0.297 (ns)

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

Source: Monthly price series (2010 - 2014) from MIS. Granger causality test was carried out in EVIEWS @ 7.

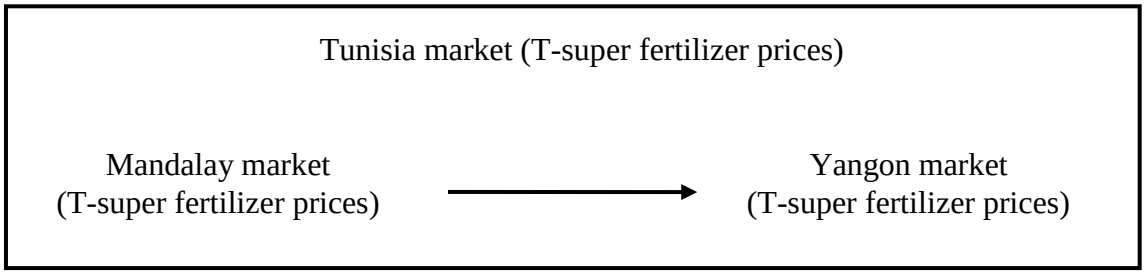


Figure 5.8 Direction of Granger causality on T-super fertilizer price

Table 5.9 Results of Granger causality test on compound fertilizer price series

No.	Hypothesis	F-statistic	Prob.
1	Armo fertilizer prices in Mandalay market does not Granger cause Armo fertilizer prices in Yangon market	0.556	0.577 (ns)
2	Armo fertilizer prices in Yangon market does not Granger cause Armo fertilizer prices in Mandalay market	0.157	0.855 (ns)
3	Golden Lion fertilizer prices in Mandalay market does not Granger cause Armo fertilizer prices in Yangon market	0.566	0.571 (ns)
4	Armo fertilizer prices in Yangon market does not Granger cause Golden Lion fertilizer prices in Mandalay market	0.002	0.997 (ns)
5	Golden Lion fertilizer prices in Yangon market does not Granger cause Armo fertilizer prices in Yangon market	0.984	0.381 (ns)
6	Armo fertilizer prices in Yangon market does not Granger cause Golden Lion fertilizer prices in Yangon market	0.537	0.588 (ns)
7	Compound fertilizer prices in Cfr.SE Asia market does not Granger cause Armo fertilizer prices in Yangon market	0.055	0.946 (ns)
8	Armo fertilizer prices in Yangon market does not Granger cause Compound fertilizer prices in Cfr.SE Asia market	0.058	0.944 (ns)
9	Golden Lion fertilizer prices in Mandalay market does not Granger cause Armo fertilizer prices in Mandalay market	1.728	0.188 (ns)
10	Armo fertilizer prices in Mandalay market does not Granger cause Golden Lion fertilizer prices in Mandalay market	0.908	0.409 (ns)
11	Golden Lion fertilizer prices in Yangon market does not Granger cause Armo fertilizer prices in Mandalay market	0.616	0.544 (ns)
12	Armo fertilizer prices in Mandalay market does not Granger cause Golden Lion fertilizer prices in Yangon market	0.425	0.656 (ns)
13	Compound fertilizer prices in Cfr.SE Asia market does not Granger cause Armo fertilizer prices in Mandalay market	1.278	0.287 (ns)
14	Armo fertilizer prices in Mandalay market does not Granger cause compound fertilizer prices in Cfr.SE Asia market	0.054	0.947 (ns)
15	Golden Lion fertilizer prices in Yangon market does not Granger cause Golden Lion fertilizer prices in Mandalay market	4.228	0.019 (ns)
16	Golden Lion fertilizer prices in Mandalay market does not Granger cause Golden Lion fertilizer prices in Yangon market	5.353	0.008 (***)
17	Compound fertilizer prices in Cfr.SE Asia market does not Granger cause Golden Lion fertilizer prices in Mandalay market	0.472	0.626 (ns)
18	Golden Lion fertilizer prices in Mandalay market does not Granger cause compound fertilizer prices in Cfr.SE Asia market	1.608	0.210 (ns)
19	Compound fertilizer prices in Cfr.SE Asia market does not Granger cause Golden Lion fertilizer prices in Yangon market	0.225	0.799 (ns)
20	Golden Lion fertilizer prices in Yangon market does not Granger cause compound fertilizer prices in Cfr.SE Asia market	1.18477	0.314 (ns)

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

Source: Monthly price series (2010 - 2014) from MIS. Granger causality test was carried out in EVIEWS @ 7.

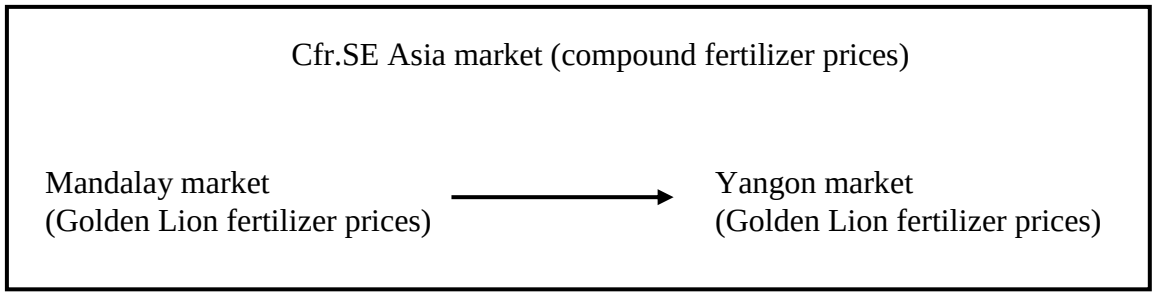


Figure 5.9 Direction of Granger causality on compound fertilizer price

CHAPTER VI

SUMMARY FINDINGS, CONCLUSION AND POLICY IMPLICATION

This study aimed to analyze fertilizer supply chain and market structure for the agricultural development in Myanmar. This chapter draws to point out the important findings of the study as a detailed summary based on the findings per objective and the recommendations for policy change. Furthermore, the integration of Myanmar fertilizer market with international fertilizer market was very important for Myanmar fertilizer market development.

6.1 Summary Findings and Conclusion

6.1.1 Description of the market participants, their marketing activities and functions

This study mainly focuses on the status of the Myanmar fertilizer market. Field survey with simple random sampling method was practiced to know the present fertilizer marketing channel and to understand the activities and function of the market participants along the fertilizer supply chain. According to the market survey, there were four main market participants (local wholesalers, village retailers, company agents and farmers) in Tatkon Township. According to the result findings, all local wholesalers were the most important intermediaries in the market. The second most important intermediaries were village retailers in the study area.

In registered urea fertilizers market of local wholesalers, there were four trading brands such as Shwe Taung, Shwe Nagar -1, Shwe Nagar -2 and domestically produced urea. In selected villages, registered urea fertilizer especially Shwe Taung was sold by some retailers. Registered urea fertilizers purchased only from Mandalay market. Therefore, imported registered urea fertilizer from China especially Shwe Taung was the mainly fertilizer supply in Tatkon Township, followed by registered compound fertilizers and unregistered compound fertilizers. Supply of domestically produced urea fertilizer did not influence well in the fertilizer market.

In the marketing activities of local wholesalers, they sold imported registered compound fertilizer products (local name) from foreign countries such as Awba, Golden Cock, Pender, Kie Mie Yar (MC), Golden Key, Golden Lion, Zar Ma Ni and other brands. The village retailers also sold several registered trading compound fertilizers brands such as Golden Cock, Mahkota, Armo, Golden Lion and Awba and so on. Those registered compound fertilizers purchased from Mandalay and Yangon markets. The most popular brands among those registered compound fertilizers were Awba, Armo, Golden Cock and

Mahkota brands in the study area. The compound fertilizers with nutrient ratio (10:10:5) and (15:15:15) were the most popular products in Tatkon Township. Two trading brands from Myingyan market such as Butterfly and Lu Yine Khaung unregistered compound fertilizers which were also marketing by all local wholesalers except one local wholesaler. Only Lu Yine Khaung unregistered compound fertilizer was sold by one village retailer. The supplies amount of unregistered compound fertilizers were the lowest in the study area. Fertilizer repackaging was used by all local wholesalers and some village retailers to sell as small amounts or small bags in the study area. According to the market investigation, the smallest local wholesalers chiefly used to sell repackaging as smaller amounts while the smallest village retailers mainly sold as the whole bag or the weight of 50 kg.

When marketing urea fertilizer, all market intermediaries used only cash down payment system. The most local wholesalers used only cash down payment system when purchase compound fertilizers. Some local wholesalers purchased by both cash down and credit system. Sometimes, only credit system was used to purchase by some local wholesalers. All of local wholesalers resold fertilizer by both cash down and credit system. In compound fertilizers market, some village retailers used to purchase by cash down system. And most village retailers used credit buying system. In credit based buying system, they had to pay an interest rate of 3% per month. The sales by credit system had an interest rate of 5% per month. Their main transportation vehicle was truck.

The Diamond Star Company Limited mostly imported fertilizer from China, Korea, Vietnam and Thailand. Yangon was the primary market for Diamond Star Company Limited and supplied fertilizers to all over the Myanmar. The fertilizer brands by Golden Lion High Tech Agricultural Resources Company Limited were regularly imported from China and India. Therefore, Mandalay was the primary market and then to distribute fertilizers to the whole country. These two Company Limited offered sale promotion activities to the staffs in order to promote the sale by encouraging the staffs and buying promotion activities to market intermediaries. The company agents mainly performed as field staffs and marketing extension for their products. Their commodities were mainly distributed to the market intermediaries. The compound fertilizers with nutrient ratio (10:10:5) and (15:15:15) for Diamond Star Company Limited were the peak sale brands. The compound fertilizers with nutrient ratio (15:7:8), (10:10:5) and (4:18:18) were the top sale brands for Golden Lion High Tech Agricultural Resources Company Limited in the local market. They mostly used by cash down payment for selling but sometimes used to sell with credit system to pay about one week or one month with no interest rate.

The last market participants were farmers or end users. Half of the sample farmers mainly grew both monsoon and summer rice. The rest sample farmers mostly grew vegetable especially cabbage and cauliflower as winter crops. All sample farmers applied mainly urea fertilizer which was China products in their crops production. Half of the sample farmers bought urea fertilizer from village retailers. And the rest of them purchased from local wholesalers in Tatkon Town. In the case of compound fertilizers, most of sample farmers purchased from village retailers whereas the rest of village retailers purchased from local wholesalers. When buying urea fertilizer, half of the sample farmers bought with cash down transaction type and the rest half of them purchased by credit system transaction. More than half of the sample farmers bought compound fertilizers by credit system with an interest rate of 5% per month and the rest farmers used to buy with cash down system.

The problems faced by most of the marketing intermediaries in the study area were difficulty in fertilizer marketing, poor quality of domestically produced urea fertilizer, price fluctuation and high price. Most of the sampled farmers faced damage of soil condition. And some farmers did not know exactly the composition of nutrient ratio (N, P, K) content in compound fertilizer.

6.1.2 Fertilizer marketing channels and profit of market intermediaries

According to the market survey, it was found that there were three main types of fertilizer marketing channels in Tatkon Township. Urea fertilizer and registered compound fertilizers were mainly imported from China. These fertilizers flowed from private companies to main market such as Mandalay wholesale market, Yangon wholesale market and then reached to local wholesalers and village retailers. Unregistered compound fertilizers flowed from only Myingyan wholesale market and then reached to market intermediaries. In fertilizer market structure, Mandalay was the major fertilizers supplier to Tatkon Township.

In marketing channel (1), there was marketing link with all market participants (local wholesalers, village retailers, company agents and farmers). In channel (2), there was marketing link with all market intermediaries except local wholesalers. In channel (3), there was direct marketing link with only company agents and then their commodities flowed to local wholesalers, village retailers and finally to farmers. Based on the results, the fertilizer marketing channel (1) was the major channel which sold the largest amount of fertilizer in the study area. The channel (2) was the second important channel and the lowest amount of fertilizer flowed from the channel (3) to the consumers.

In channel (1), profit of local wholesalers on urea, Armo (10:10:5) and Golden Lion (15:7:8) fertilizers from Mandalay market were investigated along the fertilizer market in the study area. The average profit obtained by local wholesalers on Armo compound fertilizer was relatively higher than the profit of urea fertilizer and Golden Lion compound fertilizer. In the case of Myingyan market for local wholesalers, the average profit of Lu Yine Khaung unregistered compound fertilizer was twice than Butterfly's profit. For Yangon market of local wholesalers in channel (1), average profit for Awba (15:15:15) was relatively higher than Kie Mie Yar (MC) (15:15:15) in the study area. For the urea fertilizer market, village retailers from channel (2) got higher profit than local wholesalers from channel (1).

6.1.3 Description of monthly fertilizer price movement and fluctuation

For the seasonal pattern, urea fertilizer price in Mandalay market was fluctuated by bimodal manner in the year of 2012-2014. Urea prices in May and September were the peak season and prices went down in August and November for those years.

In the case of Armo price for Yangon market, the price occurred with little fluctuation throughout the year of 2012. The highest price for Armo was observed in April and price down in October 2013. In a year 2014, March, April and May were the lowest months in price and during July to December the price was high.

Golden Lion's price rose in April and May then fell with static from June to December in 2012. In 2013, the peak price was observed from June to October and the lowest price was in December. Golden Lion's seasonal price movement was no variation in 2014. Therefore, monthly fertilizer price movement was not the same in the years 2012 to 2014.

Fluctuation of urea fertilizer prices in the selected markets were the similar trend in 2014 and T-super prices in the domestic (Yangon and Mandalay) markets were also the same trend but fluctuation of Tunisia market prices was not the same pattern with domestic markets. Domestic market prices of compound fertilizer showed the same pattern whereas fluctuation of international (Cfr.SE Asia) market prices of compound fertilizer was found in 2014.

6.1.4 Market integration and price causality

In this study, the monthly fertilizer price series data were used from January 2010 to December 2014 with total 60 observations for price integration.

For step 1, according to the results of the Augmented Dickey Fuller tests, all of the fertilizer price series were non-stationary at the level test. However, in the first difference all the fertilizer price series were stationary and integrated of order 1 process.

For step 2, according to the results of co-integration tests, the Johansen's multivariate procedure was used to determine the presence or absence of co-integration among the price series. The Johansen procedure gave two likelihood ratio tests: the trace test and the maximum eigenvalue test. According to the results from those two tests, the entire fertilizer price series were co -integrated among those price series. Therefore, all of the fertilizer price series had long-run integration between fertilizer markets.

For step 3, according to the Granger causality results, Arab Gulf market caused all markets prices with unidirectional in urea fertilizer markets. Therefore, Mandalay and Yangon urea fertilizer price changes were caused by Arab Gulf market at 1% and 5% levels. So, Arab Gulf market has the strongest market power. For the domestic fertilizer markets, Mandalay market caused Yangon market prices with unidirectional. Thus, Yangon urea fertilizer price changes were caused by Mandalay market at 5% level.

For T-super fertilizer markets, Mandalay market caused Yangon market prices with unidirectional. Therefore, Yangon T-super fertilizer price changes were caused by Mandalay market at 1% level. The price movement in international fertilizer market did not reflect well in the domestic fertilizer markets.

Finally, for Golden Lion fertilizer in compound fertilizer markets, Mandalay market caused Yangon market prices with unidirectional. In the other words, Yangon Golden Lion fertilizer price changes were caused by Mandalay market at 1% level. The rest of pair- wise combinations, price causality was not distributed well among all markets. Based on the finding of price causality, Mandalay market was a leading market for price formation in fertilizer markets.

6.2 Policy Implication

The analysis on Myanmar fertilizer supply chain and market structure in this study by evaluating the local fertilizer market and price integration among fertilizer markets will provide some policy implications in order to enhance the efficient of Myanmar fertilizer market in the future.

The fertilizer supply chain was well composed of four main market intermediaries; local wholesalers, village retailers, company agents and farmers. In the fertilizer market structure, Mandalay market was the key player for the distribution of imported urea fertilizer

from China and domestically produced urea as local market participants such as local wholesalers and village retailers were mainly relied on this market. Additionally, large sale promotion for the imported compound fertilizer by the fertilizer companies, and big dealers from Mandalay markets became the main distributors of imported compound fertilizer. Therefore, the means to promote the commodity (fertilizer) flowed of Mandalay market by reducing transportation cost or relaxing some restrictions on trade will enhance the fertilizer market access by the market participants or end users, farmers. On the other hand, the monitoring or evaluation on the holding market power by the Mandalay market needs to be assessed in order to prevent market distortion by misconducting of big dealers in Mandalay market or to secure the consumer right especially end users, farmers.

The local wholesalers purchased imported (registered) urea fertilizers, local trading brands such as Shwe Taung, Shwe Nagar -1, Shwe Nagar -2 and domestically produced urea from Mandalay market. Although domestic urea was mainly produced in the lower part of Myanmar, the local wholesalers purchased from Mandalay market. Among the imported (registered) urea fertilizers, local trading brand, Shwe Taung occupied a large share of local wholesaler's sale. In addition, it was the only brand marketed by village retailers in the selected villages. The most imported popular fertilizer brands should be enforced especially in terms of standardized quality.

Two unregistered compound fertilizers from Myingyan market namely Butterfly and Lu Yine Khaung were also marketed by most local wholesalers and some village retailers in the study area. The marketed amount of unregistered compound fertilizers was the lowest compared to urea and compound fertilizer in the study area. Marketing of registered and unregistered compound fertilizers in Myanmar and its nutrient content should be regulated. Therefore, laws and regulations concerning fertilizer business relations and contracts should be needed to be more clarified and enforced.

Although imported compound fertilizers were accessible in the study area, urea fertilizers were largely utilized by farmers. They should be trained to use appropriate fertilizer application to protect soil fertility problem. Lack of awareness on nutrient content of compound fertilizers by the sample farmers showed the necessity of extension training on fertilizer technology and application techniques in agricultural production. Thus, there is needed to educate fertilizer application technique to their production according to the recommendation by MOAI. Moreover, research activities on rate of fertilizer application on the respective cultivated varieties should be reinforced and fertilizer usage technology should be disseminated to farmers.

Domestically produced urea was not popular in the local market because of its inconsistent granule type, easily solvent and improper packaging. The constraints of domestic fertilizer production and marketing should be explored. Enhancing domestically produced fertilizer can fulfill the local demand of fertilizer and provide fertilizer with affordable price to the farmer. Therefore, local urea fertilizer production should be promoted by solving problems particularly related with quality competitiveness. Additionally, rules and regulations to ensure competitive practices should be taken into account.

The imported registered urea and compound fertilizer products were purchased from Mandalay and Yangon markets by the local wholesalers and village retailers. Thus, distribution system of fertilizers from wholesale markets to farmers' field should be promoted by minimizing transaction costs. The high transportation cost in the marketing channel was one of the main obstacles in Myanmar. In addition, the fertilizer market participants did not have enough capital for fertilizer marketing including the end user, farmers. As the local traders were marketing fertilizers with credit system, it is essential to provide loan which can reduce the transaction cost not only for market intermediaries but also for end users, farmers.

The fertilizer importing companies used large sale promotion activities by giving bonus to sale staffs and extra fertilizer bags to local traders with fixed price. Such kind of marketing strategy made local fertilizer market price especially T-super and Compound fertilizer deviated from the international fertilizer market price and consequently local fertilizer price market varied differently with the international fertilizer market price. As a result, the local fertilizer market price was not occurred by the international fertilizer market price. The fertilizer market price in Mandalay market largely influenced on the local market price accordingly. If the influencing factor of Mandalay market is increased largely, there will be distorting factors to the Myanmar fertilizer market and the ways to improve the competitiveness of fertilizer market should be developed.

The fertilizer consumption reached a peak in the months of August and September in the study area. On the other hand, according to the analysis on seasonal price fluctuation, urea fertilizer price in Mandalay market was fluctuated by bimodal manner because of high fertilizer demand in the major crop growing seasons. Rules and regulations which enhanced the fertilizer market development should be enforced not only for the market competitiveness but also for the consumer right protection from the market manipulation of big fertilizer traders.

Efficient market information system is the main stream for the whole development of the marketing channel. Market Information Service (MIS) should be strengthened to

broadcast market data because it is an important institution which is responsible for supplying and demanding adjustments of the agricultural products, agricultural products prices monitoring, marketing research and development programs for marketing participants. The government should pay attention in the development of fertilizer distribution system by enhancing the knowledge of intermediaries through marketing extension services. Therefore, the government authorities link to invest in fertilizer sector that can improve significantly the efficiency of agricultural sector in Myanmar.

According to the results of the market integration and price causality, pricing efficiency in terms of price integration and price movement in urea fertilizer markets should be modeled to other fertilizer markets. Although Myanmar is an absolute fertilizer importer, T-super and compound fertilizer prices did not disseminate well among domestic and international markets. Therefore, the causes of price distortion which reduced the competitiveness of fertilizer markets should be investigated more as further research to facilitate the efficiency of Myanmar fertilizer market. This study could be the useful guide for other analysis essential in agricultural development.

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