Background Paper No.6
Rapid Value Chain Assessment:
Structure and Dynamics of the Rice Value Chain in Myanmar

by

Larry C.Y. Wong and Eh Mywe Aye Wai

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EXECUTIVE SUMMARY

This Background Paper is an integral part of the Diagnostic Assessment. It involves an assessment of the Myanmar rice value chain within the context of the Myanmar rice industry. Special focus is paid to its structure and performance, dynamics, and future prospects. Also included is a consideration of its weaknesses and constraints that had influenced the development of the industry as well as an evaluation of the prospect of improving the value chain and consequently the industry and suggesting crucial steps that should be taken for the short game and the long game. Basically, the report integrates the findings from intensive literature review and desk research coupled with observations and interviews conducted during field visits in October and November 2012 and supplemented by personal communication with key players in the public and private sectors as well as civil society at various levels of the rice value chain.

A backdrop was provided by considering the historical development of the rice industry and key policies and milestones as they relate to the development and transformation of the rice value chain, particularly the series of liberalization of the rice sector since the drastic total withdrawal of Myanma Agricultural Produce Trading (MAPT) in both the domestic and export rice market in April 2003. Since then, the transformation of the rice supply or value chain has been nothing short of spectacular at the upstream, midstream and downstream segments of the chain, involving various forms of Public-Private-Partnership. Key developments include the establishment of Rice Specialization Companies (RSCs) from 2008, followed by the formation of the Myanmar Rice Industry Association (MRIA), an umbrella association representing the entire rice supply chain, in January 2010 and subsequent upgraded to Myanmar Rice Federation (MRF), followed by the launching of Myanmar Agri-business Public Company (MAPCO) in 2012. It was recently announced that a new think-tank, the MAPCO Institute, will be established in early 2013 to support agribusiness development in Myanmar.

In the course of the assessment, the study team was often surprised by the array of data and information collected by government agencies, MRF, international nongovernmental organizations, and non-governmental organizations (NGOs). Unfortunately, they are available in bits and pieces in different ministries and departments and often only referenced once in reports. There are also many data and information gaps and, more often than not, data quality and consistency is suspect as there do not seem to have been serious attempts at validating and verifying them. Basic data series on acreage planted, harvested, yield, production, consumption and available surplus for export are often overstated and hence, dubious and too weak to form the basis for any detailed policy analysis or for attracting large strategic foreign direct investments (FDI). Consequently, we have to resort to patching data and information from different sources together to at least provide an indication of trends and relative importance of issues as well as performance and transformation. Unfortunately, patching of data does not lend itself well to advanced or structured analytics. The effect of this on some of our findings may be telling.

Nevertheless, it should be stressed that this Diagnostic Assessment is conducted in the midst of rapid transformation brought on by the new regime which has seen attempts at addressing well recognized perennial weaknesses in the rice industry with a view of reinvigorating it and re-establish Myanmar as a major reliable exporter into the global rice market. It is conducted at a time when the government is seriously addressing desirable policy reforms, cognizant that Myanmar has not performed to its potential, given its resource endowment and farmers and agri-business participants who have proven to be adaptable, thoughtful, resourceful,

resilient and entrepreneurial but poorly supported. The study draws from secondary data sources, on published reports coupled with observations and key informant interviews during field visits to Naypyitaw; Shwebo and Monywa in Sagaing Division; and Pakkoku in Magwe Division. It also draws upon prior knowledge of other rice areas and the on-going transformation of rice supply chains as well as personal communication with a network of knowledgeable persons, from both the public and private sectors. These individuals are conversant with the historical development and intricacies of the various levels of and familiar with the coping mechanisms adopted to handle risk and uncertainty of the Myanmar rice value chain.

Guided by the objective of this background paper on assessing the value chain of the pervasive and dominant rice industry in Myanmar in support of key assertions in the overall Diagnostic Assessment Report as well as somewhat inspired by the recent work of Reardon et al. (2012) on the *quiet revolution* in Asian rice and potatoes value chains transformation, we have elected to orientate this rice value chin assessment towards also examining strategic investments as well as other considerations at the upstream (inputs, farmers and organization of production units); midstream (milling, other processing and wholesaling); and downstream (retailing, especially supermarkets as well as international trade) segments and their impact on the transformation of the Myanmar rice value chains. Furthermore, guided by the peculiarities of Myanmar when compared to other ASEAN rice producing and exporting countries, arising from its strategic geo-political and geo-commercial location coupled with the potential to be water, food and energy secure at the macro level, we also elected to examine the flows of paddy and rice and the current and future prospects of exporting rice. This was also prompted Ã, by the government's declared objective of reestablishing Myanmar as a major rice exporter with a set target of exporting three million tons of rice by 2017.

Consequently, this paper is organized such that after this introduction Section 2 provides an overview of the Myanmar rice sector to act as a back-drop by elaborating on the production (area, yield, types of rice grown), consumption (per capita consumption, household expenditure on rice); surplus and deficit regions; and peculiarities of Myanmar and its rice sector. Section 3 focuses on the Myanmar rice value chain starting with the mapping of the overall rice supply chain and subsequently the differentiated or sub-chains as well as the structure, performance and economics of rice production, marketing and trading before considering recent investments at the upstream, midstream and downstream segments of the rice value chain. Section 4 considers the dynamics and transformation of the supply/value chains as well as weak links in the Myanmar rice supply/value chain and other salient issues. Subsequently, Section 5 considers the future prospects and options before making recommendations for the short game, comprising suggestions for improving performance in the rice industry without structural or policy reforms as well as *quick wins* generating immediate gains while bridging to long term structural reforms. Recommendations are also made for the long game which involves structural and policy reforms which requires political will, commitment, investment, and patience but will increase efficiency, raise productivity, reduce risk, and encourage private investments along the rice supply chain. Section 6 concludes the paper.

At the end of this rapid assessment of Myanmar’s rice value chain, we suggest key recommendations for the short game which include increasing productivity by using good-quality or certified high-yielding seeds and modern production techniques; promoting rational and selective dry season diversification into high value crops; improving water management and agri-support services; maintaining and upgrading rural roads and developing farm roads

(feeder networks); and expanding rural financial services to improve access to inputs and reduce reliance on money lenders, all targeted at the upstream segment of the rice value chain. For the midstream segment, improving post-harvest handling; improving food safety and traceability; promoting strategic end-uses and rice co-products and by-products/wastes; encouraging private sector participation in processing rice and other end uses, and developing linkages to upstream and downstream segments of rice value chain so as to facilitate the development and strengthening of comprehensive supply chains which compete with each other. At the downstream level, recommendations include enhancing trade facilitation and improving export processing; targeting niche export markets for better quality (5 to 15% brokens) of specific varieties/types of rice rather than continue exporting low quality (25% brokens) of a generic Emata[1] category; improving grading and quality standards; improving branding and highlighting unique selling points of Myanmar rice; shorten supply chains by increasingly by-passing intermediaries like international traders and sell direct to strategic overseas markets; and develop more structured border trade, especially to China. In terms of low hanging fruits that will bridge to long term structural reforms, recommendations include improving statistical and resource data base, especially the stocks and flows of inputs and outputs at various levels of the value chain as part of rigorous ground-based statistical surveys, combined with latest satellite based measurement systems; and synthesizing expert opinion on current best practices for specific upstream, midstream, and downstream settings.

Key recommendations for the long game include creating a farmer-centered, market-oriented research system; promoting transparent, predictable policies to support and regulate the private sector; investing in rural financial systems serving the different segments of the value chain; establishing and strengthening capacity of farmer organizations; investing in infrastructure to reduce transportation and export costs by developing an integrated intermodal logistics system; and attracting or facilitating financing for infrastructure development (new as well as upgrading of large irrigation projects, roads, and farm roads) and exports (export-import bank).

The successful framing and rolling-out of the above short game and long game recommendations will require a meeting of the minds as much as a pooling of resources (especially data, information, people and funds of the public, private and civil society). Consequently, the proposed recommendations are expected to contribute greatly towards increasing the efficiency, competitiveness, and sustainability of Myanmar's Rice Supply Chain and Rice Industry as we move into a more globalized and liberalized trading environment as well as a more integrated ASEAN in the 21st Century.

[1] Emata is a mixture of a range of varieties of varying proportions and hence, without consistence or uniqueness of taste or cooking characteristics (not a blend of varieties which gives a distinctive taste).

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ACRONYMS

ACMECS	Ayeyarwady-Chao Praya-Mekong Economic Cooperation Strategy
ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BIMSTEC	Bay of Bengal Initiative for Multi Sectoral Technical and Economic Cooperation
CSO	Central Statistical Organization
DOA	Department of Agriculture
FAO	Food and Agricultural Organization of the United Nations
FMCG	Fast Moving Consumer Good
FOB	Freight on Board
GDP	Gross Domestic Product
GMS	
HYVs	High Yielding Varieties
Kg	kilogram
Ks	Kyats
MAPCO	Myanmar Agri-business Public Company
MAPT	Myanma Agricultural Produce Trading
MDRI/CESD	Myanmar Development Resource Institute - Centre for Economic and Social Development
MEC	Myanmar Economic Corporation
MRF	Myanmar Rice Federation
MRIA	Myanmar Rice Industry Association
MT	Metric Tons
MMT	Million Metric Tons
OEM	
REXC	Rice Exchange Center
RSCs	Rice Specialization Companies
TMT	thousand metric tons
TPD	tons per day
TPH	tons per hour
UMEH	Union of Myanmar Economic Holding
USAID	United States Agency for International Development
USD	U.S. Dollar
USDA	United States Department of Agriculture
YGN	Yangon

1. INTRODUCTION

This background paper is the result of a rapid assessment of the rice value chain which forms an integral component of the output of the Diagnostic Assessment. Special focus is paid to the structure, dynamics, and future prospects of the value chain and by extension the Myanmar rice industry. It also involves a consideration of its weaknesses and constraints that have influenced the development of the industry as well as evaluate the prospect of improving the value chain and consequently the industry and suggesting crucial steps that should be taken for the short game and the long game. Basically, the report integrates the findings from intensive literature review and desk research coupled with observations and interviews conducted during field visits in October and November 2012. It is also supplemented by personal communication with key players in the public and private sectors as well as civil society at various levels of the rice value chain, working in close collaboration with Eh Mywe Aye Wai of MDRI.

> *"When we see other people's (countries') way of life through our own value system, we may be shocked; but if we know what brought that person (country) to the place where they are today, then perhaps we can be a bit more understanding" –*
>
> Yu Dan (2006) *Confucius From The Heart: Ancient Wisdom for Today's World*

At first blush, there is a general feeling that all is not well with the Myanmar rice industry, indeed with Myanmar agriculture as a whole, given the widely acknowledged data weakness, stemming from inconsistent and questionable data sets from disparate sources, lack of clear policy direction and coherence, and persistent obsession with self-sufficiency and price control measures to ensure food security. While micro level studies have been largely critical, particularly those conducted by civil society and academics, especially prior to 2008, more recent macro and especially meso level studies by international agencies like FAO (and even some by academics and civil society since 2008) are more constructive. Many lament the failure to fulfill the inherent potential and advantage provided by Myanmar's varied resources of water, land, and energy, with some highlighting the thoughtful, adaptable, resilient and entrepreneurial but unfortunately poorly supported farmers and participants along the rice value chain. They also provide suggestions and recommendations of how Myanmar should move forward.

Nevertheless, many are baffled by the speed and gusto which fueled Myanmar's concerted effort to address some of the key issues identified so far, so as to fulfill this potential and develop Myanmar into a more sustainable and inclusive manner, especially over the last two years. It is during these exciting and interesting times that the current diagnostic assessment is undertaken by USAID. It aims to explore and prioritize strategic follow-up areas of study and action as well as what and how Myanmar can fit in to USAID's Feed the Future program. It distills and builds on the range or studies that have been conducted both by foreign and local researchers, and public and private sectors as well as civil society and is complemented by the insights and experiences of key individuals operating or have operated at various levels as well as carefully structured and programmed field visits and meetings facilitated by our local counterparts, MDRI.

A backdrop was provided by considering the historical development of the rice industry and key milestones as they relate to the development and transformation of the rice value chain, particularly the series of liberalization of the rice sector since the drastic total withdrawal of

Myanma Agricultural Produce Trading (MAPT) in both the domestic and export rice market in April 2003. Since then, the transformation of the rice supply or value chain has been nothing short of spectacular at the upstream, midstream, and downstream segments of the chain, involving various forms of Public-Private-Partnerships. Key developments include the establishment of Rice Specialization Companies (RSCs) from 2008 followed by the formation of the Myanmar Rice Industry Association (MRIA), an umbrella association representing the entire rice supply chain, in January 2010 and subsequently upgraded to Myanmar Rice Federation (MRF), followed by the launching of Myanmar Agri-business Public Company (MAPCO) in 2012. It was recently announced that a new think-tank, the MAPCO Institute, will be established in early 2013 to support agribusiness development in Myanmar.

In the course of the study, the study team was often surprised by the array of data and information collected, both published and unpublished. Unfortunately, they are available in bits and pieces in different ministries and departments and often only referenced once in reports. There are also many data and information gaps and, more often than not, data quality and consistency is suspect as there do not seem to have been serious attempts at validating and verifying them. Basic data series on acreage planted, harvested, yield, production, consumption, and available surplus for export are often overstated and hence, dubious and largely too weak to form the basis for any useful policy analysis. However, the positive aspect is that such attempts at improving data collection, storage, and retrieval already is funded by the government, private sector, and civil society. This augurs well for the future as there is already a felt need at tackling this underlying or overarching data problem or weakness. Clearly, a collective and synergistic effort aimed at more transparency and democratization of data, information, and analyses all round is needed. This should form the basis for more public and policy dialogue as government reform efforts take root and bear fruit subsequently.

Now, this diagnostic assessment is conducted in the midst of rapid transformation brought on with the new regime which has seen attempts at addressing well-recognized perennial weaknesses in the rice industry with a view of reinvigorating it and re-establishing Myanmar as a major reliable exporter into the global rice market. It is conducted at a time when the government is seriously addressing desirable policy reforms, cognizant that Myanmar has not performed to its potential given its resource endowment, and farmers and agri-business participants who have proven to be adaptable, thoughtful, resourceful, resilient and entrepreneurial but poorly supported. The study draws from secondary data sources and published reports coupled with observations and key informant interviews during field visits to Naypyitaw, Shwebo and Monywa in Sagaing Division, and Pakkoku in Magwe Division. It also draws upon prior knowledge of other rice areas and the on-going transformation of rice supply chains as well as personal communication with a network of knowledgeable persons, from both the public and private sectors. These individuals are conversant with the historical development and intricacies of the various levels of and familiar with the coping mechanisms adopted to handle risk and uncertainty of the Myanmar rice value chain.

Guided by the objective of this background paper on assessing the value chain of the pervasive and dominant rice industry in Myanmar in support of key assertions in the overall Diagnostic Assessment Report as well as somewhat inspired by the recent work of Reardon et al. (2012) on the quiet revolution in Asian rice and potatoes value chains transformation, we have elected to orientate this rice value chin assessment towards examining strategic foreign and local investments as well as other considerations at the upstream (inputs, farmers, and organization of production units); midstream (milling, other processing and wholesaling); and

downstream (retailing, especially supermarkets as well as international trade) segments and their impact on the transformation of the Myanmar rice value chains. Guided by the peculiarities of Myanmar when compared to other Association of Southeast Asian Nations (ASEAN) rice producing and exporting countries, especially its strategic geo-political and geo-commercial location with respect to China and India as well as being a component of various regional constructs like ASEAN, GMS, BIMSTEC, and ACMECS and being potentially water, food, and energy secure at the macro level; we also elected to examine the flows of paddy and rice and the current and future prospects of exporting rice in view of the government's declared objective of reestablishing Myanmar as a major rice exporter in view of its increasing surplus and its set target of exporting three million tons of rice by 2017.

Consequently, this paper is organized such that after this introduction Section 2 provides an overview of the Myanmar rice sector to act as a back-drop by elaborating on the production (area, yield, types of rice grown), consumption (per capita consumption, household expenditure on rice); surplus and deficit regions; and peculiarities of Myanmar and its rice sector. Section 3 focuses on the Myanmar rice value chain starting with the mapping of the overall rice supply chain and subsequently the differentiated or sub-chains as well as the structure, performance, and economics of rice production, marketing, and trading before considering recent investments at the upstream, midstream, and downstream segments of the rice value chain. Section 4 considers the dynamics and transformation of the supply/value chains as well as weak links in the Myanmar rice supply/value chain and other salient issues. Subsequently, Section 5 considers the future prospects and options before making recommendations for the short game, comprising suggestions for improving performance in the rice industry without structural or policy reforms as well as quick wins generating immediate gains while bridging to long term structural reforms. Recommendations are also made for the long game which involves structural and policy reforms which requires political will, commitment, investment, and patience but will increase efficiency, raise productivity, reduce risk, and encourage private investments along the rice supply chain. Section 6 concludes the paper.

2. BACKGROUND

Rice is the most important food crop of Myanmar and it remains a strategic sector in terms of its continuing significant contribution to the gross domestic product (GDP), income, and employment generation. Of the estimated total population in 2010-2011 of 59.78 million, about 66% (or 39 million) are engaged in agriculture. On the supply side, the major crop, rice, is cultivated in 18.9 million acres or 33% of the total crops sown area. Labor absorption rate is the highest in the rice industry and nearly three-fourths of farm household income is derived from rice farming and related activities, especially in the main rice area of Ayeyarwady, Bago, and Sagaing Regions.

Rice is the major source of the energy for the Myanmar people as it contributes about 73 and 80 percent of the total daily dietary energy requirement in urban and rural households, respectively. Household expenditure studies found that almost two-thirds of household expenditure is spent on food and rice carries the largest weight in the Consumer Price Index with 17% on average and with 27% for low-income groups (CSO 2012). This suggests that a major percentage of the budget for low-income families is spent on rice. So not surprisingly, successive governments have intervened in the rice market using various production, marketing, and trade policies and programs in pursuit of its self-sufficiency and food security objectives.

Despite persistently targeting at increasing growth in paddy production over the years, Myanmar's performance in generating an increasing exportable surplus has been erratic up to more recently at the Union as well as at the different region/state levels. Consequently, it is important to not only focus on domestic price stability but also to examine the price gaps between domestic wholesale price and the price at harvest-time on the one hand, and between domestic wholesale prices and international prices of different rice varieties.

2.1. Historical Perspective

At this juncture, it is deemed prudent to examine the development of the Myanmar rice industry through the years, under various regimes, in terms of harvested area, yield, production, and quantity exported, (see Table 1) before zooming into a consideration of the evolution of Myanmar rice policy as well as key milestones or significant events.

From Table 1, it can be seen that Myanmar exported a high of about 3.0 million metric tons (MT) under British colonial rule (Colonial I, II, and III) and a low of zero exports during Japanese rule in the war years, and fluctuating quantities subsequently as a result of periodic banning of exports under the previous regime. Driven by the export-oriented commercialized agriculture of the British government, Myanmar became the number one exporter and was tagged as the Rice Bowl of Asia as early as 1890 (Hnin 2010). After the disruption of the war years, Myanmar became again a major exporter of rice after it gained its independence, in spite of its new focus on food security.

In December 1963, rice marketing was nationalized and the government focused on a domestic rice distribution system undertaken by the Public Trade Corporation and supported by the Union of Burma Agricultural Marketing Board. In July 1964, the government fixed the domestic rice price to be the same all over the country irrespective whether the state or division is a surplus or deficit and irrespective of logistics and transportation costs.

Table 1. Average Export Variation in Different Government Eras

Year	Regime	Harvested area ('000 ha)	Yield (MT/ha)	Production ('000 MT)	Export ('000 MT)
1826-00	Colonial I	n.a.	n.a.	n.a.	639
1901-20	Colonial II	n.a.	n.a.	n.a.	2,179
1921-41	Colonial III	4,713	1.6	7,415	2,863
1942-45	Japanese Gov.	3,495	1.3	4,761	0
1946-61	Parliament	3,667	1.5	5,437	1,404
1962-73	Revolutionary	4,751	1.6	7,369	552
1974-87	Socialist Gov.	4,742	2.6	12,141	483
1988-03	Previous Gov.	5,552	3.1	17,632	280
2010-Current	Present Govt.	7,789	3.8	17,159	812

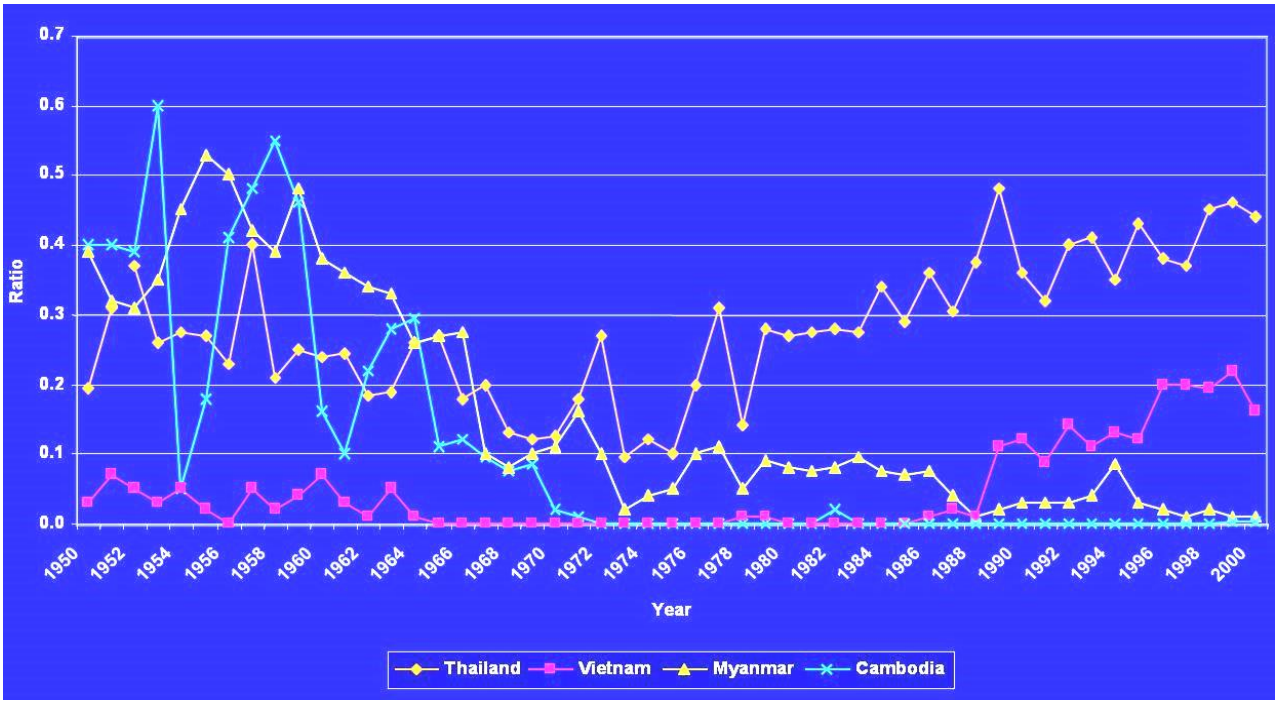
Source: Theingi Myint 2007; Hnin 2010.

In September 1987, the first market liberalization process began with the freeing of the domestic rice market. Myanma Agricultural Produce Trading (MAPT) was responsible for the export of rice and authorized to purchase 10 % of farmers' paddy production at a fixed seasonal price, which is lower than prevailing market price, effectively at a discount. Rice milled from such procured paddy at MAPT mills and contracted mills at strategic places is used to implement a rice ration system for special target groups comprising public servants, and the military as well as social welfare via special *low price* shops at reasonable price. Any balance of rice was exported solely by MAPT. Because of the *discounted* purchase price of paddy by MAPT, the resultant price of rice was very competitive in the international market.

It should be pointed out that the ban on private sector involvement in exports was lifted by stages, starting with pulses and beans which were fully liberalized in October 1988. However, rice exports remained under the state until 2003. In April 2003, the government suddenly announced the second liberalization of rice marketing, ostensibly to ensure better paddy price to farmers while enabling consumers to get rice at a fair price. The rice ration system was abolished along with the right of MAPT to procure 10% of farmers output at a discounted price. Somewhat surprisingly, MAPT was also no longer allowed to export rice, with rice exports totally turned over to private traders, along with military linked companies like Myanmar Economic Corporation (MEC) and Union of Myanmar Economic Holding (UMEH). An export tax of 10% was imposed and investors were encouraged to develop uncultivated land, especially deep-water areas, for rice and were promised the right to export 50% of production from such developed large farms. Such a move of sidelining a state trading enterprise is unprecedented, even among economies in transition like China and Viet Nam. In these countries, COFCO and VINAFOOD, respectively state trading enterprises in each country, continued to play a role in rice exports and imports even with liberalization which allowed the private sector to export rice, in order to ensure food security and price stabilization.

A perhaps unintended consequence is that all the rice and rice product (especially rice bran oil, glue making) processing facilities and reprocessing plants of MAPT were made redundant. Some were sold off to MEC and UMEH while the others fell into disrepair and were subsequently sold off, some to RSCs to be either repaired or upgraded and some even sold off as scrap. Initially, many of the new rice exporting companies, mostly without any

Figure 1. World Rice Marketing Dynamics - Fall and Rise of Rice Exporting Countries



Source: Author compilation from Wong and Suraya 2004. Note: Ratio = ratio of export to total production

pedigree in international rice trade, floundered and exports tapered off for a few years before picking up again in 2007/08, coinciding somewhat with the major food crisis and tripling of rice prices in May 2008. Subsequently, the establishment of RSCs, coupled with the later formation of MRIA in 2010, seems not only to have arrested the slide but also facilitated the subsequent increase in Myanmar's rice exports. Judging from the spate of investments in rice processing facilities and a more concerted effort at re-establishing Myanmar as a dominant rice exporting nation, further increases in exports can be expected.

From another perspective, Hnin (2010) pointed out that that Myanmar only exported 0.4 to 12% of its apparent rice surplus over the 2003-2008 period as compared to 40 to 60 % of rice surplus in 1994-95 and 2001-02 (just prior to second liberalization). In fact, Myanmar exported 40 to 50% of its total production during the 1950s when it was the leading exporter in the world as shown by Wong and Suraya (2004) in Figure 1. It also shows that major reliable exporters like Thailand and later Viet Nam consistently exports more that 30% of their total production, underscoring the concerted effort required to address the challenges involved for Myanmar to achieve its stated target of exporting three million tons of rice by 2017.

2.2. Evolution of Rice Policy and Key Milestones

Consequently, an understanding of the evolution of rice policy and key milestones to date would be important. This is summarised in by Table 2 which focuses on those relating to land rights, production, and marketing.

Table 2. Evolution of Rice Policies and Key Milestones in Myanmar

Period	Land Rights	Crop Production	Marketing
Independence 1948-1952	• private land ownership	• farmer decides what crops to grow	• private traders market
1953-1961	Land Reform (1953) • state ownership of all land • state grants tillage rights • transfers illegal	Same as above	Same as above
Socialist Period 1962-1987	Same as above	• government mandates cropping plan	• government monopoly on domestic and export marketing for scheduled[2] crops • compulsory procurement quota for scheduled crops: government purchase at fixed price
Early Liberalization 1988-2002	Same as above • informal land transfers due to increased profitability of deregulated crops	• formally, free cropping choice • in practice, government enforces cropping plan for procured crops (paddy, cotton, sugarcane)	• pulses trade liberalized • government markets and exports politically important crops: rice, cotton, sugarcane, sometimes oilseeds • compulsory procurement of above crops at reduced quota
Adjustments 2003	Same as above	• in practice, government enforces cropping plan for paddy if irrigation water are available	• compulsory paddy quota procurement abandoned As for rice export, allows to private exports
2008	Same as above	Same as above	• Rice Specialization Companies (RSC) granted export licenses in return for contract farming
Political Reforms 2011-2012	Farmland Law (2012) Virgin and Fallow Land Law (2012) Same as before: • state ownership of all land • state grants tillage rights New provisions: • transfers and mortgages legalized • farmers can contest land confiscations in court	Same as above	• Any trader can apply for a rice export license, rice specialized companies lose preferred access to export permits. • 10% export tax was imposed from 1988 to 2010. In 2011, new government reduced this to 2%
Related law in Agriculture sector			• Plant pest quarantine law(1990) • Pesticide law (1993) • Fertilizer law (2000) • Seed law (2013)

Source: Authors' compilation building on Okamoto 2008.

[2] Scheduled crops included all major crops: paddy, pulses, oilseeds, cotton, sugar, and maize.

2.3. Overview of Production, Consumption, Exports, and Self-sufficiency

With this, we turn to provide an overview of the production, consumption, and exports as well as surplus and deficit regions in Myanmar, especially from the perspective of providing a backdrop for our subsequent consideration of rice value chains and their transformation. Table 3 provides some key parameters of paddy production from 1990/91 to 2011/12 while Table 4 provides the production, consumption, and self-sufficiency (surplus or deficit based on consumption or total utilization) at the state/division and Union levels. Figure 2 shows the rice self-sufficiency level at the disaggregated level from 2005 to 2010.

Table 3. Paddy Production in Myanmar (1990-91 to 2011-12)

Year	Sown area (Million acres)	Harvested Area (Million acres)	Yield (Ton/acre)	Paddy production (million baskets)	Paddy Production (million tons)	Rice Export (Million tons)
1990/91	12.22	11.76	1.19	669	14.0	0.1950
1991/92	11.93	11.31	1.24	633	13.2	0.2610
1992/93	12.68	12.49	1.28	711	14.8	1.0410
1993/94	14.02	13.56	1.20	805	16.8	0.3540
1994/95	14.64	14.19	1.24	872	18.2	0.0930
1995/96	15.17	14.91	1.25	860	18.0	0.0280
1996/97	14.52	14.25	1.27	847	17.7	0.1200
1997/98	14.29	13.36	1.31	798	16.7	0.0550
1998/99	14.23	13.49	1.37	818	17.1	0.2510
1999/2000	15.53	15.35	1.38	965	20.1	0.8400
2000/01	15.71	15.57	1.38	1,022	21.3	0.6780
2001/02	15.94	15.85	1.43	1,050	21.9	0.1063
2002/03	16.03	15.76	1.47	1,045	21.8	0.1835
2003/04	16.17	16.13	1.55	1,109	23.1	0.1751
2004-05	16.95	16.82	1.55	1,186	24.7	0.0145
2005-06	18.26	17.87	1.59	1,327	27.7	0.3656
2006-07	20.08	19.95	1.63	1,482	30.9	0.4118
2007-08	19.99	19.80	1.64	1,507	31.4	0.8972
2008-09	20.00	19.96	1.65	1,561	32.6	0.5364
2009/10	19.93	19.91	1.55	1,566	32.7	0.7910
2010-11	19.88	19.80	1.19	1,561	32.6	0.5950
2011-12	18.76	18.70	1.24	1,390	29.0	0.2610

Source: Ministry of Agriculture and Irrigation 2012.
Note: 1 Hectare=2.471 Acres, 1basket=46 Pounds, 1Metric Ton=2,205 Pounds.

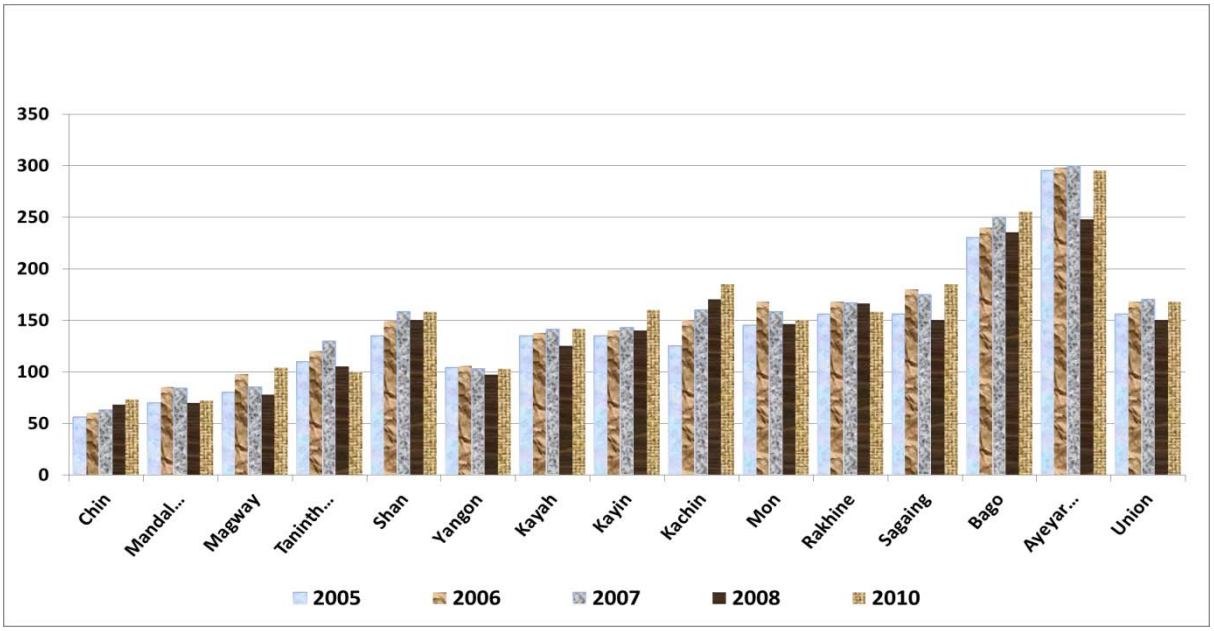
Table 4. Paddy Production and Consumption, Seed Stored for Next Planting Season, Losses and Surplus and Deficit Condition (2011/12)

State/ Division	Sown acre	Production	Population	Consumption	Seed for next season	Losses	Total utilization	Self-sufficiency based on consumption (%)	Self-sufficiency (%) based on total utilization (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) = (3 /5)	(10) = (3/8)
Nay Pyi taw	185	16,045	1,161	16,104	370	555	17,029	100	94
Kachin	545	35,418	1,600	22,407	1,090	1,635	25,132	158	141
Kayah	106	6,637	361	5,100	212	318	5,630	130	118
Kayin	652	45,633	1,837	26,658	1,304	1,956	29,918	171	153
Chin	108	4,852	563	8,079	216	324	8,619	60	56
Sagaing	2,181	187,712	6,603	95,337	4,362	6,543	106,242	197	177
Taninthayi	357	24,718	1,736	24,570	714	1,071	26,355	101	**94**
Bago	3,055	216,047	6,073	86,670	6,110	9,165	101,945	249	212
- Bago(East)	1,911	137,135	3,995	56,676	3,822	5,733	66,231	242	207
-Bago(West)	1,144	78,912	2,078	29,994	2,288	3,432	35,714	263	221
Magway	1,055	90,368	5,682	82,056	2,110	3,165	87,331	110	103
Mandalay	789	64,491	7,352	102,753	1,578	2,367	106,698	63	60
Mon	911	63,028	3,168	44,424	1,822	2,733	48,979	142	129
Yakhine	1,143	76,826	3,341	48,330	2,286	3,429	54,045	159	142
Yangon	1,383	97,376	7,104	90,312	2,766	4,149	97,227	108	100
Shan	1,513	118,824	5,726	80,802	3,026	4,539	88,367	147	134
-South	632	42,304	2,117	30,048	1,264	1,896	33,208	141	127
-North	472	45,334	2,508	35,661	944	1,416	38,021	127	119
-East	409	31,186	1,101	15,093	818	1,227	17,138	207	182
Ayeyarwaddy	4,778	342,371	8,131	117,348	9,556	14,334	14,1238	292	242
Union	18,761	1,390,346	60,438	850,950	37,522	278,0692	94,4755	163	147

Source: Ministry of Agriculture and Irrigation 2012.[3]

[3] The Department of Agriculture (DOA) assumes that per capita rice consumption in rural and urban is 150 and 120 kg per year (or paddy 15 and 12 baskets in rural and urban with the conversion factor of 100 basket of paddy equals to one ton of rice), seed use for planting is two baskets and waste at harvesting time is three baskets of paddy per acre. Based on these assumptions, rice self-sufficiency ratios in different States and Divisions are estimated annually.

Figure 2. Rice Self-sufficiency at Region/State level – 2005 to 2010



Source: Ministry of Agriculture and Irrigation 2012.

Taken together, they show that production has increased steadily with the encouragement of summer crop production since 1992/93 with the increasing provision of irrigation facilities. Summer paddy sown areas have increased from 0.82 million acres in 1992/93 to 2.63 million acres in 2011/12. Despite higher yields in the summer crop on account of 100% adoption of high yielding varieties (HYVs) compared to 59% of farmers adopting HYVs[4] in the monsoon crop of 20011/12 crop, the summer crop production accounted for 17% of total production for 2011/12.

Myanmar has been increasing its rice surplus and been exporting[5] varying quantities of rice each year (i.e., self-sufficient at the Union level). There has also been an increase in exported rice since the second liberalization in 2003, especially from 2008 onward with the formation of the rice specialization companies.

At the disaggregated level, it is clear that the major traditionally surplus areas are Ayeyarwaddy Division, followed by Bago (comprising East and West Bago) in Lower Myanmar, and Sagaing Division in Upper Myanmar. On the other hand, the traditionally deficit areas are Chin State as well as Mandalay and Magwe Divisions. It should be pointed out that the deficit for Yangon Division in 2008 is due to the effect of cyclone Nargis.

For comparison purposes and to underscore the discrepancy of data, Table 5 presents the production, consumption, exports, and stocks from 2003 to 2013 compiled from United States Department of Agriculture (USDA) data.

[4] Despite their lower yields some farmers, where conditions are favorable (especially in Ayeyarwaddy and Sagaing), still prefer to plant traditional varieties, especially Paw San, which fetches much higher prices.

[5] It should be noted that the export figures reported by MOAI refers only to exports from Yangon and do not capture the quantities exported through the border crossings which are only captured by the Department of Border Trade of the Ministry of Commerce. In view of the increasing importance of border trade, especially to China the extent of border trade should be tracked as well.

Table 5. Production, Consumption, Exports and Stocks – 2003 to 2013

Myanmar	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Area Harvested (1,000 HA)	6,200	6,300	6,800	7,000	7,000	7,085	6,700	7,000	7,000	6,500	6,350
Beginning Stocks (1,000 MT)	929	1,229	1,629	709	702	601	1,200	548	855	505	431
Milled Production (1,000 MT)	10,788	10,730	9,570	10,440	10,600	11,840	11,200	11,642	10,528	10,816	10,750
TY Exports (1,000 MT)	388	130	190	47	31	541	1,052	445	778	700	600
Consumption and Residual (1,000 MT)	10,100	10,200	10,300	10,400	10,670	10,750	10,800	10,890	10,100	10,190	10,380
Ending Stocks (1,000 MT)	1,229	1,629	709	702	601	1,200	548	855	505	431	201
Total Distribution (1,000 MT)	11,717	11,959	11,199	11,149	11,302	12,491	12,400	12,190	11,383	11,321	11,181
Myanmar Yield (Rough) (MT/HA)	3.00	2.94	2.43	2.57	2.61	2.61	2.61	2.60	2.35	2.60	2.65
World Yield (Avg)	3.83	3.92	3.93	4.04	4.04	4.14	4.22	4.21	4.25	4.36	4.38
Rough Production (1,000 MT)	18,600	18,500	16,500	18,000	18,276	18,500	17,500	18,191	16,450	16,900	16,797

Source: U.S. Department of Agriculture 2013.

As expected, there are significant differences in yields, harvested acreages, production, consumption, and exports. Nevertheless, it also showed annual rice exports throughout the period, even over the Nargis period (impact and recovery) and underscored the fact that exports increased from 2008, some years after the 2nd liberalization in 2003, and somewhat coinciding with the beginning of the spate of RSCs involvement.

Before discussing in greater detail the overall flows of rice arising from the surplus and deficit areas and annual exports and increasing volumes via the border crossings besides Yangon, it would be prudent to consider albeit briefly, various aspects related to consumption, including household expenditure on food, especially on rice.

With regard to per capita consumption of rice, Department of Agriculture, MOAI, computes the country's rice surplus, assuming per capita consumption of paddy to be 15 baskets of paddy (that is 312 kilograms (kg) of paddy or 187 kg of rice) for the rural population and 12 baskets of paddy (that is 250 kg of paddy or 150 kg rice) for the urban population. However, according to the Food and Agriculture Organization of the United Nations (FAO) food outlook, rice statistics showed that per caput food use in Myanmar is 239 kg per year in 2011/12, the highest in the region, as indicated in Table 6. However, it should be noted that this is for per capita food use.

In the Household Income and Expenditure Survey conducted in 2006, expenditure on rice also included rice vermicelli, rice noodle and traditional rice snacks. Based on this survey, total household expenditure on rice accounted for 16.0% of urban household expenditure on food (which in turn accounted for 68.3% of total household expenditure) and 19.6% of rural household expenditure on food (which in turn accounted for 72.1% of total household expenditure (Table 7).

Table 6. Per Capita Food Use Based on FAO Rice Statistics

Countries	07/08-09/10 Average	2010/11 (estimate)	2011/12 (forecast)
	Per caput food use (kg per year)		
Bangladesh	149.0	153.0	154.2
Thailand	128.7	133.5	136.8
Vietnam	186.2	186.9	187.4
Myanmar	237.9	240.0	239.0

Source: FAO 2012.

Table 7. Average Monthly Household Expenditure by Group of Consumed Items (2006 Survey)

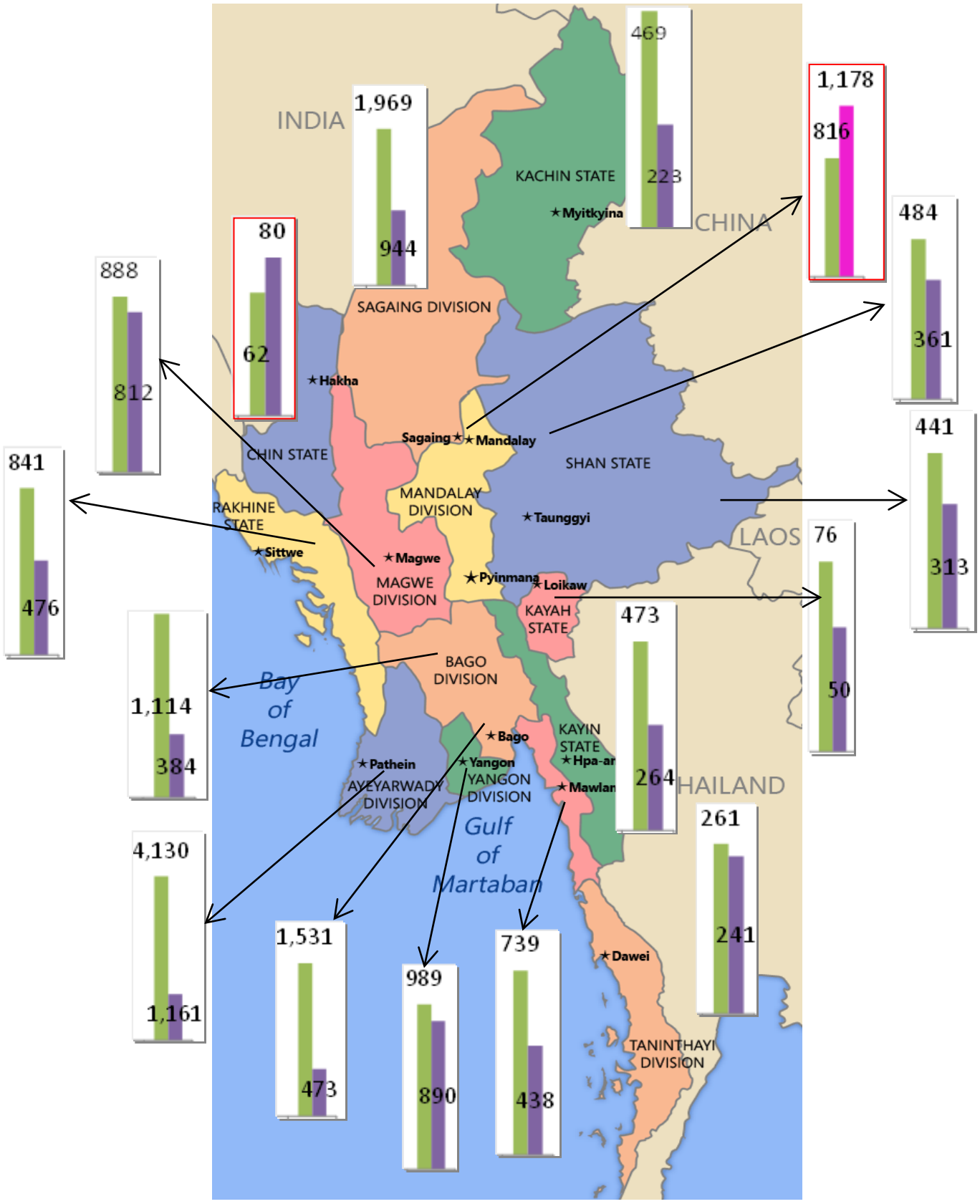
Particular	Urban		Rural		National level	
	Kyats	% (percent)	Kyats	% (Percent)	Kyats	Value
Total food expenditure	77,345.92	68.25	65,358.17	72.11	69,170.71	70.80
Rice	18,186.16	16.05	17,781.5	19.62	17,891.45	18.31
Fruit and vegetable	9,560.30	8.44	8,480.76	9.36	8,826.45	9.03
Cooking oil	5,887.05	5.20	5,309.74	5.86	5,536.11	5.67
Pulses	2,046.60	1.81	1,814.61	2.00	1,842.16	1.89
Other food items	41,371.3	36.51	6,5358.17	72.11	35,074.54	35.90
Non-food	35,974.6	31.75	25,273.68	27.89	28,529.16	29.20
Total expenditure	113,320.51	100.00	90,631.85	100.00	97,699.87	100.00
Size of household	4.87		4.67		4.72	

Source: CSO 2012.

Coming back to further consider rice surplus and deficit States/Divisions in Myanmar, Figure 3 on the next page, shows that for the 2010/11period, Chin State and Mandalay Division are in deficit while Magway and Tanintharyi are marginally surplus and Ayeyarwaddy, Bago, Sagaing, and Rakhine are the major surplus regions.

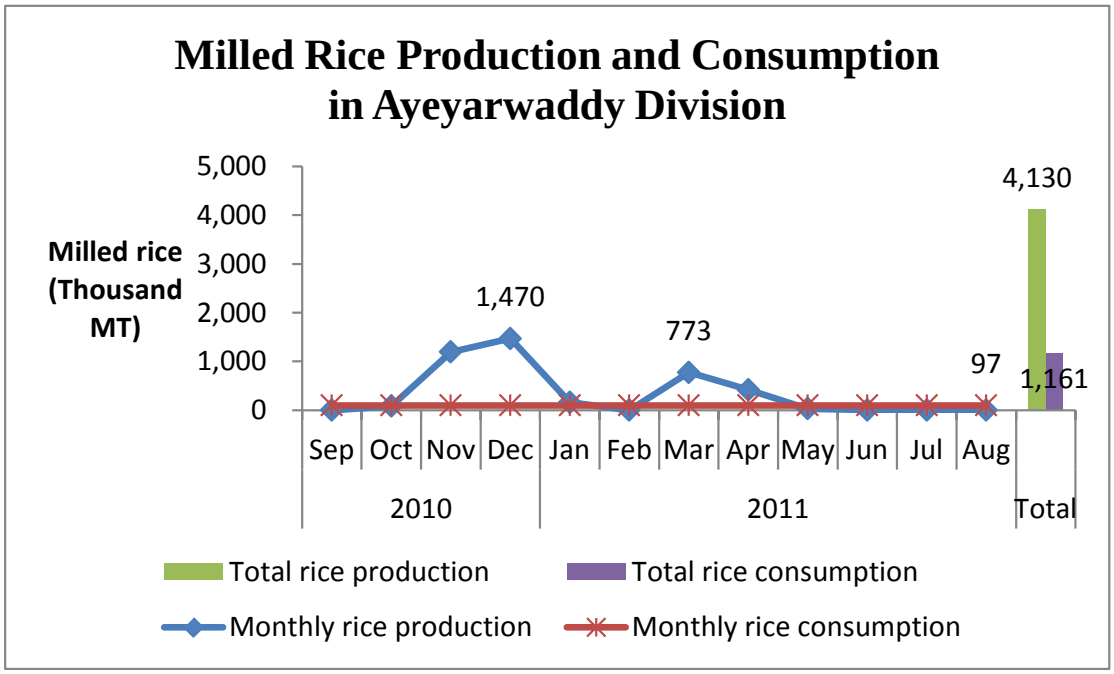
However, as depicted in Figure 4a and Figure 4b on the following pages, rice is demanded all the year round while rice supplies are dependent on each rice harvest. Hence, it is shown that surplus areas like Ayeyarwaddy Division have not only a large monsoon but also a sizable summer crop harvest and is largely double cropped. Whereas the perpetually deficit areas like Chin State are invariably single cropped or with only a small area planted to summer crop due to a lack of irrigation facilities.

Figure 3. Surplus and Deficit States/Divisions, 2010/11



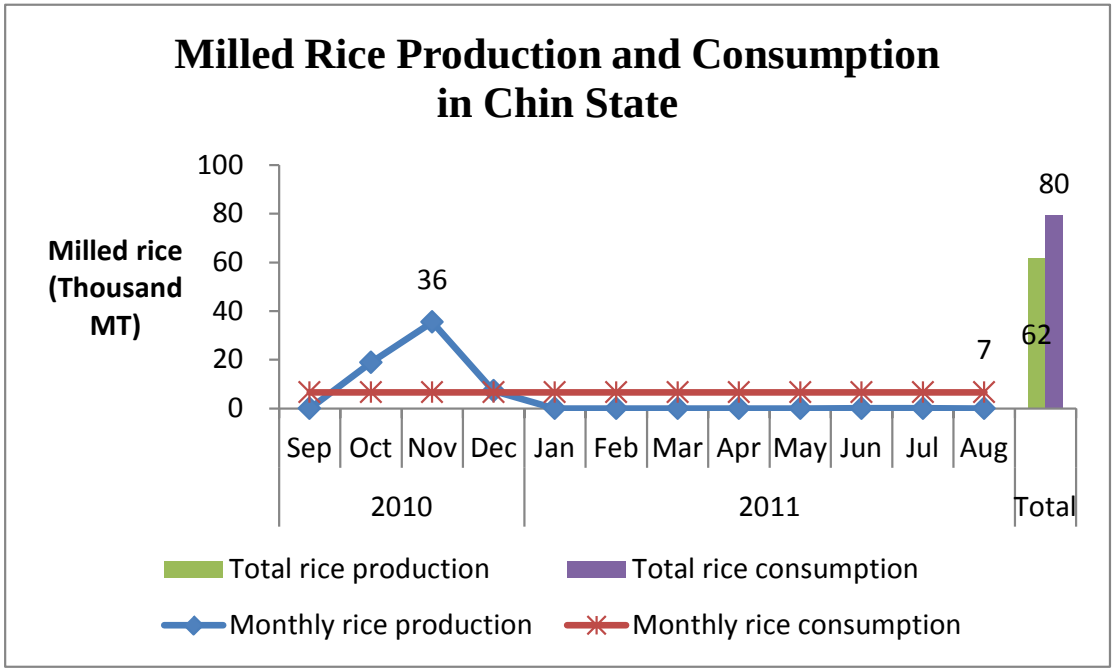
Source: Prepared by authors from DOA and MRF records for 2010/11.

Figure 4a. Intertemporal Considerations: Seasonal Supply – Demand of Rice in Double Cropped Surplus Area – Ayeyarwaddy Division



Source: Prepared by authors from DOA and MRF records for the relevant months.

Figure 4b. Seasonal Supply – Demand in Area with Only Monsoon Crop and no Summer Crop – Deficit Area – Chin State



Source: Prepared by authors from DOA and MRF records for the relevant months.

Figure 5. Time of Sowing and Harvesting of Paddy Calendar for Wet Season Paddy (Monsoon Paddy) and Dry Season Paddy (Summer Paddy) in Myanmar

Particular	May.	Jun.	Jul	Aug.	Sep.	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
Wet season paddy(Monsoon paddy)															
Lower Myanmar	S	S/G	S/G	S/G	S/G	G/H	G/H	H	H						
Central Myanmar			S	S/G	S/G	S/G	H	H	H						
Upper Myanmar		S	S	S/G	S/G	H	H	H							
Dry season paddy(Summer paddy)															
Lower Myanmar						S	S/G	S/G	S/G	H	H	H			
Central Myanmar									S	S/G	S/G	S/H	H	H	
Upper Myanmar											S	S	G	H	H

Source: Ministry of Agriculture and Irrigation 2000. Note: S=Sowing, G=Growing, H=Harvesting.

To complete our consideration of the importance of temporal and spatial considerations in conditioning food security and the flows of rice in a country, Figure 5 presents the planting and harvesting patterns of the monsoon and summer crop for different regions of the country to underscore the seasonality of production and marketing.

For the country as a whole, paddy planting from May to September is locally referred to as wet season paddy or monsoon paddy or first rice and from October to April is referred to as dry season rice or summer paddy or second rice. Lower Myanmar, receives the rain bearing southwest monsoon earlier than Central Myanmar and Upper Myanmar. Thus, farmers in Lower Myanmar, Central, and Upper Myanmar follow a natural stagger of land preparation and other sequenced farm activities like preparation of nursery and planting in May and June for transplanting. Some farmers have started direct seeding their crop.

Consequently, newly harvested paddy comprised mainly of HYVs begins to enter local markets in October in Lower Myanmar, as compared to Pawsan paddy, a longer maturity high quality traditional variety which only enters the local markets in January the following year. An earlier maturing Pawsanyin variant enters the market in December in Lower Myanmar[6].

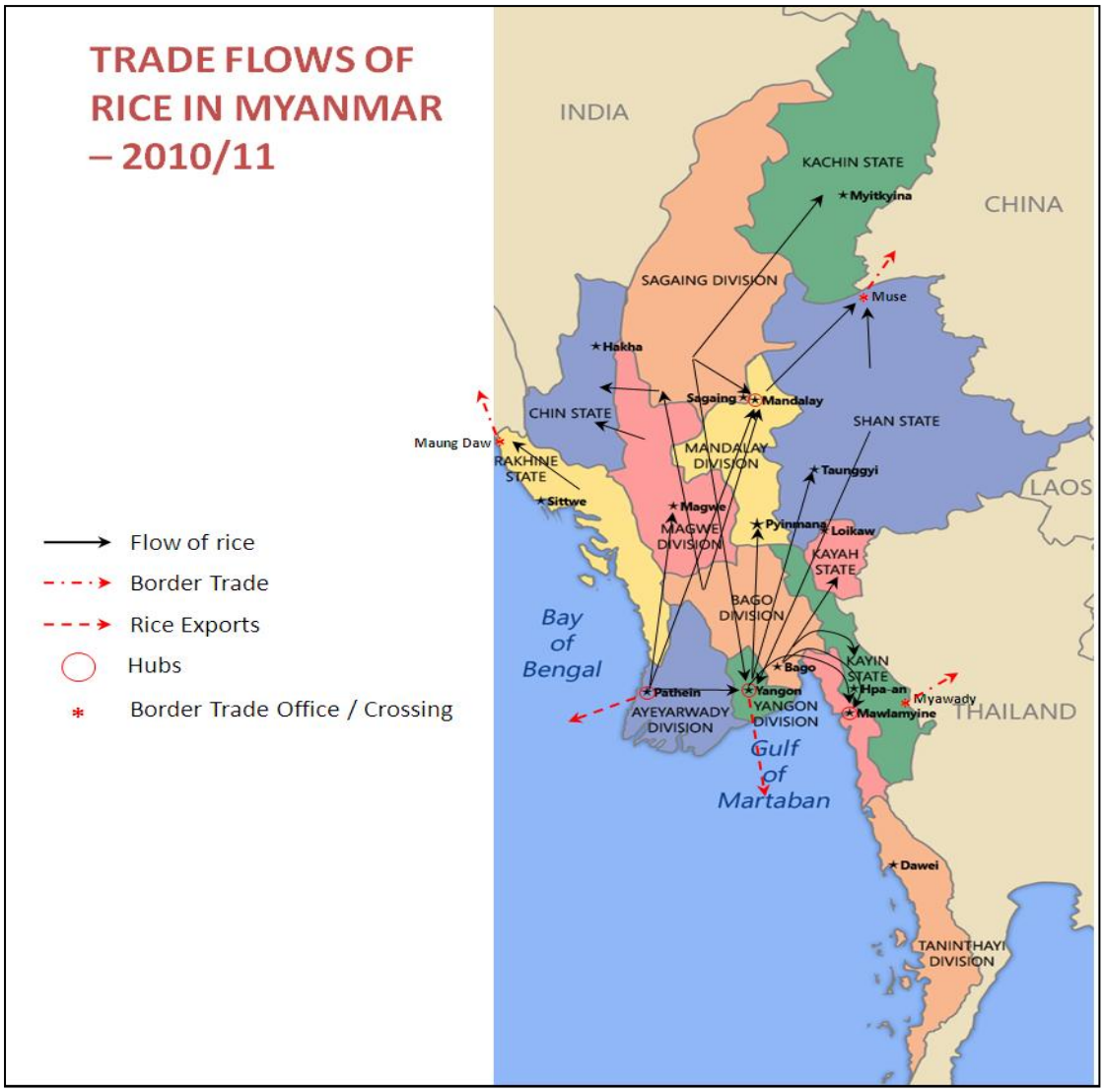
After harvesting the monsoon paddy harvest, some farmers prepare their land for the summer crop if irrigation water is available and plant pulses if outside of irrigated areas.

In terms of seasonal marketing, new supplies of harvested monsoon crop will start in October which harvested summer crop will enter the market in February or before mid-April in Lower Myanmar. As May, June, July, and August is the monsoon season in Lower Myanmar, this is when stored paddy is marketed to capture price increases. Similarly, the millers who mill this together with their stored paddy purchased earlier.

Summer paddy enters local markets from April to June in Central Myanmar where rainfall (precipitation) is low in June and July compared to Lower Myanmar. Because of this, sesame, groundnut, and pulses were sown in monsoon season in Central Myanmar.

[6] The area sown to Pawsan in 2011/12 was 341,000 acres, of which 116,000 acres were in Ayeyarwaddy and 125,000 acres in Shwebo district in Sagaing Division. Total Pawsan Yin sown area was estimated 326,000 acres – personal communication with U Kyaw Myint.

Figure 6. Trade Flows of Rice in Myanmar – 2010/11



Source: Prepared by authors with assistance from U Kyaw Myint of e-Trade Myanmar.

However, the irrigated areas in Central and Upper Myanmar also produces two crops a year. Notable, is the Kabo irrigation scheme in Sagaing, which has a command area of some 500,000 acres, more than twice the size on Malaysia's largest Muda Irrigation Scheme or four times the size of Singapore.[7]

2.4. Trade Flows of Rice in Myanmar

This natural staggering coupled with availability of irrigation facilities and the surplus and deficit regions invariably influences the flow of rice in Myanmar. Figure 6 traces the flows from the surplus to deficit regions as well as the points of rice exports. The major rice trading and marketing hubs are Pathein, Yangon, and Mandalay. Rice which flows in from various surplus regions to Yangon and Mandalay are then redistributed to the surrounding deficit

[7] With a multipurpose dam generating electricity besides the irrigation water, this scheme can and should be further developed as an integrated development project with either the World Bank, ADB, or other international funding. It has the potential to become a showcase of rice-based agricultural and rural development.

regions. In the case of Mandalay, due largely to its strategic location on the Muse (China border)-Mandalay-Monywa-Tamu (Indian border) trunk road, there has been increasing *exports* of Myanmar rice via Muse into China, especially over the last two years. Anecdotal evidence suggests that this Gateway to China also provides a convenient springboard to non-traditional markets like North Korea and the Commonwealth of Independent States countries via the New Silk Route. There is likely to be increased export of rice from Mandalay to Tamu to supply the Assam region of India, as well as using it as a potential link to Nepal and Bhutan in the future. Other active border trade in rice includes Myawaddy with Thailand as well as the Maung Daw border post to Bangladesh. Anecdotal evidence suggests that some paddy is flowing into Thailand to take advantage of the Thai Paddy Pledging Scheme, as well as interest by Thai parties to cultivate rice, including Hom Mali in Mon state

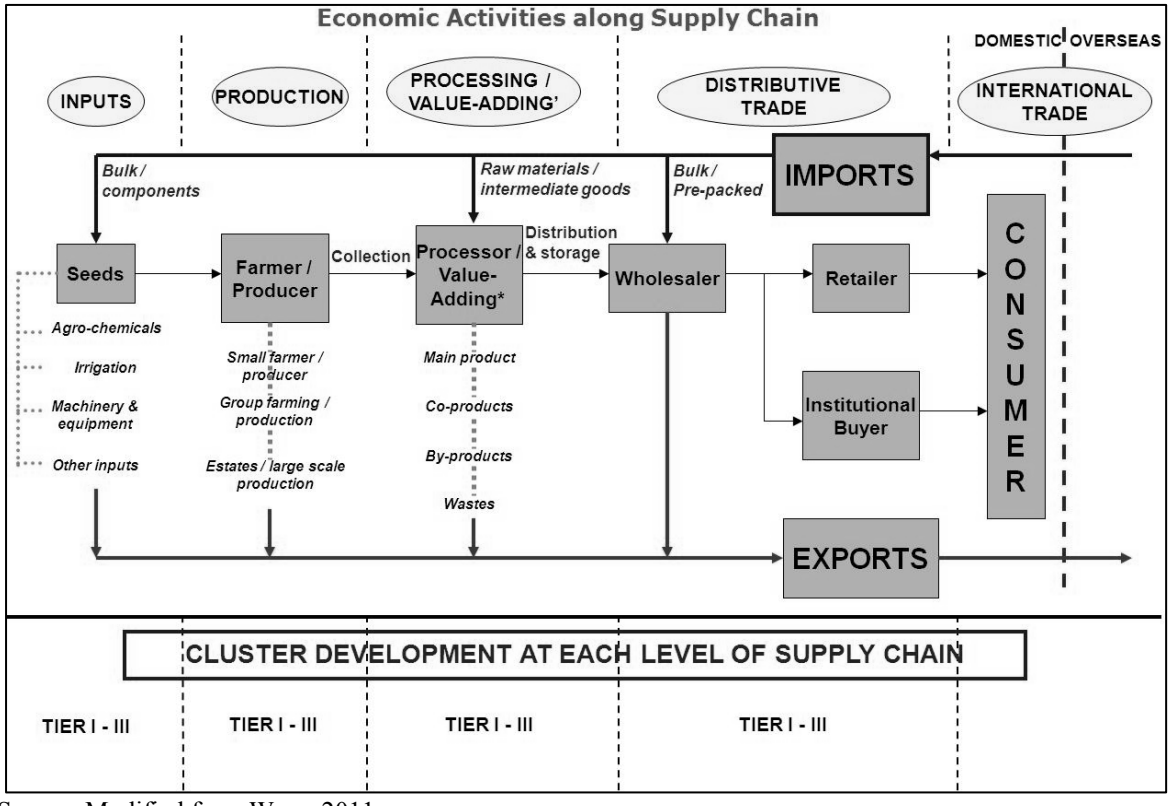
While most of the rice is exported from Yangon, there have been trail shipments directly from Pathein in the Ayeyarwaddy Delta. Many believe that the border trade will gain added significance in the future, particularly to China, as it is expected to import rice for its southwestern region as it struggles with water scarcity and the impact of its ambitious plan to transfer water from the south to its more precarious north. Due to this water scarcity and the availability of alternative crops generating more remunerative returns, China may not be able to afford to grow rice in many parts of their country in the future.

3. MYANMAR'S RICE VALUE CHAIN

Before embarking on a mapping of Myanmar's Rice Supply Chain, it would be prudent to consider a generalized Rice Supply Chain together with the economic activities along the supply chain (as depicted in Figures 7a and 7b) to underscore some key points, including how agriculture can be leveraged to drive overall growth. Unlike a normal production-centric approach of considering the rice economy by focusing only on the production level, a supply chain management approach employs a more holistic agribusiness approach of considering the sequence of key activities and their attendant supporting economic activities at the various levels of the chain, from inputs, production, processing/value adding, distributive trade, and international trade, and linking producers to consumers, from *seed to shelf* or *field to fork*.

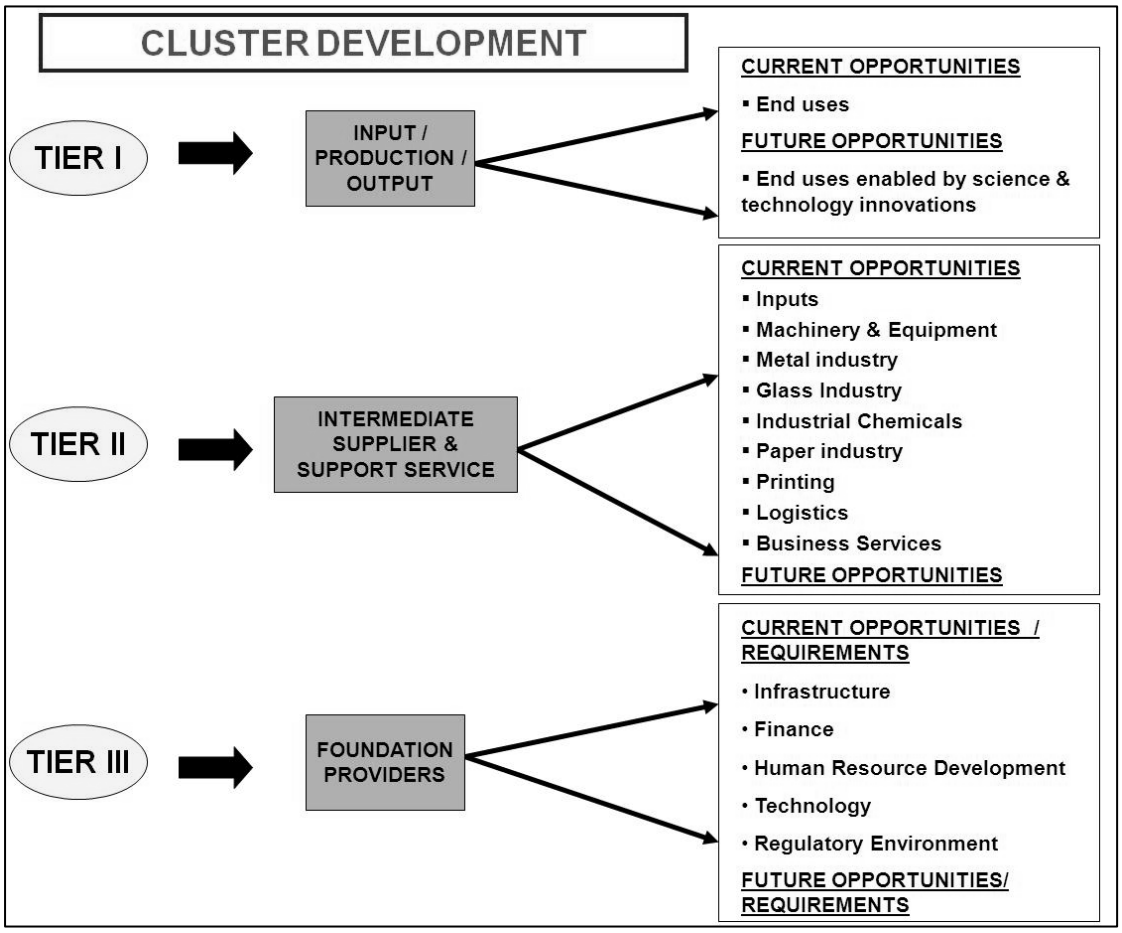
From a macro-framework or national accounting perspective, it should be noted that agriculture's contribution to GDP only considers value added in the production of crops (as well as livestock, fisheries, timber, and their products) as well as processing at the farm level (on farm processing). All forms of off farm processing (and subsequent value adding) are captured in the manufacturing sector, as are the production of inputs and equipment. All wholesaling and retailing of fresh and processed agricultural products are captured as distributive trade under services. Figures 7a and 7b illustrated a generalized rice supply chain as well as the range of economic activities along the rice supply chain and those associated with the economic foundations in the cluster development sense. This understanding is crucial in order to appreciate the meaning of using agriculture as an engine of growth.

Figure 7a. Generalized Rice Supply Chain – From Seed to Shelf: Potential Economic Activities



Source: Modified from Wong 2011.

Figure 7b. Economic Activities along Rice Supply Chain

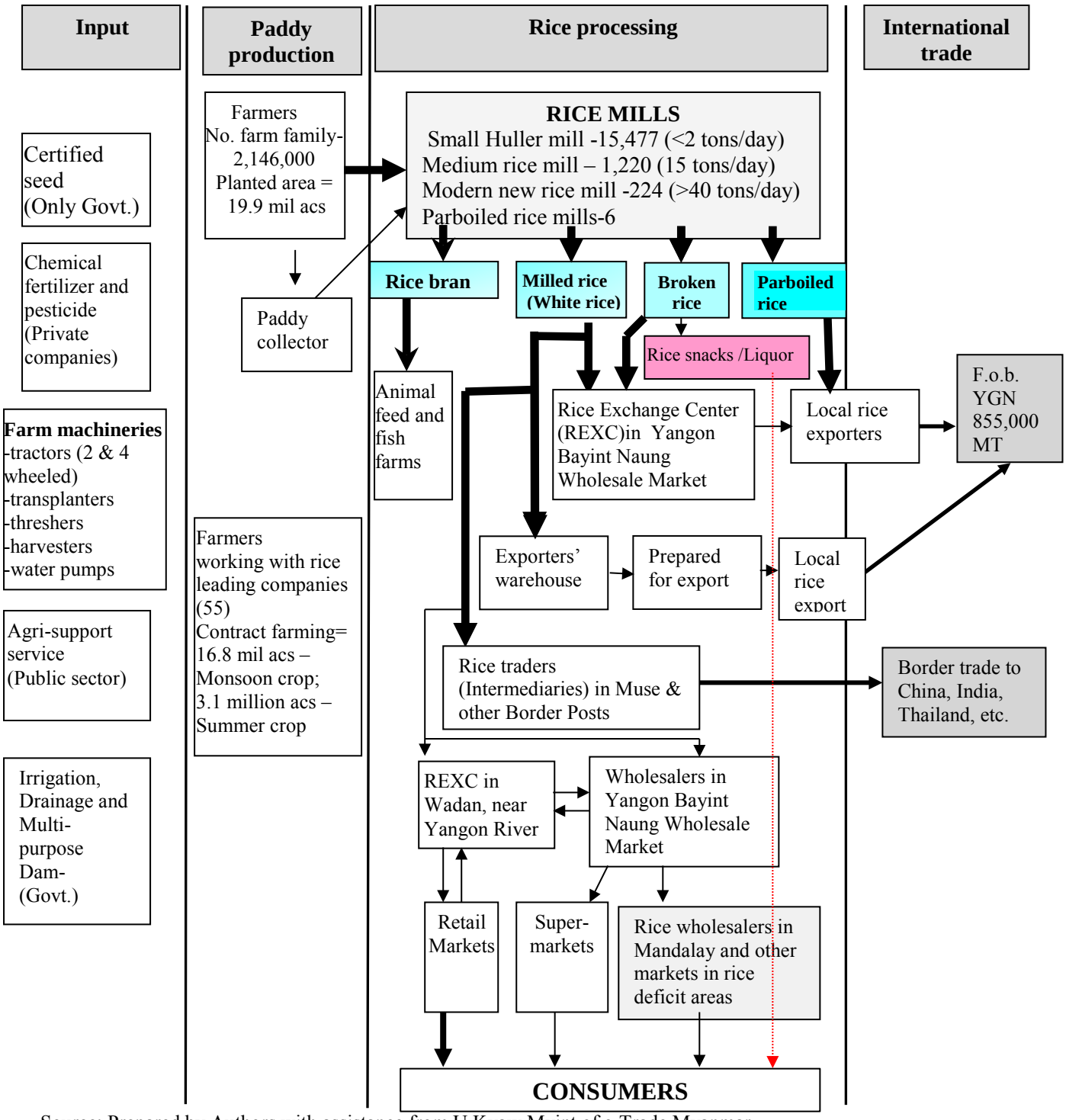


Source: Modified from Wong 2011.

3.1. Myanmar's Rice Supply Chain

Myanmar's Rice Supply Chain for 2011/2012 is mapped and depicted in Figure 8. It indicates the certified rice seeds are still largely produced by the Department of Agriculture (DOA) under MOAI although some RSCs are also beginning to produce certified or high quality seeds of varieties that they are promoting, largely for their own contract farmers. Fertilizer and agrochemical supplies have proved to be a problem with the sale of poor quality fertilizers and inappropriate pesticides, including banned insecticides. We note the entry of some big companies as well as plans for MAPCO to be involved in the importation and supply of better quality fertilizers and MRF in warning its members of the danger of pesticide misuse. In terms of farm machinery, we note that some of the RSCs have started offering contract mechanization services for land preparation in many areas as well as mechanized threshing and to a lesser extent combined harvesting. Some RSCs are also experimenting with mechanical transplanters from Japan and Korea. Agri-support services are still largely provided by the government, especially in research and extension. Marketing and credit are increasingly private sector-led although high interest rates remain a problem. Infrastructure such as multi-purpose dams, irrigation, drainage, and farm roads are still provided by Government.

Figure 8. Myanmar's Rice Supply Chain Map - 2011/2012



Source: Prepared by Authors with assistance from U Kyaw Myint of e-Trade Myanmar.

At the production level in 2011/12, rice production is carried out by 2,146,000 farm families planting 19.9 million acres (16.8 million acres for monsoon and 3.1 million acres for summer crop) and producing 32.6 million tons of paddy. Most of the producers are individual farmers although we note an increasing number of RSCs who may or may not have nucleus estates of their own and engaged in contract farming.

There were 55 registered RSCs at the end of 2011 and as depicted in the following Tables 8a and 8b (for the monsoon and summer crop from 2009 to 2011). Some 42 (out of the 55) RSCs contract farmed 454,397 acres in monsoon crop (or 2.7% of monsoon crop) and 20 RSCs contract farmed 228,969 acres in the summer crop (or 7.4% of summer crop) in 2011. It will be interesting to watch if ongoing efforts to establish farmers' associations can lead to other forms of organization of production units like cooperative or group farming, for example.

At the processing level there are 15,477 small huller mills (less than 2 tons/day capacity) mainly performing custom or contract milling for home or community consumption; 1,220 medium sized commercial mills (less than 15 tons/day capacity) some of them dating back to pre-war date of construction with repeated upgrading; 224 modern mills belonging to or strategically aligned to the RSCs (see Table 8a). There are also six new parboiled rice mills which are geared towards the export market. Another four parboiled mills are planned marking the entry of Myanmar's rice exports into this new segment in the global rice market.

Although the numbers are not available, there exists many cottage industry type operations producing vermicelli and mohingar (a local popular noodle made from rice) and rice flour. A former MAPT rice bran oil mill in Kyaukse, which was privatized in 2004, has already ceased operation. There are also small operations producing snacks and biscuits from rice bran. However, a high proportion of usage of bran currently is for animal and fish feed. Noteworthy is the calling of tender by MAPCO to build up to five rice-processing complexes, involving the production of rice bran oil, parboiled rice, animal feed, and other rice products besides high quality rice and selected varieties of rice. MAPCO announced an ambitious plan to establish, in phases, up to 15 of such complexes in strategic locations all over the country. So far, overseas companies such as Mitsui from Japan and VinaCapital have signed memorandum of understandings, while others have shown interest to joint venture in such complexes which is expected to further transform Myanmar's rice value chain.

The distribution trade increasingly involves packed and branded rice being sold in an increasing number of supermarkets such as City Mart, Ocean, Orange, Sein Gay Har, Capital, Super One, and Asia Light in Yangon. These supermarkets are largely local owned. Similar developments are being observed in Nay Pyi Taw and Mandalay. An interesting development over the last two years is that the sale of packed and branded rice has moved beyond the supermarkets into restaurants and even into traditional rice retail shops.

Since 2011, MRF has responded to a request by the government to partly fund and manage a rice stockpile of up to a 100,000 MT to help stabilize the price of paddy and rice via buffer stock operations besides facilitating food security. In 2011 financial year (April 2011 to March 2012), Myanmar exported 815,000 MT of rice. It has already exported a similar volume by the 3rd week of December and so is well placed to export the targeted 1 million MT for the 2012 financial year.

Table 8a. Growth of Contract Farming via RSCs: Monsoon Crop 2009-2011 and Milling

No.	RSC's Name	Location		Owned Rice Mill		Share Member Possessed Mill		Contract Farming Acre (Monsoon Paddy)		
		Township	Regions	Qty	Milling Capacity	Qty	Milling Capacity	2009	2010	2011
1	Adipadi Agricultural Production Co., Ltd	Myaung Mya/ Mawkyun Kyikelatt/ Dadaeye'	Ayerwaddy					12,000	165,000	
2	Aung Naing Yoe Ma thitsar Co., Ltd	Thekone	Bago (west)						4,193	8,644
3	Aya Delta Agri Export Co., Ltd	Bogalay	Ayerwaddy	2	75	3	40	9,700	10,198	12,998
4	Ayear Kyan Khim Co., Ltd	Kyan Khim	Ayerwaddy							11,498
5	Ayer Dipar Pathein Co., Ltd	Pathein/ Kangyidaunk	Ayerwaddy					1,024	2,500	3,648
6	Ayer Pathein Rice Trade Co., Ltd	Pathein	Ayerwaddy					3,157	20,000	10,782
7	Ayer Shwehinthar Co., Ltd	Hintada	Ayerwaddy							
8	Ayer Tharpaung Rice Co., Ltd	Tharpaung	Ayerwaddy							10,785
9	Ayer Wun Co., Ltd	Lay Myat Nhar	Ayerwaddy	3	200	4	60	4,361	2,500	4,001
10	Ayertakun Ngathike Chaung Co., Ltd	Ngar Tike Chaung	Ayerwaddy							
11	Ayerwaddy Green Land Co., Ltd	Pyarpon	Ayerwaddy			1		10,020	10,000	10,000
12	Dana Tharha Rice Co., Ltd	Khin Oo	Sagaing							
13	Dawna Land Development Co., Ltd	Kayin	Kayin							
14	Delta Kyone Pyaw Co., Ltd	Kyone Pyaw	Ayerwaddy						60	30,000
15	Eine Mae Ayeyar Co., Ltd	Einemae	Ayerwaddy						3,333	8,925
16	Gold Delta Co., Ltd	Danuphyu/ Pantanaw	Ayerwaddy	9	100			35,929	45,822	60,416
17	Green Land Myanmar Rice Co., Ltd	Nattaline	Bago (west)	6	40/80/15/100/30 /30	5	40	1,200	1,000	1,000
18	Hintada Rice Trade Co., Ltd	Hintada	Ayerwaddy	3	200	4		6,002	7,000	4,000
19	Hla Taw Myay Co., Ltd	Wauk latt	Sagaing	2		1			2,807	4,800
20	Kaytu Yadanar Co., Ltd	Taung Ngu	Bago (East)	8					2,097	12,582
21	Kitayar Hinthar Co., Ltd	Pyay/ Shwe Taung Pataung/ Paukkhaung Paungtae/ Taekhone	Bago (west)	3	480/75/75			11,583	11,654	49,257
22	Kyaik Lat Rice Proudtion Co., Ltd	Kyite Latt	Ayerwaddy	34	Big 19/ Small 15			2,200	3,815	5,889
23	Latpadan Rice Co., Ltd	Lapadan	Bago (west)			8		2,205	7,385	6,536
24	Min Hla Agriculture Production Co., Ltd	Minhla	Bago (west)	5	35/35/5/5/3				735	2,000
25	Mrauk Oo Specilization Co., Ltd	Mrauk Oo/ Kyauk Taw	Rakhine			2	100		472	3,806
26	Mrauk Oo Top Rice Trade Co., Ltd	Mrauk Oo	Rakhine							
27	Myakyun Yarmanya Co., Ltd	Mudone	Mon							
28	Myaungmya Nagar Co., Ltd	Myaung Myae	Ayerwaddy	14					6,244	15,269
29	Oka Thar Myay Rice Development Co., Ltd	Bago	Bago (East)							

No.	RSC's Name	Location		Owned Rice Mill		Share Member Possessed Mill		Contract Farming Acre (Monsoon Paddy)		
		Township	Regions	Qty	Milling Capacity	Qty	Milling Capacity	2009	2010	2011
30	Paddy Growers' Prosperity	Wull	Bago (East)	1				6,002	4,600	14,000
31	Paung Tae Shwe Myay Co., Ltd	Paung Tae'	Bago (west)			8				7,878
32	Pyarpon Yadanar Theinga Co., Ltd	Pyarpon	Ayerwaddy			1				3,050
33	Rakhine Rice Development Co., Ltd	Kyauktaw/ Mrauk Oo Minpyar/ Ponenar Kyunn	Rakhine					1,100	6,750	2,000
34	Sein Kyun Yadanar Co., Ltd	Mawlamyine	Ayerwaddy	1				16,246	8,736	1,838
35	Shan State (East) Agricultural Production Development Co., Ltd	Kyine Hhone	Shan (East)							
36	Shan State (East) Mileyung Agricultural Production Co., Ltd	Min Yaung	Shan(North)							
37	Shwe Kan Thar Rice Trade Co., Ltd	Yaekyi/Kangyidaunk Kyaung Kone/ Thar Paung	Ayerwaddy					2,250	7,272	400
38	Shwe Kaw Lin Co., Ltd	Kawlin	Sagaing			1			500	1,700
39	Shwe Kawa Myay Co., Ltd	Kawa	Bago (East)	1		2		3,500	7,000	10,000
40	Shwe Myae Kyaung Kone Co., Ltd	Kyaung Kone	Ayerwaddy			7			13,291	17,234
41	Shwe Pyar Co., Ltd	Gyopinkaunk	Bago (west)	3	40/60/50	2		7,404	7,404	10,000
42	Shwe Supine Rice Trade Co., Ltd	Dike Oo	Shan (East)							
43	Shwe War Hinthar Co., Ltd	Gyopinkaunk/ Okephon	Bago (west)	18					16,665	25,000
44	Shwewar Thiha Rice Co., Ltd	TanNyin/ Kyauk Tan	Yangon							
45	Toe Ayer Co., Ltd	Dadaeye'	Ayerwaddy	2	45/70			1,543	2,250	3,674
46	Tone Khwa Shwemyay Trade Co., Ltd	Thone Khwa	Yangon							
47	United Agriculture Production Co., Ltd	Nyaung Tone	Ayerwaddy	5	50				4,070	3,534
48	Wakema Trading Co., Ltd	Warkhma	Ayerwaddy			25		9,410	8,000	10,000
49	Yadanar Taung Goke Co., Ltd	Taung Goke/ Tanthwe Yanbyae'/ Gya	Rakhine	2	35/15			2,000	2,000	2,000
50	Yay Kyi Rice Trade Co., Ltd	Yaekyi	Ayerwaddy			13		11,000	20,000	30,000
51	Yay Waddy Co., Ltd	Maohu Pin	Ayerwaddy					4,360	1,484	3,863
52	Zalun Ayear Co., Ltd	Zalun	Ayerwaddy					2,200	3,215	5,890
53	Zalun Forward Link Co., Ltd	Zalun	Ayerwaddy	4		7	50/25	1,447	5,000	16,000
54	Zayyar Aung Myay Co., Ltd	Dipaeyin	Sagaing			4				8,000
55	Zayyar Theinga Co., Ltd	Shwe Bo	Sagaing					350	700	1,500
Total				**126**		**98**		**168,193**	**425,752**	**454,397**

Source: Compiled by authors from MRF records.

Table 8b. Growth of Contract Farming via RSCs: Summer Crop 2010-2011

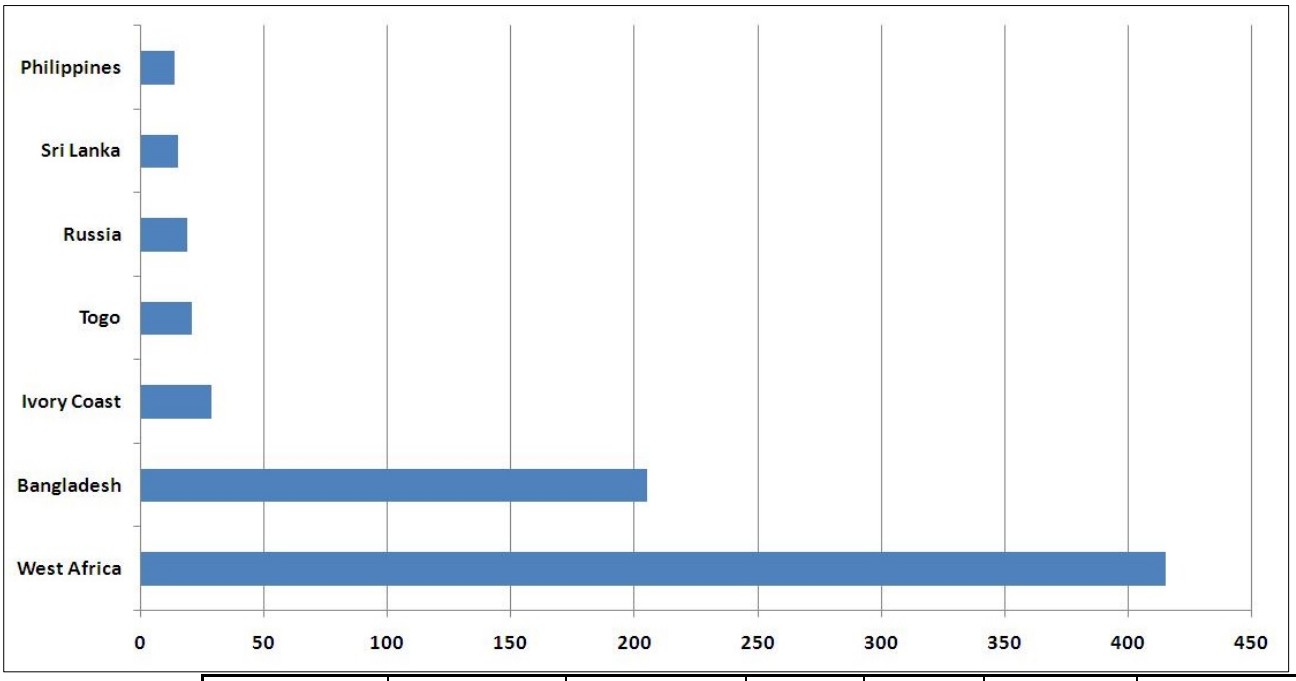
RSC Names	2010			2011		
	Acres	Farmers	Average Farm Size	Acres	Farmers	Average Farm Size
Adipati Trading	67,531	7,685	8.8	86,236	12,855	6.7
Aung Naing Yoema Thitsar	-	-	-	6,277	1,361	4.6
Ayear (Kyoe Pyaw)	5,000	684	7.3	5,010	670	7.5
Ayear Pathein	4,762	413	11.5	14,519	1,270	11.4
Ayer Dipar Pathein	3,071	85	36.1	2,744	222	12.4
Ayer Wun	-	-	-	500	48	10.4
Ayeyar Delta	3,807	587	6.5	6,419	852	7.5
Gold Delta	8,573	1,849	4.6	28,566	3,024	9.4
Green Land Myanmar	600	100	6.0	1,000	345	2.9
Khittayar Hinthar	2,050	647	3.2	11,583	2,429	4.8
Kyike Latt Rice Production	3,722	280	13.3	-	-	-
Mrauk Oo Specialization	2,500	102	24.5	560	142	3.9
Myanug Mya Nagar	-	-	-	5,234	372	14.1
Paddy Growers' Prosperity	600	115	5.2	454	73	6.2
Sein Kyunn Yadanar	16,246	1,664	9.8	-	-	-
Shwe Kan Thar	863	29	29.8	-	-	-
Shwe Myay Kaung Kone	900	123	7.3	-	-	-
Shwe Pyar Rice	-	-	-	3,000	583	5.1
Shwe War Hinthar	6,000	621	9.7	12,440	3,105	4.0
United Agriculture Production	1,000	102	9.8	1,000	102	9.8
Wakema Trading	-	-	-	2,120	352	6.0
Yawaddy Trading	8,935	694	12.9	31,330	2,586	12.1
Yay Kyi Rice Trading	4,700	400	11.8	-	-	-
Zalun Ayear	-	-	-	8,477	984	8.6
ZaLunn link (Forward)	1,886	664	2.8	-	-	-
Zayyar Theinga	500	100	5.0	1,500	150	10.0
TOTAL	**143,246**	**16,944**	0.1	**228,969**	**31,525**	7.3

Source: Compiled by authors from MRF records.

According to the USDA, Myanmar exported 778,000 MT of rice from January to December 2011[8] (recall Table 5) of which 415,520 MT (53.4% of total exports) were exported to West Africa, 205,069 MT (or 26.4%) to Bangladesh, 28,463 MT (or 3.7%) to Ivory Coast, 20,649 MT (or 3.7%) to Togo, 18,858 MT (or 2.4%) to Russia, 15,000 MT (1.9 %) to Sri Lanka, and 13,484 MT (1.7%) to the Philippines as depicted in Figure 9 which shows the top destinations for Myanmar rice in 2011

[8] This may explain some of the discrepancy between USDA and MOAI or MOC data as USDA reports for January to December for any particular year while Myanmar reports for April of one year to end of March in the next, in accordance with their financial year.

Figure 9. Myanmar's Rice Export 2011 – Top Destinations ('000 MT)



	West Africa	Bangladesh	Ivory Coast	Togo	Russia	Sri Lanka	Philippines
Export (TMT)	415,520	205,069	28,463	20,649	18,858	15,000	13,484

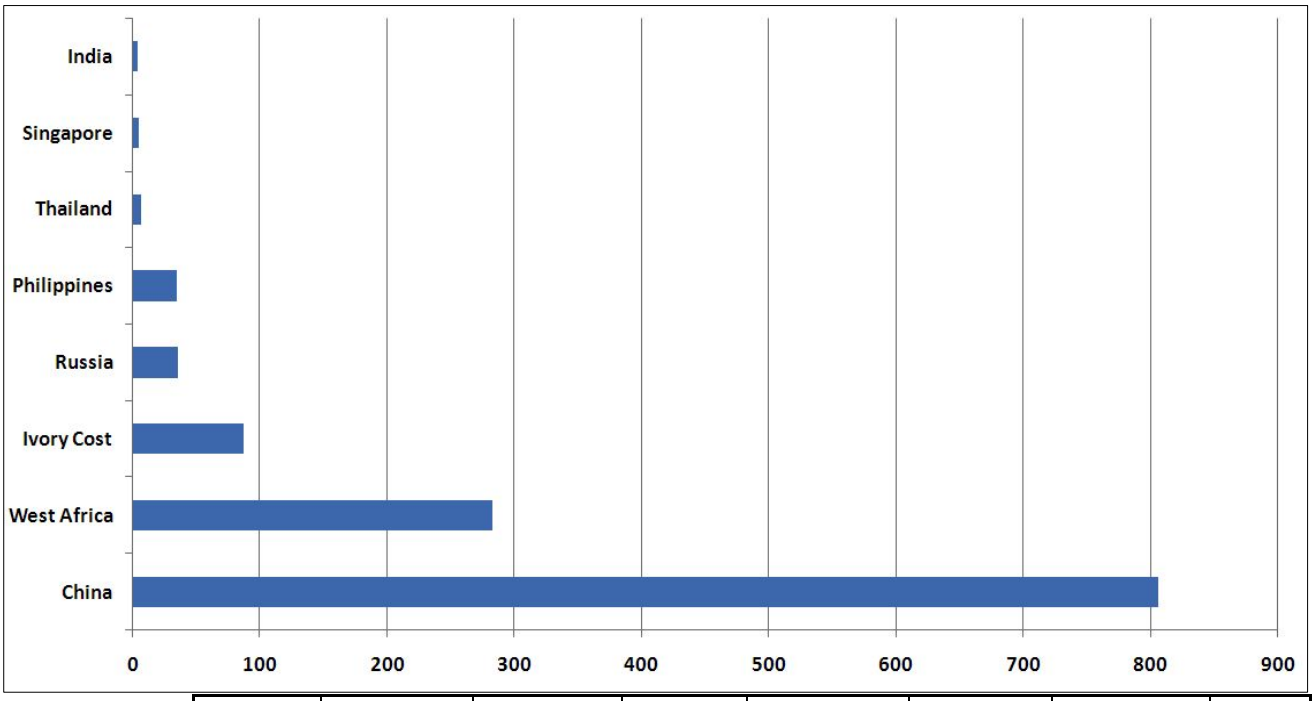
Source: Compiled from USDA 2013. Note: TMT = Thousand Metric Tons.

Now, as indicated in Figure 10 which shows the top destinations of Myanmar rice in 2012, there has been a big shift resulting with China now taking top spot with 805,938 MT[9] (61.1%), and West Africa a distant second with 282,864 MT (21.4%) followed by Ivory Coast, Russia, Philippines, Thailand, Singapore, and India. The interplay accompanying this shift in destinations and quantities needs to be monitored closely as it does reflect the consequences of MRF's effort to diversify Myanmar's overseas markets, and has important implications to the development of supply chains and trading networks which merits closer study.

Overall, in terms of the Myanmar rice supply chain we found that the mills and processing plants (especially those owned by or strategically linked to the RSCs) are increasingly acting as the pivot or fulcrum linking/driving upstream and downstream development/ transformation of the supply chain - upstream through contract farming, the provision of good/certified seeds, fertilizers, and mechanization services and downstream to modern retailers like supermarkets and minimarkets with branded packaged rice. Some are also involved in exports of Emata 25% and higher quality 5% to 15% Emata as well as by varieties like Zeeyar, Sinthwelatt, and Inmayebaw to a more diversified overseas markets or destinations. The recent announcement of MAPCO building five mega integrated rice processing plants will further drive the transformation of Myanmar's rice value chain. It would be interesting to see how the progress made by the RSCs so far will be built upon and allowed to develop alongside MAPCO, the Myanmar way. With this, we turn to examine the differentiated sub- supply chains.

[9] USDA contends that this big jump was due to a surge of border trade to 620,000 MT. Please note that Table 5 did not include border trade and that's why the export for 2012 was only 700,000 MT instead of 1.32 million MT if border trade is included.

Figure 10. Myanmar's Rice Exports 2012 – Top Destinations ('000 MT)



	China	West Africa	Ivory Cost	Russia	Philippines	Thailand	Singapore	India
2012 exports	805,938	282,864	86,920	35,288	34,291	6,735	4,277	3,550

Source: Compiled from USDA 2013.

3.2. Differentiated Supply Chains or Sub-chains

In the course of the study, we can differentiate four different sub-chains with another one likely to develop. Firstly, a) the most traditional rice value chain where the producers milled the bulk of their output for their own consumption through custom milling (using huller mills) with the excess sold to local small mills or collectors. This form is prevalent in both surplus and deficit regions, especially when far away from district and state/division capitals as well as where infrastructure is still poor. Here, the antiquated and small mills are used to supply to the local community and surrounding areas. This chain is still quite large as it was estimated that an average of 30% of overall production is retained by farmers for their home-consumption[10]. Secondly, b) the sub-chain involved in spatial arbitrage, by linking rural to urban and/or surplus to deficit areas. This is also a traditional rice value chain involving small and medium size mills and traders involved in both spatial and temporal arbitrage, as well as larger mills dealing with bigger volumes linking or operating in distribution hubs to channel rice from surplus to deficit areas. This chain is probably the largest in terms of number of farmers, millers, wholesalers, and retailers involved as well as volume of rice involved. Hence, this chain should not be neglected in terms of technology transfer, financing, and all other recommendations, while emphasizing Myanmar's intent to re-establish itself as a major rice exporting country. There is an inherent danger in being too export-centric in considering the development of the Myanmar rice value chain. Thirdly, c) the supply chain that has been developed since 2003 after the withdrawal of MAPT, to support the international trade of rice (white rice, broken rice, and parboiled rice) that is exported almost exclusively from Yangon. A subset of this chain involves the RSCs who owns or are strategically aligned to large

[10] Personal communication with Dr. Hnin of Yezin University

modern mills, are involved in contract farming and the provision of seeds and fertilizers as well as mechanization services on credit. These RSCs[11] are also involved with MRF in operating a rice reserve pilot scheme at the behest of the government which also operates as a buffer stock in order to stabilize the supplies and prices of paddy as well as rice. Most of their mills have mechanical dryers, wet polishers, and color sorters and hence, capable of producing high quality rice which are exported as higher quality Myanmar rice (better than the normal Emata 25% exported by most exporters) to more discerning, non-traditional (other than African and Bangladesh) markets . Fourthly, d) is a new but fast developing chain which supports the border trade via border posts to the neighboring countries of China, India, Bangladesh, and Thailand. The most significant is that via Muse to Shweli (Ruili) in China, which as mentioned earlier registered an incredible 620,000 MT in 2012. This chain can be potentially very large. However, at the moment it is still evolving and is blurred as it also involves those traditionally operating in chain (b) as well as chain (c). Finally, new sub-chains are also expected to develop with impending plans to produce and export special quality rice in future such as Japanese firms preparing to produce Japonica rice in Shan State as well as Thai investors interested in producing Khoa Hom Mali in Mon State.

So overall we can see that the biggest chain is probably (b) spatial arbitrage followed by (a) and then (c) and (d) in 2011 at least. It would be interesting to see the impact of the dynamics and transformation of supply chain as the demarcations between these sub-chains are blurred and as players shift between sub-chains.

3.3. Economics of Rice Production, Marketing, and Trading

In terms of costs and returns at the farm level, we utilized data from a comprehensive survey conducted by e-Trade Myanmar with the help of U Kyaw Myint. These are presented for the monsoon and summer crop of 2011/12 in Table 9.

Table 9. Production Cost and Returns for Monsoon and Summer Crop, 2011/12

Particular	Unit	Monsoon paddy (Ks*/acre)	%	Summer Paddy (Ks/ acre)	%
1.Hired labour	Ks per acre	72,100	55	84,800	41
2.Agro-input cost	Ks per acre	53,000	41	116,400	56
Total cash cost	Ks per acre	125,100	96	201,200	97
3.Farm family labour	Ks per acre	4,800	4	6,000	3
4. Cost of production	Ks per acre	129,900	100	207,200	
5. Paddy yield per acre	Basket per acre	60		85	
6. Paddy yield per acre	Tons per acre	1.25		1.77	
7.Break-even price of paddy (4)/(5)	Ks per basket	2,165		2,438	
8. Marketing cost of paddy to be sold at rice mill	Ks per basket	250		250	

[11] The RSCs while growing, involves less than 10% of the farmers. It was noted that in the main season of 2012, only 4 out of the RSCs continued with their sizable contract farming. Whether this is a temporary set-back and how this sub-chain can work and synergize with the operations of MAPCO in future is worth close monitoring and study.

Table 9 con't.

Particular	Unit	Monsoon paddy (Ks/acre)	%	Summer Paddy (Ks/ acre)	%
9. Break-even cost of production and marketing	Ks per basket	2,415		2,688	
10. Selling price at rice mill	Ks per basket	3,550		3,550	
11. Net margin for farmers (8-9)	Ks per basket	1,135		862	
12. Net margin (returns) per acre	Ks per acre	68,100		73,270	
	U.S. Dollars (USD) *per acre	79.18		85.19	

Source: e-trade Myanmar data computed with the assistance of U Kyaw Myint. Note: Ks = Kyats.

Average cost of production of paddy varied between $151.05/ac and $120.84/MT for monsoon paddy and $240.93/ac and $138.58/MT for summer crop. Therefore, cost of production of summer paddy was more than that of monsoon paddy both in terms of cost per ac and cost per unit output. Consequently, average profit margin for monsoon and summer crop was 68,100 Kyats or USD79 per acre (or USD63/MT) and 73,270 Kyats or USD85 per acre (or USD48/MT), respectively. Using simple averages, farmers' average margin in 2011/12 was USD82/acre and USD55.5/MT

To complete the picture, we consider the marketing margins from the farm to rice export (freight on board [FOB] Yangon), computed together with U Kyaw Myint of e-Trade Myanmar using their survey data for 2011/12 monsoon crop in Ayeyarwaddy Region. Farmers sold their harvested paddy at a rice mill at an average of 35,500 Kyats per 100 baskets (or at USD182 per ton). The Emata 25% FOB Yangon price averaged USD330 per ton. The price structure and margins along the rice supply chain are summarized in Table 10.

From Tables 9 and 10, it can be seen that the average margin for the 2011/12 monsoon season at the farmer level (including transportation cost to mill) was USD63 per ton; at the mill level (including milling cost) was USD21; at Yangon trader level (excluding transportation cost) was USD11; and at exporter level (excluding cargo preparation, transportation, and documentation) is USD28. Besides providing an indication of the relative margins along the rice value chain, it also highlights the point that the relative competitiveness between exporting countries is not so much dependent on the cost of production at the farm level (i.e.,

Table 10. Price Structure and Margins along the Rice Supply Chain for Exported Rice Monsoon Crop 2011-12

Market participants	USD per ton (Emata 25% rice)	(%)Percent on farmer selling price of paddy	Margin (USD per ton)
Paddy: Ex mill price	182	100	63 (see Table 9)
Rice: (conversion ratio, milling cost)	270	148	
Rice millers (Selling price of rice)	291	160	21 (291-270)
Rice traders in Yangon REXC	302	166	11 (302-291)
Rice exporters (f.o.b. YGN) price	330	181	28 (330-302)

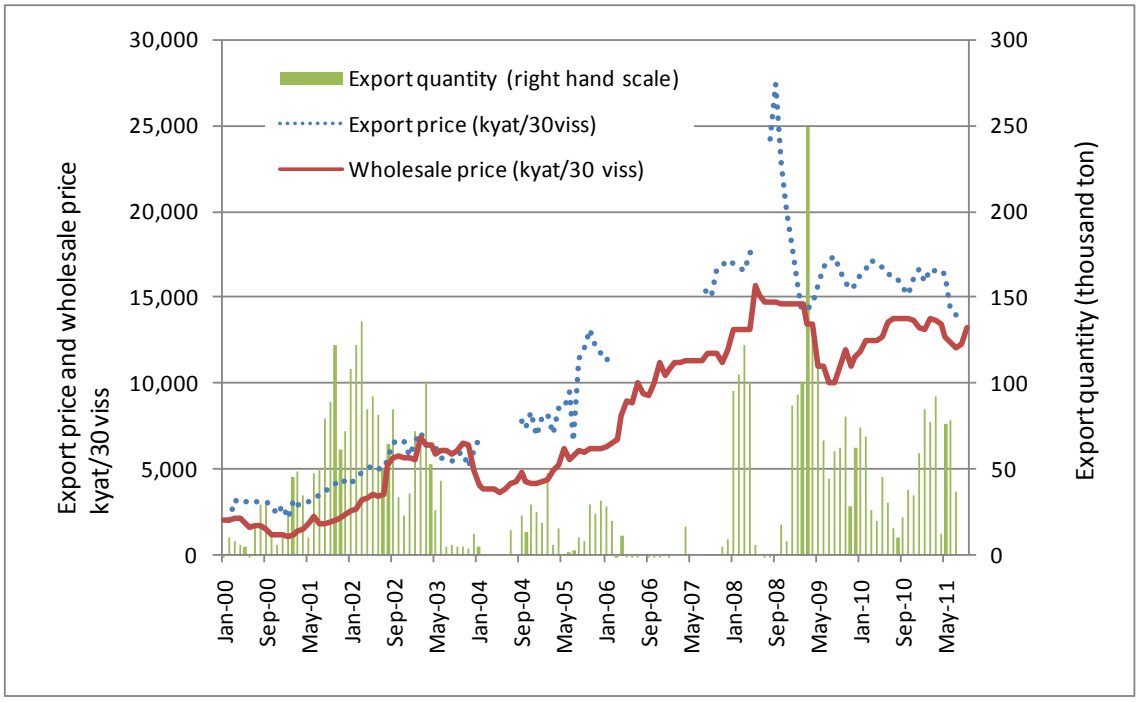
Source: Prepared by authors from MRF and e-Trade records with assistance from U Kyaw Myint of e-Trade Myanmar. Note: USD=860 Kyats, cost of rice bag for rice millers (paddy price + milling) = 11,629 Kyats per bag (USD13.52 per bag) or USD270 per ton), rice selling price at rice mill is USD291 per ton. REXC: Yangon Bayint Naung Rice Exchange Center; Yangon Bayint Naung Wholesale Market.

USD120.84/MT) but also, if not more importantly, milling efficiency/cost, transportation cost, handling, export documentation, and loading costs. The feedback from people involved in the supply chain confirms the problems at the milling and post-harvest stage as well as in transportation (due to poor road condition, high fuel cost, and hence, trucking charges), and costs embodied in export procedures and activities.

Next, we turn to consider Myanmar's export performance in the past and its future prospect by examining export price relationship with wholesale price and export volume on a monthly basis. Figure 11, sourced from Kubo and Okamoto (2011), shows the trends of the domestic wholesale and export prices along with the monthly export volume. The domestic wholesale price is for Emata 25% at Yangon market, compiled from the data in the *Market Information Service (MIS) Bulletin* of the Ministry of Agriculture and Irrigation. The export price and export volume are from the *Selected Monthly Economic Indicators*, Central Statistical Organization. The export price is the monthly average export price, converted into kyat using the prevalent parallel market rate.

Kubo and Okamoto (2011) examined the interrelationship between wholesale price, export price, and export volume of rice over the 2000 to 2011 period as they wanted to see (from the relationship between the export volume and the domestic wholesale price) whether an increase in exports will lead to a rise in the domestic price, or will a decline in the domestic price bring about an increase in exports? As indicated in Figure 11, there do not appear to be any consistent relationship between exports and the domestic price. In fact over this period, the proportion of exports to total production seems to be low, so much so that exports appear not to affect the domestic price. However, this relationship between export and the domestic wholesale price may change if the volume of exports increases to the order of three million tons, as targeted for the near future.

Figure 11. Trends of Wholesale and Export Prices and Export Volume of Rice



Sources: Kubo and Okamoto 2011.

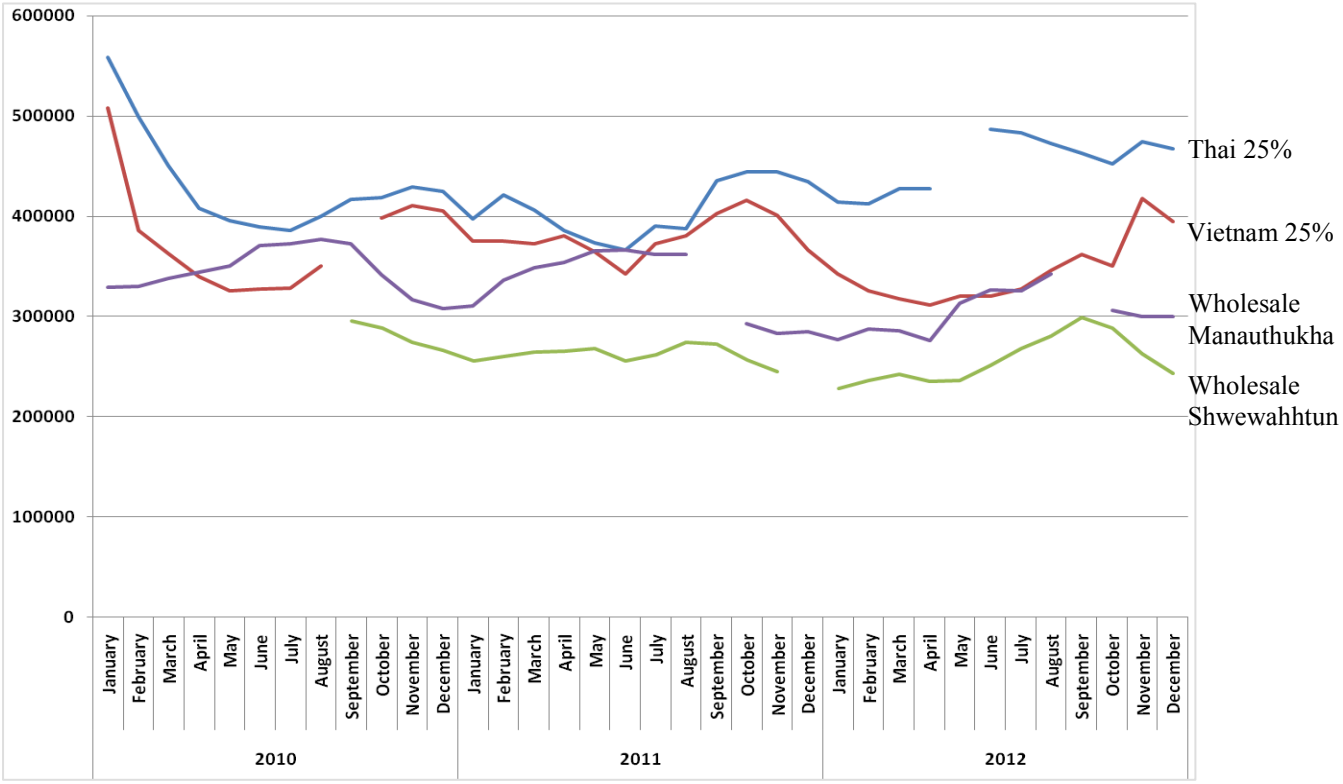
We should also note that the margins between export price and wholesale price, although fluctuating, seems to have widened since 2004, peaked in 2008 (coinciding with the global food crisis when rice prices tripled in May), and narrowed since 2010.

Now, in order to have an idea of how competitive Myanmar's rice is or likely to be in future, we should compare the wholesale price of Myanmar rice varieties with the international price of Thai and Viet equivalent varieties or grades. We were fortunate enough to gain access to e-trade data sets and obtained plots of the monthly wholesale price of two easily available Myanmar varieties which goes into the Emata (mixed varieties) 25% rice that forms the bulk of Myanmar's rice export with the international price of Thai 25% and Viet 25% (which were converted into Kyats using e-trade's monitoring of US-Kyats exchange rates) over the 2010 to 2012 period. This is presented in Figure 12.

Here we find that Viet 25% prices tracked that of Thai 25% closely over the period with Viet 25% prices always below that of Thai 25%. Similarly, wholesale price of Shwewahhtun also tracked Manawthuka variety closely with Shwewahhtun wholesale prices always below that of Manawthuka. However, these two sets of prices do not appear to move together but rather quite independently over the 2010 and 2012 period.

We also found that while Thai 25% was always higher than Shwewahhtun and Manawthuka wholesale prices but Viet 25% while always higher than Shwewahhtun wholesale price throughout the period, dipped below that of Manawthuka wholesale price once each year, around April/May and June/July. Overall, it would seem to indicate that from this comparison between the wholesale price of the two Myanmar varieties and FOB export prices of Thai and Viet 25%, Myanmar 25% was competitive over most of the period between 2010 and 2012

Figure 12. Comparison of Thai and Vietnam 25% FOB Price with Myanmar Wholesale Rice Prices



Source: Prepared by authors with assistance from U Kyaw Myint of e-Trade Myanmar.

when we consider that Emata 25% is actually a mix of various varieties. However, we understand from international traders that just as Viet Nam white rice normally trade at a discount to Thai white rice, Myanmar white rice (Emata 25%) normally trade at a discount to Viet Nam white rice. Consequently, in gearing up for Myanmar to meet its set target of exporting 3 million tons of rice by 2017, not only should the price relationships at the production, marketing, and trade levels be properly monitored and understood, there should also be a clear understanding of the behavior in rice importing countries and the various segments and destinations in the global rice market that are targeted. The global rice market will discussed further in a later section.

3.4. Investments along the Rice Value Chain

Although there have been significant investments in the upstream, midstream, and downstream segments of Myanmar's rice value chain, it is evident that the milling/processing segment of the supply chain is increasingly becoming the pivot or fulcrum for linking the upstream segment of inputs and farming to the downstream segment of wholesaling, retailing and exports. Hence, not surprisingly, we noticed that there has been a spate of investment in new rice mills as well as the upgrading of existing milling facilities, involving state-of-the-art European, Japanese, Korean, Thai, and Chinese made dryers, wet-polishers, color-sorters, and packers. Most of these are owned or strategically linked to Rice Specialization Companies (RSCs). Table 8a (presented earlier) provides an indication of the number and range of mills owned by or strategically linked to these RSCs as well as the scale and their extent of contract farming operations in the monsoon seasons of 2009, 2010, and 2011. Underscoring how data is captured and reported in bits and pieces, Table 8b depicts the extent of contract farming by the RSCs for the summer crop of 2009 and 2011 together with the number of farmers involved and their average farm size.

A list of the types of new mills built by some RSCs between 2009 and 2011 are provided in Table 11. Many more has been constructed since then and there have been tenders called for five mega integrated rice processing complexes by MAPCO in 2012. Since its establishment, MRIA/MRF has formed 177 township level associations, 12 State and Region level associations and has 11,005 individual members and 95 companies, with 59 of them registered as RSCs.

Since a major recent policy thrust is to re-establish Myanmar as a significant reliable exporter in the global rice market, it would be prudent to address the dynamics and organization of export related facilities and activities as well. The situation in the export of rice increasingly involves Rice Specialization Companies and MAPCO warehouses at the Yangon port, which accounts for almost all of the shipment to overseas markets. However, there have also been exports from Pathein (most notably a shipment to the Philippines) as well as Sittwe. There is also formal and informal exports of rice through border trade office or crossing, particularly Muse to China, Maung Daw to Bangladesh and Myawaddy to Thailand. There is anecdotal evidence that rice is beginning to go to India (Assam) via Tamu border post.

Table 11. New Rice Mills Installed by RSCs 2009-2010

Companies	Capacity	Make	Location	Warehouse (feet)
Gold Delta Co Ltd	6 TPH	Yong Xiang	Yangon (Shwe Lin Ban)	(300 x 200) 2 Nos
Gold Delta Co Ltd	2.5 TPH	Satake	Yangon (Shwe Lin Ban)	-
Gold Delta Co Ltd	2.5 TPH	Young Xiang	Da Nu Phyu Township	(80 x 40) 1 No
Gold Delta Co Ltd	4.5 TPH	Satake	Da Nu Phyu Township	(225 x 50) 2 Nos (80 x 70) 1 No
Zalun Link Co Ltd	1 TPH	-	Zalun Township	-
Zalun Link Co Ltd	2 TPH	China	Zalun Township	
Zalun Link Co Ltd	2 TPH	China	Ma u bin Township	
Zalon Ayeyar	2.5 TPH	Yong Xiang	Zalun Township	
Kyaiklat/Dagon Int'l	4 TPH	Satake	Yangon	
Khittayar Hinthar	2.5 TPH	Wuhan Dingxin	Pyay	(60 x 120)1 Nos (40 x 80) 3 Nos
Ayeyar Hinthar	10 TPH	Satake	Yangon (Hlaing Thar Yar)	(360 x 400) 1 No
Ayeyar Hinthar	10 TPH	Wuhan Dingxin	Yangon (Hlaing Thar Yar)	-
Khittayar Hinthar	2.5 TPH	Wuhan Dingxin	Thae Kone Township	(20 x 80) 2 Nos
Khittayar Hinthar	2.5 TPH	Wuhan Dingxin	Paung De Township	(40 x 80) 2 Nos
Total Capacity	**54.5 TPH**	**1,308 TPD**		

Source: Compiled by authors from MRF records. Note: TPD = Tons per day; TPH = Tons per hour.

4. DYNAMICS

4.1. Transformation of Supply Chains

4.1.1. Upstream Level

By and large the farmers we met during our field visits in October and November 2012, as well as those I have met in different parts of Myanmar on previous visits, have proven to be exceptionally skillful, innovative, and entrepreneurial in optimizing the use and maximizing the impact of the limited resources and support available to them. They have managed to maintain yields despite all the weaknesses identified so far – poor quality seeds, poor quality fertilizers, inappropriate pesticide, and poor application equipment, poor market information, high interest rates, and lack of formal credit and other agri-services (especially research and extension).

In terms of transformation, we find that things have improved over the last few years and have accelerated since 2009 with the formation of Rice Specialization Companies (RSCs), the formation of MRIA (later upgraded to MRF) and the launching of MAPCO this year. Contract farming is on the increase and farmers get better access to inputs (including seeds and fertilizers), mechanization services, and better market access. What is critical is more recently the leading RSCs are working closely with the MOAI (especially DOA and DAR) and MOC along the lines of Public-Private-Partnership. Production credit with better terms and safeguards against crop failure (drought, flood, and pest or disease outbreaks) is being explored. Equally exciting will be what the farmers' associations that are being formed can do in terms of their prioritize activities, especially if they will be involved in the organization of farmers in group farming, input supply, credit and other agri-support services. All these developments will transform the supply or value chain further including closing the yield gap and increasing farmer incomes.

With the increasing involvement of leading RSCs in the production of certified seeds of selected varieties, we already notice contract farmers growing selected varieties that are subsequently milled and exported by these RSCs to niche markets in selected countries as well as sold as branded packed rice in domestic markets. This trend is expected to grow.

4.1.2. Midstream Level

With the increasing investments in milling and processing facilities led by RSCs as well as the in pending development of strategically located mega integrated rice processing complexes (producing rice bran oil, rice noodles/vermicelli, rice flour, par boiled rice besides high quality rice and selected rice varieties for targeted markets) there can be an expected increase in more export by variety, concurrent with the increase in branded packed rice in local retail markets including supermarkets, restaurants, and in the major Myanmar airports (which will further promote Myanmar rice with the expected hike in tourist arrivals).

Together with the improved packing and branding, we find increasing advertisements involving rice and rice products in print and telecast media. Consequently, we notice that rice is increasingly marketed as a Fast Moving Consumer Good (FMCG). This will continue to transform the sale of rice from the traditional volumetric measure in traditional shops to packed branded rice by variety and by weight (1kg, 2kg, 5kg, 10kg bags etc.). This will support the trend of exporting rice by varieties in conventional 50 and 25 kg bags or in

convenience-sized branded (either own brand or OEM) packed rice by variety that are ready for shelf.

These developments will lead to the disintermediation of excessive levels in the supply chain, effectively shortening the supply chain and at the same time lengthening the supply chain in terms of linking up farmers and players at different levels of the supply chain to more lucrative and further away overseas market. We already witness the exporting of rice to Europe (including Belgium and Russia) and MAPCO in negotiating to supply rice to Korea and Japan. At the same time, more rice is exported through border trade to China, India, and Bangladesh. With all these developments increasing efforts at integrating logistics to be more cost efficient will result in making Myanmar's rice more competitive.

4.1.3. Down Stream Level

Rice retailing has transform significantly over the last two years with the introduction of branded packed rice by varieties especially into the increasing supermarket chains and outlets led by the Ayeyar Brand of the Ayeyar Hinthar Group. The packed rice is sold by weight (rather than the traditional volumetric measure) and is safer and more traceable (increasingly from farms to mills and reprocessing plants in the leading RSCs' comprehensive supply chain which are rapidly evolving). This trend is expected to continue.

In fact, we now find some branded packed rice on sale at restaurants and food outlets and even at departure hall of Yangon airport. This will transform the supply chain and under the leading RSCs leadership can effect better transmission of prices along the value chain back to the farmers. As MAPCO's rice processing complexes comes on stream, we can expect similarly packed rice and rice products (rice flour, vermicelli, rice bran oil, rice-based snacks) to be branded, packed and sold as FMCGs both in the domestic and international markets. The major difference here is that as a result of value adding in other end-uses besides the normal form of rice, some of this value will be transmitted back to the farmers in terms of better paddy prices. It would be interesting to monitor how much of these potential gains can be realized in future.

So as we can see from the above, the Myanmar rice value chain has transformed significantly to date. Recent developments and efforts by both the public and private sector promises further transformation of the value chain. While it is generally expected to be a boon to most players along the supply chain, we should, however, be vigilant and take on-course corrections to mitigate against the possible negative impact of such transformation like the marginalization of smaller scale farmers and smaller players along the supply chain as well as other vulnerable groups like the landless and urban poor.

4.2. Rice Supply Chains Developed to Date: Strengths and Weaknesses

It is, thus, important to highlight the strengths as well as weaknesses at each level of the current rice supply chain and the chain taken as a whole. The strengths and weaknesses will determine the opportunities found in the present value chain system. This in turn will indicate how the government can utilize and manage the supply chain system to meet national rice policy objectives. From the strengths and weaknesses, one would also be able to formulate the tasks which need to be undertaken to assist the government in using the supply chain system to meet national objectives.

It will be clear from the discussions that follow that the supply chain transformation, consolidation and integration that has taken place at the upstream, midstream and downstream levels coupled with the data collection system that has been improved by the government (MOAI and MOC) as well as MRF and private entities like e-trade acting together, albeit not always in tandem as yet. Once streamlined and integrated properly they can provide a golden opportunity for the application of sophisticated supply chain data analysis techniques, including macro-level optimization and aggregate forecasting in due course. These techniques will be ideal for policy makers and government regulators to monitor national rice policy objectives. At the same time, the techniques will be able to provide macro-level information to industry players to assist their planning of their own supply chain activities. This dual-purpose strategy is possible only because key industry players, MRF, MAPCO, and some Rice Specialization Companies have together developed strong stable supply chain channels from 2008. The following discussion will show the developments that have taken place in the rice supply chain and how they offer opportunities for improved micro and macro-level planning.

4.3. The Strength of the Rice Supply Chain is Determined by its Weakest Links

From a different perspective, we can focus on the weak links along the rice supply chain as depicted in Figure 13.

Here we find that there are four identified weak links.

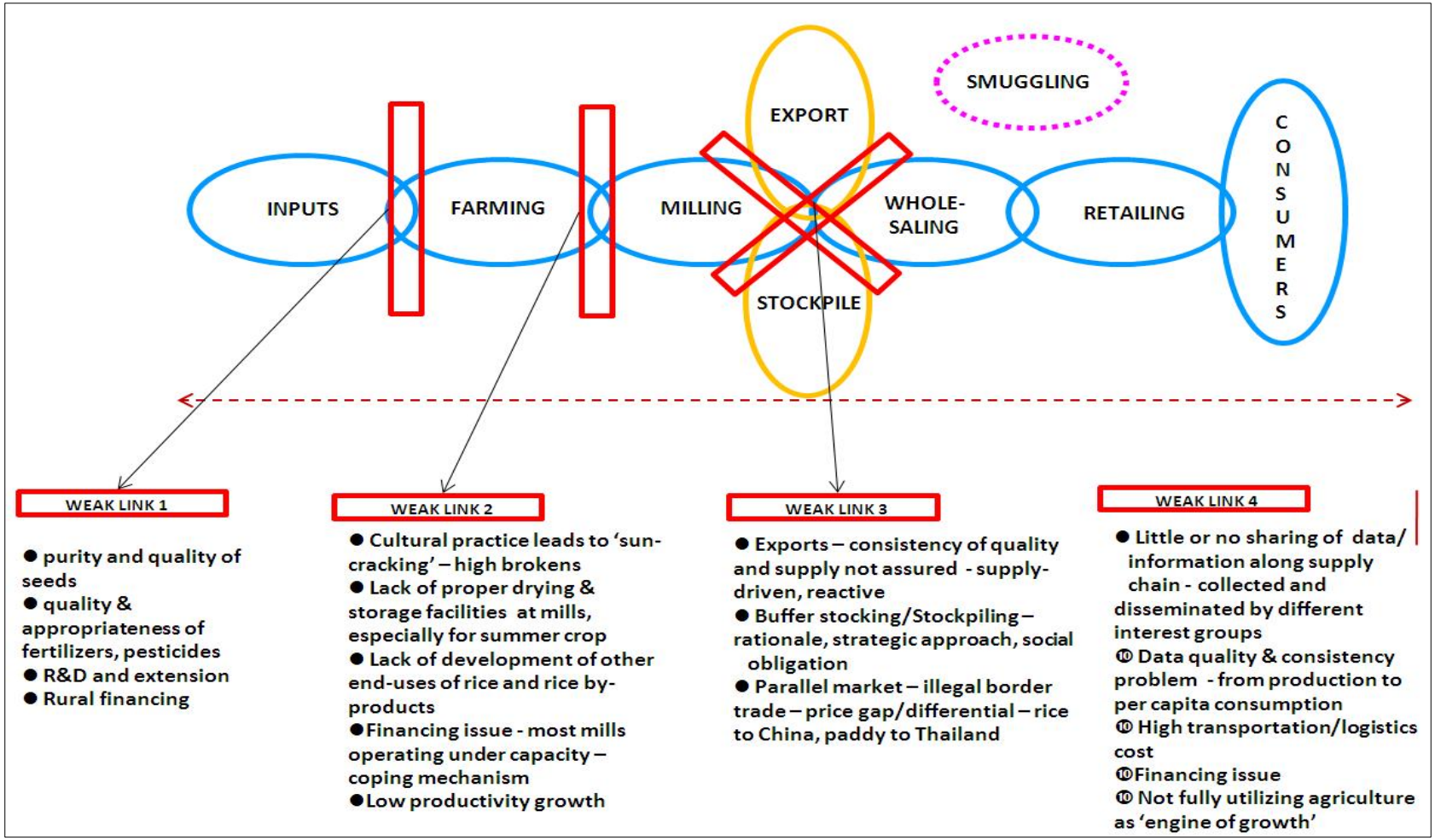
4.3.1. Weak Link 1

The inter phase between inputs and the farming/production level where the contributory factors are the purity and quality of seeds which is so important if Myanmar wishes to regain its position as a significant dependable exporter in the global rice market. This is especially so for the identified High Quality Rice like Paw San Hmwe (which won the World's Best Tasting Rice Award in 2011) and Lone Thaw Hmwe, as well as specific varieties like Zeeyar (for Middle East Market), Inma Yebaw (for South East Asian countries) and Sin Thwe Lat which are targeted at European besides Asian market. Another weakness at this inter phase is the dubious quality and appropriateness of fertilizers and pesticides. For example, there have been reports of urea sold to farmers having only around 20% N (instead of the standard 46%). Pesticides that are banned in neighboring countries for rice are still widely sold in pesticides shops visited during our field visits. The weak R&D and extension system is discussed in detail in another background paper, as is rural financing, therefore will not be elaborated here.

4.3.2. Weak Link 2

This link is at the inter phase between the farm and the mill and comprises three main considerations. Firstly, is the observation that present cultural practice of farmers, especially those who are rushing to establish a pulses and beans crop after the monsoon crop harvest, often leave their harvested crop in the field as the harvest usually occur in a dry period.

Figure 13. Myanmar Rice Value Chain: Strength Is Determined by Weakest Links



Source: Authors.

However, during this period, the day and night time temperature variation is very significant leading to sun-cracking or fissures in the paddy grain which will lead to a higher degree of broken rice during milling irrespective of milling equipment upgrade. Secondly, there is a lack of proper drying facilities for the summer crop which is harvested in wetter months. Thirdly, we note that largely due to financing constraints (high interest rates), many of the mills do not (cannot afford to?) purchase and store enough paddy to run at or near rated capacity. Some mills in the Ayeyarwaddy delta region and in Sagaing are seemingly circumventing this by offering farmers free storage capacity at their mills and only pay the farmers when their paddy is eventually milled (timing mutually decided) at prevalent market price then. Another factor is the lack of value adding at the mills and processing plants for other end-uses. Acting together all these have put a lid on productivity growth as well as the transmission of low paddy prices to farmers.

4.3.3. Weak Link 3

This link is at the inter phase between the milling and the wholesaling (or distribution trade) as well as export and stockpiling levels of the rice supply chain. There is an inter play of three major issues here. Firstly, to be considered a reliable exporter of choice, Myanmar must improve its consistency of supply and quality and be more proactive and demand driven in seeking out and developing markets for its range of white rice by variety as Myanmar is blessed with a range of varieties and indeed sells and exports rice by variety. This will enable Myanmar to meet consumer preferences of different major traditional as well as emerging rice importers. Secondly, Myanmar's current attempt at involving the private sector (through MRF) in national stockpiling operations (for buffering to stabilize paddy and rice prices as well as food security purposes) would require the development of standard operating procedures coupled with transparency of trigger mechanisms and how private sector can configure the operations to be self-financing and Government to work out its support and regulatory oversight required. Thirdly, current informal or parallel markets to China, Bangladesh and Thailand as well as India should be increasingly formalized and exploited to facilitate cross border trading networks in the GMS and BIMSTEC region. It is expected that China will import rice more regularly for snacks, feed and human consumption as China's rationalization program for competing use of increasingly scarce water resources coupled with its ambitious water transfer scheme from the south to the water starved north unfolds.

4.3.4. Weak Link 4

This link pervades the entire supply chain. Firstly, generally data is patchy and available only in bits and pieces along the supply chain and worse still are invariably not shared or reconciled for a variety of uses and users. Furthermore, as government agencies as well as representative private sector associations focus only on specific levels of the rice supply chain that is under their purview or affecting them directly, there have been various misrepresentations, intentionally or otherwise, that has led to sub-optimal government interventions and even those have made the situation worse. Fortunately MRIA, and subsequently MRF, is addressing this issue together with the MOAI, MOC, and the Ministry of National Planning and Economic Development. Secondly, Transportation and logistics cost are high arising from antiquated regulations and the prevailing structure of the water, road and rail transportation. This needs urgent attention and resolution as it can either support or hinder Myanmar's ability to maximize the potential benefits of increasingly connecting with the region via overlapping regional constructs – ASEAN, GMS, BIMSTEC, as well as

bilaterally with its immediate neighbors. Related to connectivity is its current low level of mobile phone and internet penetration. Interestingly, efforts are in train to liberalize and accelerate penetration rates by liberalizing the telecommunication sector. Fourthly, not only is financing an issue at the farmers level but it pervades the entire rice supply chain which calls for a more holistic and sequenced approach in addressing and resolving this overarching problem which together with data and organizational capacity has hindered and constrained the full utilization of agriculture as an engine of growth to drive Myanmar's transformation.

The above weaknesses are not exhaustive but are put together to highlight the range of key issues and the various obvious weak links in the rice industry which must be approached in a more holistic manner than the hitherto largely piece meal and hasty manner. Now, as in any chain, its strength is in its weakest link. Therefore, these identified weak links must be addressed in tandem and resolution sequenced where necessary and implementation well supported by a structured monitoring and evaluation system. This should be affected through various forms of public and private partnerships to create a demand-oriented industry-wide system linking back all the way to paddy production and the farmers. For, unless problems are framed properly within a more holistic framework, whatever solutions arrived at will lack forethought and adequate perspective and hence, run the risk of being easily overtaken by events.

At this juncture it may be prudent to consider the structure and peculiarities of global rice market as well as the increasing importance of rice border trade with China.

4.4. Global Rice Market and Types of Rice Market Segments and Prices[12]

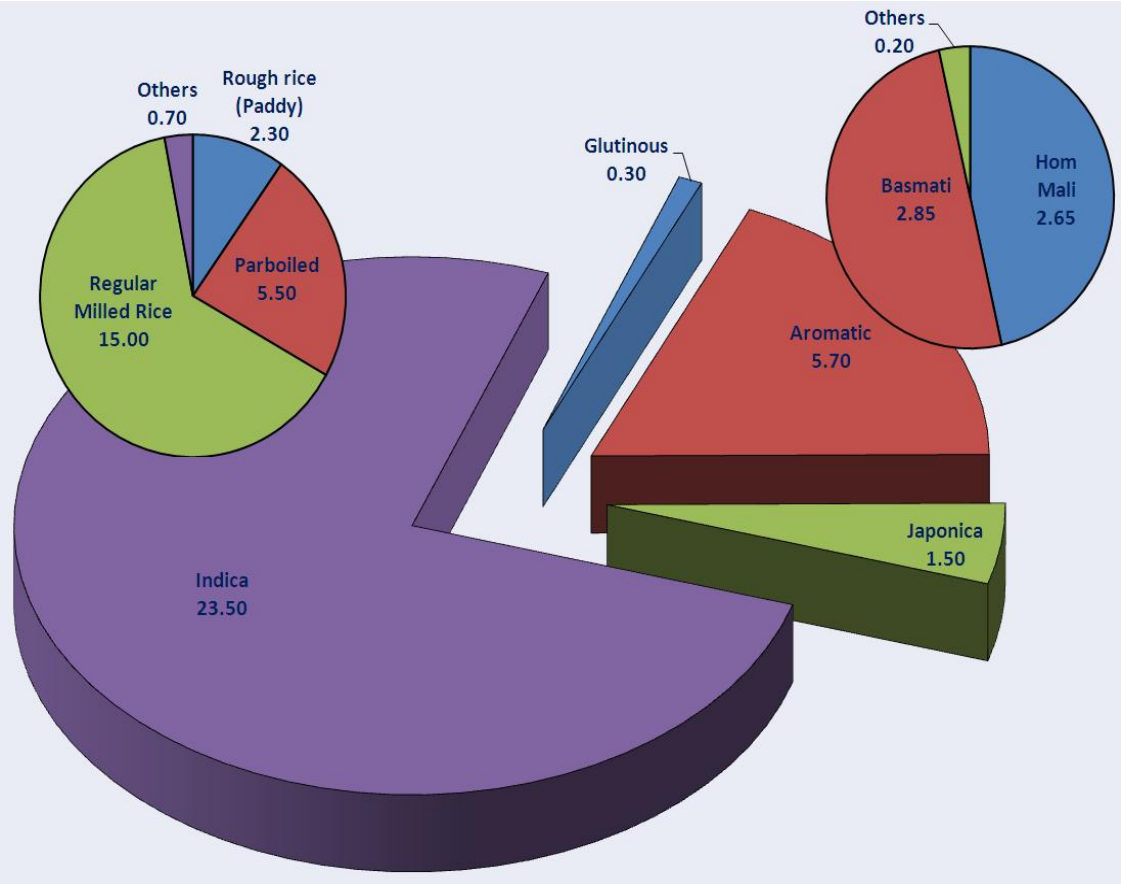
The world rice market is a thin, imperfect, and segmented market in which governments are still key actors. World trade has averaged 30 million tons over the last four years. There are very distinct markets based on different rice types, qualities, methods of processing and in-grained preferences which makes perfect substitution very difficult, if not impossible.

Besides the usual criteria of quality of grain length and percentage of brokens, kernel shape (length/breadth ratio), chalkiness (the absence of it), and translucency are also important as is uniformity of quality.

As can be discerned from Figure 14, there are basically four types of rice: glutinous, aromatic, Japonica, and Indica. The tenderness and stickiness of cooked rice are inversely correlated with the amylose content of the type of rice. Glutinous or sticky or waxy rice (a very low amylose content rice) is typically used in deserts and Asian festivals and only consumed as a staple in certain countries (Lao and parts of Thailand and Viet Nam) and only about 300,000 tons is traded (exported mainly by Thailand and Viet Nam) annually in the global market. Aromatic or perfume or scented rice accounted for some 5.7 million tons in 2010, largely made up of Basmati (exported mainly by India and Pakistan) and Jasmine rice (exported mainly by Thailand and Viet Nam). Japonica rice (a fairly low amylose content rice) is round-shaped, semi-sticky, and moist when cooked. About 1.5 million tons is traded annually. Indica rice (with intermediate to high amylose content) cooks fluffy with volume expansion and grain separation and accounts for the major bulk of traded rice, with some 23.5 million tons annually. Out of this some 2.3 million tons are shipped as rough rice or paddy.

[12] This portion draws heavily from and builds on Slayton and Muniroth (2011).

Figure 14. Composition of Global Rice Trade 2011 (Million Tons)



Source: Slayton and Muniroth 2011.

Indica milled rice are further separated into parboiled rice (5.5 million tons) and normal white rice (15.5 million tons). There appears to be little substitution between Japonica and Indica rice as well as between parboiled and normal white rice.

In terms of pricing, broadly speaking aromatic rice is highest (with prices varying depending on country of origin and varieties), followed by Japonica, glutinous, parboiled and the normal white rice. However, prices at importing countries varies greatly depending on time of year, freight rates and handling costs besides any shocks to the global rice market.

Consequently, a clear understanding of the structure and dynamics of the global rice market, especially the changing trends in the rice market segments as well as relative prices are crucial in the planning of expanding Myanmar's rice export significantly into the future.

4.5. Increasing Importance of Border Trade with China

Myanmar is bordering five neighboring countries, namely Bangladesh, India, China, Lao PDR, and Thailand. Small volumes of rice has traditionally been exported to Thailand and Bangladesh but increasing volume of rice has been traded to China through Muse town located on Myanmar-China border from which rice was traded to Shweli (Ruili) in China. The average price of rice purchased by Chinese traders was USD458 per ton for Emata rice and USD448 per ton for Nga Sein rice in 2012 as compared to the average price of USD345 per ton of 25% Emata rice FOB Yangon as depicted in Table12 below.

Table 12. Monthly Average Rice Price of FOB YGN Basis and in Shweli (Ruili) in China

Month	Monthly Average Rice export price (FOB YGN)		Monthly average wholesale selling price of rice in Shweli (Ruili) in China	
	25% Emata rice		Nga Sein rice	Emata rice
	2011	2012	2012	2012
	USD per ton			
January	330	-	453	454
February	330	-	459	463
March	330	-	471	471
April	390	335	459	459
May	395	330	436	438
June	400	330	425	425
July	390	345	427	426
August	410	347	439	
September	415	376	452	
October	415	363	458	
November	305	346	459	460
December	310	336	436	
Average	**368**	**345**	**448**	**458**

Source: Rice price (f.o.b. YGN), Directorate of trade and rice price in Shweli (Ruili) in China was collected by Crop Exchange Center in Muse. Rice price data was gathered by e-trade Myanmar (private MIS).

Now, the distance from Shwebo via Mandalay to Muse is 253 miles (407 kilometers) and that of Yangon to Muse is 635 miles (1022 kilometers). The distance from Muse to Shweli is only 3 miles (5 kilometers). The transportation cost for Shwebo to Muse via Mandalay is USD0.15/ton/km while that for Yangon to Muse is USD0.1/ton/km giving a total transportation cost of USD65/ton for Shwebo to Muse versus USD101.75/ton for Yangon to Muse. Now, given that the average price differential between Shweli and Yangon prices for 25% Emata (recall Table 12) is USD113/MT it would appear that areas surrounding Shwebo, especially the 500,000 acres Kabo Irrigation area, will continue to have an advantage over rice from Yangon, or for that matter, Ayeyarwaddy or Bago rice area. Hence, the Shwebo/ Sagaing area is expected to benefit most from increasing border trade with China via Muse.

It should also be noted that the transpotation costs reported ranging from USD0.1 to USD0.17 per ton per km is very high compared with that in Thailand and Viet Nam, the two consitently largest exporters in the world. This point was also stressed by ADB (2012**).**

5. SECURING FUTURE PROSPECTS

The above discussion has traced the historical development of both the Myanmar Rice industry as well as the value chain and highlighted the dynamic more recent development and potential outcomes. However, as always key policy issues as well as structural weaknesses remain.

Now, keeping to the approach adopted by the Diagnostic Assessment team, we now present short game and long game recommendations.

5.1. Short Game

5.1.1. Key Recommendations for the Upstream Segment of the Value Chain Include:

- Improving the productivity of monsoon rice through improved certified seeds (increasingly led by selected RSCs working closely with DOA and DAR towards the development of a viable seed industry) for both contract farmers as well as sale to other farmers; improved agronomic practices; better quality fertilizers and appropriate agro-chemicals coupled with optimized fertilizer and input dosage and application; and integrated pest management.
- Promoting rational and selective dry season (summer crop) diversification into higher value crops (especially where water availability is insufficient to support a summer rice crop); and improving water management and agri-support services.
- Expending rural financial services to improve access to inputs and reduce reliance on informal money lenders.

5.1.2. Key Recommendations for the Midstream Segment of the Rice Value Chain Include:

- Improving post-harvest handling – especially to avoid sun-cracking by organizing quick collection of harvested rice, improve drying facilities and ensure consistent and cost effective power source at mills.
- Improving food safety and traceability by developing comprehensive supply chains and production of branded packed rice by variety.
- Promoting strategic end-uses and by products (as championed by MAPCO) to generate more value adding and facilitate transmission of better paddy prices back to farmers.
- Improving linkages to upstream and downstream segments to facilitate the strengthening of comprehensive supply chains which compete with each other so as to contribute to increased competitiveness and increased productivity.

5.1.3. Key Recommendations for the Downstream Segment of the Rice Value Chain Include:

- Targeting niche export markets for specific type/varieties of rice.
- Improving branding and highlighting of unique selling points as well as developing branding for Myanmar rice as a whole.
- Shortening supply chains by by-passing intermediaries like international traders and securing strategic international markets
- Facilitating food security

While still on the short game, in terms of low hanging fruits which will bridge to long term structural reforms, we should make concerted efforts to:

- Improve statistical and resource base especially in addressing the current data weakness as well as tracking the stocks and flows of inputs and outputs at different levels of the value chain as part of rigorous ground-based statistical surveys.
- This should combine with the latest satellite-based measurement system which enables the forecasting not only of production but also potential damage by drastic weather changes and pest outbreaks.
- Synthesizing expert opinion on current best practices for specific upstream, midstream, and downstream settings.

5.2. Long Game

5.2.1. Recommendations for Long Game Include:

- Creating a farmer-centered, market-oriented research system where outputs can contribute to guiding the future development of the rice industry as well as enable on-course corrections and shaping the transformation process.
- Promoting transparent predictable policies to regulate and support the private sector which is so important in view of the stepping up of public-private-partnership with RSCs, the involvement of the private sector in managing Myanmar's rice stockpile and the increasingly more encompassing activities of MAPCO.
- Investing in rural financial system serving the different segments of the value chain.
- Supporting farmer organizations (including the newly formed Farmers Association), water user groups and small and medium scale enterprises (SMEs) involved in or supporting the different level of the supply chain to be integrated into the entire value chain.
- Developing an integrated intermodal logistics system to overcome noticeably escalating transportation costs so that Myanmar's rice supply chain and trading network becomes increasingly more competitive.

6. CONCLUSION

This Background Paper has assessed the state of Myanmar's value chain by tracing historical development of the rice industry as a whole as well as how the upstream, midstream and downstream segments are conditioned and subsequently transformed, particularly over the last few years. It also provided short game and long game recommendations to ensure the fulfillment of inherent potential as well as address the identified salient issues.

As always, the challenge is in getting the *basics* and *balance* right. Now, the successful framing and localization of the above short game and long game recommendations will require public and policy dialogue to ensure buying in and taking ownership of them by the key players, these and it subsequent roll-out will require a meeting of the minds, full commitment and the pooling of scarce resources (relevant data information human resources and funds of the public and private sectors as well as civil society). After undergoing this process, these recommendations are expected to contribute greatly towards increasing efficiency, competitiveness, and sustainability of the Myanmar rice supply chain and rice industry as we move into a more globalized and liberalized trading environment as well as a more integrated ASEAN in the 21st century.

REFERENCES

Asian Development Bank (ADB). 2012. Myanmar in Transition: Opportunities and Challenges. Manila: Asian Development Bank.

Central Statistical Organization (CSO). 2012. Statistical Yearbook 2010. Ministry of National Planning and Economic Development. Nay Pyi Taw, Myanmar: CSO.

FAO. 2012. Food Outlook, Global Market Analysis. Rome: FAO, Trade and Markets Division (EST).

Hnin Y.L. 2010. Economic Evaluation of the Potential of Myanmar Rice Market under Changing Policy Mix. Ph.D. dissertation, Kyushu University.

Kubo, K. and I. Okamoto. 2011. Note on Export Policy for Myanmar. Paper presented at Brainstorming Meeting of Myanmar Rice Policy Group, 11 November. Yangon, Myanmar.

Ministry of Agriculture and Irrigation. 2000. Agriculture Marketing in Myanmar (Ministry of Agriculture and Irrigation Market Information Service Project TCP/MYA/8821, Department of Agricultural Planning. Yangon, Myanmar: Ministry of Agriculture and Irrigation.

Ministry of Agriculture and Irrigation. 2012. Myanmar Agriculture at a Glance 2012. Yangon, Myanmar.

Okamoto, I. 2008. Economic Disparity in Rural Myanmar: Transformation under Market Liberalization. Wakaba, Chiba Japan: IDE-JETRO.

Reardon, T., K. Chen, B. Minten, and L. Adriano. 2012. The Quiet Revolution in Staple Food Value Chains (Enter the Dragon, the Elephant, and the Tiger). Mandaluyong City, Philippines: Asian Development Bank and Washington, D.C.: International Food Policy Research Institute.

Slayton, T. and S. Muniroth. 2011. A More Detailed Road Map for Cambodian Rice Exports. (Mimeo)

Theingi Myint. 2007. Internal and External Integration of Myanmar Rice Market over Time. In *Issues and Challenges in Rural Development (Compendium on the Occasion of 15 Years Ph.D. Program 'Agricultural Economics and Related Sciences' for Students from Developing Countries), Vol 2*, ed S. Bauer and L. Karki. Weikersheim: Margraf.

USDA Foreign Agricultural Service. 2013. GAIN Report – Myanmar. Washington D.C. USDA.

Wong, L.C.Y. and A.E. Suraya. 2004. Relevance of Supply Chain Management in a Liberalizing International Rice Market. Paper presented at Myanma Rice Milling Industry Fair, 8-11 January. Yangon, Myanmar.

Wong, L.C.Y. 2011. *Agriculture, Chapter in Malaysia: Polices and Issues in Economic Development*. Malaysia: Institute of Strategic and International Studies (ISIS).