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Myanmar Rice and Pulses:

Farm Production Economics and Value Chain Dynamics

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Acronyms and Abbreviations

AED	Agricultural Extension Division
AER	Agro-ecological region
ASEAN	Association of Southeast Asian Nations
CEX	Crop exchange
DAR	Department of Agricultural Research
DOA	Department of Agriculture
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GFADR	Global Food and Agriculture Practice, World Bank
HACCP	Hazard Analysis and Critical Control Point
ICT	Information and communication technology
LIFT	Livelihoods and Food Security Multi-Donor Trust Fund
MADB	Myanmar Agricultural Development Bank
MAS	Myanmar Agricultural Survey
MOALI	Ministry of Agriculture, Livestock, and Irrigation
MPBSMA	Myanmar Pulses, Beans, and Sesame Seeds Merchants Association
MRF	Myanmar Rice Federation
MRMA	Myanmar Rice Millers Association
MRRS	Myanmar Rice Research Station
NES	National Export Strategy
NPK	Nitrogen, phosphorous, potassium
SWOT	Strengths, weaknesses, opportunities, threats

Contents

TABLES

FIGURES

Acknowledgments

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Executive Summary

1. **Agriculture has been critically important in reducing poverty in Myanmar, and further progress in agriculture will remain important as Myanmar's economy continues to evolve.** Economic structural change is underway in Myanmar, even as primary agriculture (which also includes fisheries and forestry) provides either a primary or secondary livelihood for nearly 70% of the population and accounts for nearly 30% of national gross domestic product (GDP) and merchandise exports. The fuller agri-food system accounts for some 42% of GDP when forward and background linkages to primary agriculture are considered. Agricultural growth has helped significantly to reduce poverty; progress in agriculture was directly responsible for 46% of the poverty reduction achieved between 2005 and 2015. This achievement has enabled Myanmar to devote attention to a much broader set of development challenges while seeking to reinforce agriculture's economic contributions. This study is motivated by the need to identify opportunities to improve performance in agriculture and major agricultural value chains and to understand constraints that might limit those opportunities.

2. **For many years, the absence of reliable, current data at the sectoral, subsectoral, or microeconomic level has limited understanding of the dynamics and performance of agriculture in Myanmar, but better information is becoming available.** A lack of data constrained policy making as well as the effective prioritization of programs and public spending (World Bank 2017), but recently a variety of studies started to fill important gaps. One example is the Myanmar Agricultural Survey (MAS), conducted in 2013/14. Results of the MAS were available two years later (World Bank 2016) and provided valuable insights on crop profitability, productivity, farm practices, and the underlying state of farm household economics.

3. **In the years since the MAS was undertaken, Myanmar has experienced significant changes in its economy, public spending, demographics, and integration into world and regional markets for agri-food products, all of which have implications for policy and public programs**. Such changes are normally expected to alter the patterns and performance of agricultural production as well as the structure and performance of agricultural value chains in relation to domestic and external market opportunities. To understand these developments better and draw implications for future policy and public programs, a new farm economics survey was undertaken. The survey, which focused on results for the 2017/18 crop year, covered 1,728 farm households involved with paddy, pulse, and/or bean production in Ayeyarwady, Bago, and Sagaing Regions and Shan State. In parallel with this farm survey, interviews and the collection of additional data helped to amplify the understanding of the evolving structure and underlying strengths, weaknesses, opportunities, and threats associated with Myanmar's rice and pulse/bean value chains. This study highlights the most salient findings from this new empirical work and lays out policy and program options for improving performance and competitiveness in these subsectors.

4. **While agriculture has diversified considerably in Myanmar over the past decade, rice, pulses, and beans remain core elements of the sector.** Agricultural diversification has occurred via fisheries and increased production of livestock products, fruit, and various industrial crops (namely rubber and sugar). During 2015/16, however, rice still accounted for 35% of agricultural output and pulses/beans accounted

for another 17%. Together, these three crops constituted just over 67% of gross crop output in 2016, only slightly lower than their 72% share a decade earlier. Rice, pulses, and beans occupy about 75% of the cultivated area in Myanmar and deliver most of Myanmar's earnings from agricultural exports (the share varies from year to year depending upon market circumstances). In recent years, the country has been the world's sixth-largest exporter of rice and second-largest exporter of pulses in terms of volume.

Paddy Production and the Paddy Value Chain

5. **Rice is an important crop and commodity for the economy of Myanmar and the welfare of its citizens.** In 2018, paddy was produced on 39% of the country's cultivated area (6.7 million of 17.2 million hectares). Rice is grown in all regions of Myanmar, although the largest share of production comes from the Delta Region (including 23% of the monsoon-season crop and 57% of the dry-season crop). In all regions of Myanmar, rice cultivation or seasonal employment on rice farms is a significant source of income for most rural households. Even so, typical rice production and consumption patterns are changing in tandem with migration from rural areas, an increase in remittances, and broader structural changes in the agricultural sector and wider economy. Rice is the single largest source of calories in the food basket of most Myanmar households, although it is no longer the dominant source of calories, especially among urban households.

6. **Paddy yields have improved modestly, but paddy production continues to underperform relative to its potential and to production in other countries.** Survey results show that paddy yields rose slightly between 2013/14 and 2017/18, although they are among the lowest in Asia. The yield gap with other countries—especially those growing similar varieties—remains very large. Factors contributing to low paddy yield in Myanmar include the comparatively low use of improved seed, ineffective fertilizer use, and low access to irrigation and advisory services. The paucity of organized farmer groups constrains economies of scale in paddy aggregation and post-harvest handling.

7. **One positive development at the production level is the significant increase in labor productivity.** Across the entire survey sample, labor productivity in paddy cultivation more than doubled from $3.7 to $8.3 per day. This increase primarily came about through the mechanization of land preparation, harvesting, and/or other paddy production operations. Farmers have increased their use of machinery mostly by hiring equipment or, more substantially, by hiring mechanization services. Actual machinery ownership rates among farmers have increased only modestly, except for power tillers, and even in this case only one 1 in 10 surveyed farmers owned a power tiller. The blossoming market for mechanized services mimics developments elsewhere in the region, especially in India, China, and Vietnam's Mekong Delta.

8. **One potentially disturbing trend is the significant rise in the use of agrochemicals in paddy production.** In Ayeyarwady, 21% of paddy farmers in the latest survey used agrochemicals, compared with only 7% in 2013/14; in Sagaing, the proportion of farmers using agrochemicals rose from less than 1% to 13%. It is not clear whether farmers are using more chemicals to save labor (for instance, using herbicides to replace hand weeding) or because the incidence of pests has increased, perhaps due to climate change. While judicious use of agrochemicals may enable farmers to manage certain risks, Myanmar needs to

adopt a cautious approach to promoting their use, given the potential adverse effects on worker safety, community air and water quality, and food safety when agrochemicals are improperly used and stored. The survey results show that increased agrochemical application on paddy plots tends to have a negative impact on monsoon and dry-season paddy profitability. Specifically, net margins of monsoon-season paddy ($/acre) decrease by 5% when farmers switch from low to high levels of chemical fertilizer application, and for dry-season paddy net margins decrease by 34%.

9. **Elsewhere in the rice value chain, operational efficiency and quality management are inadequate for many value chain functions.** For example, low yields result in high unit costs for seed multiplication, which are further increased by the high transaction costs associated with the absence of regional centers for seed testing and certification. Owing to improper drying and other factors, nearly half of the "improved seed" that is produced is of low quality and ends up being consumed as grain. Despite the growing number of investments in large modern rice mills, the vast bulk of rice milling in Myanmar continues to be undertaken by tens of thousands of very small and antiquated mills that have low rice kernel yields and reduce the quality of the final product. Quality is also compromised because millers usually lack control over the quality of paddy procured through bulk collections and assemblers, unless millers or traders enter into a contract with farmers. Most mills also have insufficient storage at the factory site, especially during the harvest, when large numbers of farmers supply wet paddy at the same time. High paddy moisture content requires mechanical drying infrastructure that most mill sites lack. Competitive trucking services are not widely available, and shortcomings in the facilities and management of the port at Yangon (and in customs clearance) constrain the efficiency with which rice is exported.

10. **The table that follows summarizes the pathways to improve the rice value chain.**

Table 0.1. Pathways to improve the rice value chain in Myanmar

CHAIN ELEMENT	PROPOSED ACTIONS
RESEARCH/EXTENSION SERVICES	• Provide training and equipment to the Department of Agricultural Research (DAR) and Department of Agriculture (DOA) for setting up demonstrations of equipment and demonstration plots for modern technologies. • Establish a training center for equipment operation and maintenance. • Set up a quality testing lab for fertilizer, pesticide, and seed. • Work with international seed, pesticide, and equipment companies to benefit from experiences and get funding. • Provide training to small-scale input suppliers on the use of pesticides, fertilizers.
SEED MULTIPLICATION, INPUT SUPPLIERS	• Continue support of existing seed multipliers and promote the creation of new professional seed farms and seed multiplier associations. • Encourage foreign and domestic investors to increase rice seed production. • Promote contract farming between rice millers/traders and farmers for seed production. • Identify a scheme to facilitate and reduce the costs of seed certification for the domestic market. • Provide enough funding to DAR/DOA to produce more foundation and registered seed. • Provide training and equipment to DAR/DOA for seed production monitoring and certification. • Encourage local production of small equipment, and adapt it to conditions in delta areas.

CHAIN ELEMENT	PROPOSED ACTIONS
	• Consolidate orders to benefit from economies of scale in importing farm machinery and inputs. • Use information and communication technology (ICT) to support traders and farmers.
RICE PRODUCTION	• Promote contract farming between rice millers/traders and farmers, and use farm machinery services and input credit to reduce the financial burden on farmers. • Promote and support the establishment of farm machinery service providers. • Continue land consolidation, with irrigation and drainage systems. • Support farmer associations to acquire and use large farm machinery. • Organize producers to concentrate the needs for machinery in the same period for contiguous plots. • Improve irrigation and promote the use of/subsidize investment in individual tubewell irrigation systems. • Build and maintain farm roads to facilitate access by large machines to plots. • Promote integrated pest management to optimize the use of chemicals. • Use ICT to make services and inputs more accessible to farmers. • Work with financial service providers/Myanmar Agricultural Development Bank (MADB) to facilitate access to long-term credit to buy farm machinery. • Enhance farmers' awareness of the advantages of using certified seed. • Work with stakeholders to set up demonstration and training session for farmers.
COMMERCIALIZATION	• Work with financial service providers/MADB to develop a good financial product for traders. • Work with exporters—specifically, with the Myanmar Rice Federation (MRF)—to learn buyers' preferences. • Work with MRF to assess the needs for warehouses at the regional level.
PROCESSING OF FERTILIZERS	• Assess the profitability and competitiveness of domestic fertilizer plants. • Expand domestic production of fertilizers to reach scale. • Encourage foreign and domestic investors to implement seed processing units at different locations.
PADDY PROCESSING	• Improve the quality and efficiency of rice mills. • Promote better organization of the supply chain to reduce intermediaries. • Assess the use of renewable energy for small rice huskers at the village level, to substitute for fuel.
RICE EXPORT	• Improve organization and infrastructure at Yangon port. • Conduct market research for high-quality rice. • Promote Paw San rice (recognized for high quality in a global competition) for export.
SECTORAL	• Establish a value chain competitiveness index and monitor the performance of the value chain over time. Make financial support to value chain initiatives contingent upon improvement in the competitiveness index. • Establish value chain development funds to promote farmer-enterprises and partnerships. • Organize annual value chain fairs, exhibits, seminars, workshops, conferences, and training both in Myanmar and abroad, aimed at increasing access to markets for agri-food products from Myanmar.

Pulse and Bean Production and Value Chain

11. **Myanmar is the world's third-largest producer of pulses after India and Canada.** Farmers produce 18 kinds of pulses, of which the most important are black gram, green gram, pigeonpeas, and chickpeas. About two-thirds of pulse production takes place during the dry season (in rotation with monsoon-season paddy) and is concentrated in the regions of Sagaing (25%), Bago (21%), Magway (18%), and Ayeyarwady (14%). The area allocated to pulse and bean production has increased over the years, reaching 4.7 million hectares in 2016/17. These crops covered 36% of arable land in Myanmar in 2016/17, up from less than 7% in the early 1980s. Total production was 6.2 million tons in 2016/17, having increased by 2.4% per annum over the previous 10 years.

12. **Myanmar is also a major exporter of pulses globally and the largest exporting country within the Association of Southeast Asian Nations (ASEAN).** Myanmar has maintained its position among the top four exporters of legume-based products over the last 10 years. Farmers produce rice for home consumption but grow pulses and beans mostly for sale, so they are an important source of farm income. Most exported legumes, especially black gram, go to India. Domestic wholesale black gram prices depend almost entirely on India's demand. Other pulse and bean export markets include China, United Arab Emirates, Thailand, Bangladesh, and European countries. In 2016, Myanmar exported about 1.4 million tons of pulses and beans, with a value of US$1.40 billion. Black gram constituted close to 40% of the total export volume and nearly half of the export value. Green gram accounted for one-third of the total export volume and one-fifth of the export value during that period. With growing global demand for plant-based protein, Myanmar's gain from exports is expected to increase.

13. **After several years of promising trade results, the pulse subsector experienced major problems in 2017 following India's restrictions on imports of black gram, chickpeas, and other commodities.** As a result, domestic prices in Myanmar dropped very sharply and unsold stocks accumulated. Farmers had difficulty marketing their pulse and bean crops and ultimately experienced either losses or very low net margins during the 2017/18 production season. Producers' net margins per hectare were positive only for green gram growers, negligible for chickpea growers, and negative for black gram growers, who incurred a net loss of $75/ha. Net losses were even larger for some oilseeds, such as winter peanut. Except for workers producing green gram, returns to labor were all below the prevailing wage rate, with adverse implications for livelihoods.

14. **While the trade restrictions exposed the vulnerability of the pulse subsector to heavy reliance on a single market for some products, the subsector faces additional challenges, particularly with respect to farm productivity.** Green gram yields increased by about 8% between 2014 and 2018, whereas black gram yields fell by 7% and chickpea yields by 4%. The yield problem is partly the result of low availability and use of improved seed. During the 2014/15 production season, less than 0.5% of the black and green gram area was sown to high-yielding varieties of these crops. Farmers also continue to use very basic traditional production techniques. Little mechanization has been introduced. Very few farmers clean or sort their produce before selling it, so they receive discounted prices from traders.

15. **Investment or value addition elsewhere in the pulse value chain is also limited.** A very small proportion of production is processed into finished consumer goods. Treatment is generally limited to cleaning, grading, and packaging. Pulse exports require tens of thousands of containers that cannot be filled with imported products. Managing these empty containers compounds logistical difficulties and costs. Shipping companies are imposing surcharges on transportation costs, adding to the already high costs of warehousing and cargo management. Another consideration is that exporters incur high transportation costs and experience bottlenecks due to management problems at Yangon port.

16. **The table that follows summarizes the pathways to improve the performance of the pulse and bean value chain.**

Table 0.2. Pathways to improve the performance of the pulse and bean value chain in Myanmar

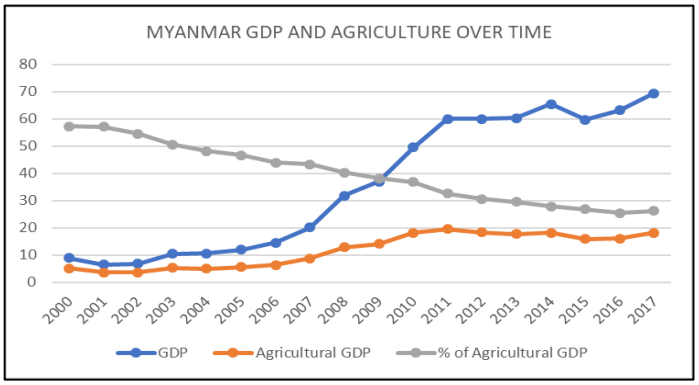
CHAIN ELEMENT	PROPOSED ACTIONS
RESEARCH/EXTENSION SERVICES	• Provide training and equipment to DAR/DOA for setting up demonstrations of equipment and demonstration plots for modern technologies. • Encourage local production of small equipment that could be used for harvesting pulses. • Use ICT and new technologies such as drones to manage production (e.g., for pest treatment, optimal harvest date). • Set up a quality testing lab for fertilizer, pesticide, and seed. • Provide training on the use of pesticides to small-scale input suppliers.
SEED MULTIPLICATION, INPUT SUPPLIERS	• Develop a program to intensify seed production, from the research entities to the seed multipliers. • Promote the creation of new seed farms and seed multiplier associations. • Encourage foreign and domestic investors to increase seed production. • Promote contract farming between exporters/traders and farmers for seed production and for pulse production. • Identify a scheme to facilitate and reduce the costs of seed certification for the domestic market. • Provide enough funding to DAR/DOA to produce more foundation and registered seed. • Provide training and equipment to DAR/DOA for seed production monitoring and certification. • Encourage local production of small equipment, and adapt it to condition in delta areas. • Consolidate orders to benefit from economies of scale in importing farm machinery and inputs. • Use ICT to support traders and farmers.
PULSE PRODUCTION	• Promote contract farming between exporters/traders and farmers to reduce the financial burden on farmers and improve access to credit for dry-season production. • Promote and support the establishment of farm machinery service providers. • Organize production to concentrate the needs for services in the same period for contiguous plots (e.g., pest treatment). • Promote the use of/subsidize investment in individual tubewell irrigation system to allow pulse production in upland areas. • Promote integrated pest management to optimize the use of chemicals. • Use ICT to make services (inputs, trade) more accessible to farmers. • Work with financial service providers and MADB to tailor specific credit products for dry-season pulse production. • Enhance farmers' awareness of the advantage of using certified seed. • Work with stakeholders to set up demonstration and training sessions for farmers.

CHAIN ELEMENT	PROPOSED ACTIONS
	• Set up demonstration plots using the correct application of fertilizers, high-yielding varieties, and farm machinery.
COMMERCIALIZATION	• Consolidate orders to benefit from economies of scale. • Work with exporters to learn buyers' preferences. • Establish an intelligence unit to forecast global trends in pulse markets and advise farmers on the type of crops to grow.
PROCESSING OF FERTILIZERS	• Identify possibilities for producing foliar fertilizers in Myanmar. Demand must be large, given the size of pulse production.
PULSE PROCESSING	• Improve the quality and efficiency of mills, and obtain Hazard Analysis and Critical Control Point (HACCP) certification if required.
EXPORT	• Improve organization and infrastructure at Yangon port. • Improve information exchange at regional and Yangon/Monywa exchange markets.
SECTORAL	• Establish a value chain competitiveness index and monitor performance of the value chain over time. Make financial support to value chain initiatives contingent upon improvement in the competitiveness index. • Establish value chain development funds to promote farmer-enterprises and partnerships. • Organize annual value chain fairs, exhibits, seminars, workshops, conferences, and training both in Myanmar and abroad, aimed at increasing access to markets for agri-food products from Myanmar.

1. Introduction

1. Agriculture has been critically important in reducing poverty in Myanmar, and further progress in agriculture will remain important as Myanmar's economy continues to evolve. Economic structural change is underway in Myanmar, even as primary agriculture (which also includes fisheries and forestry) continues to account for nearly 30% of national gross domestic product (GDP) (Figure 1) and merchandise exports. When forward and background linkages to primary agriculture are considered, the fuller agri-food system accounts for some 42% of GDP. Agriculture provides either a primary or secondary livelihood for nearly 70% of the population, and progress in agriculture was directly related to 46% of the poverty reduction between 2005 and 2015. Declining poverty enables Myanmar to devote attention to a much broader set of development challenges while reinforcing agriculture's economic contributions. This study was motivated by the need to identify the opportunities for further improvement in the performance of agriculture and major agricultural value chains, along with the constraints that might limit such opportunities.

Figure 1. Total GDP, agricultural GDP, and agriculture as a share of total GDP, Myanmar, 2000–17



Source: World Development Indicators, http://datatopics.worldbank.org/world-development-indicators/.

2. For many years, the absence of reliable, current data at the sectoral, subsectoral, or microeconomic level has limited understanding of the dynamics and performance of agriculture in Myanmar, but better information is becoming available. The lack of data constrained policy making as well as the effective prioritization of programs and public spending (World Bank 2017). In recent years, a variety of studies started to fill important gaps, including the Myanmar Agricultural Survey (MAS), which was conducted in 2013/14. Results of the MAS were available two years later (World Bank 2016) and provided valuable insights on crop profitability, productivity, farm practices, and the underlying state of farm household economics.

3. In the years since that survey was conducted, Myanmar has experienced significant changes in its economy, public spending, demographics, and integration into world and regional markets for agri-food products, all of which have implications for policy and public programs. Such changes are normally expected to alter the patterns and performance of agricultural production as well as the structure and performance of agricultural value chains in relation to domestic and external market opportunities.

4. To understand these developments better and draw implications for future policy and public programs, this study focuses on two critical agricultural value chains in Myanmar: the rice value chain and the value chain for pulses and beans. This study is based on new empirical data from a farm economics survey conducted in 2017/18 among 1,728 farm households involved with paddy, pulse, and/or bean production in Ayeyarwady, Bago, and Sagaing Regions and Shan State. In parallel with data from this farm

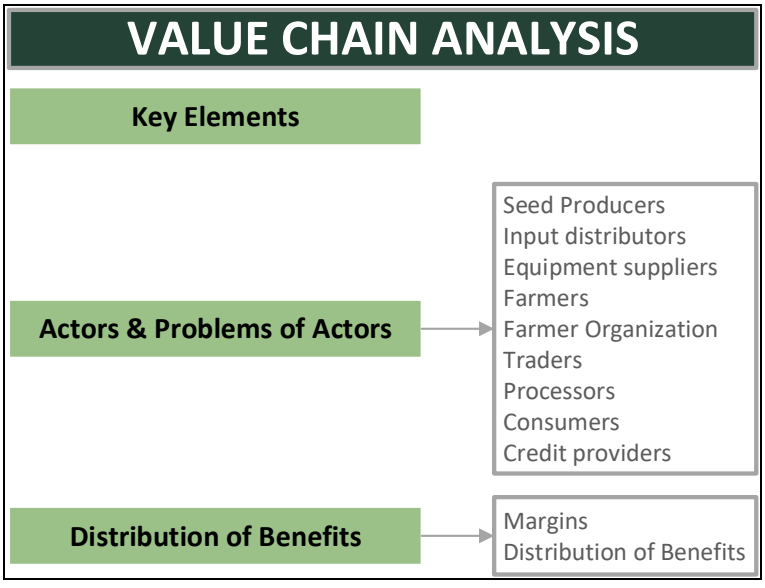
survey, qualitative data collected through interviews with value chain actors and additional secondary data amplify the understanding of the evolving structure and underlying strengths, weaknesses, opportunities, and threats associated with Myanmar's rice and pulse/bean value chains.

5. This report highlights the most salient findings from this new work and lays out policy and program options for improving performance and competitiveness in these subsectors. Section 2 provides a brief overview of each subsector. It reviews recent production trends and outlines the major changes that have occurred in the economics of paddy and pulse/bean production at the farm level between 2013 and 2018. The two sections that follow present a detailed discussion of value chain dynamics in each subsector (Section 3 focuses on rice, and Section 4 on pulses and beans). Both sections begin by mapping the value chain actors and then move into a detailed SWOT (strengths, weaknesses, opportunities, and threats) analysis for the value chain actors and enabling environment. Next, each section reviews specific options for adding value to the value chain and describes the distribution of benefits in the value chain. Section 5 concludes the discussion by summarizing the priority areas in which Myanmar can take action to seize these opportunities—diversify its trading partners, target higher-value markets, and develop its domestic markets.

6. The methodology for the farm household survey was similar to that used in the 2013/14 survey (for details, see Annexes 1 and 2). The field interviews with key actors in the value chains consisted of a first set of interviews, conducted in January 2018, focusing on the rice value chain in Ayeyarwady; the second set, conducted in March 2018, involved stakeholders in the pulse and bean value chains in Ayeyarwady, Bago, and Sagaing. The samples for these interviews included at least one of the largest actors (trader, processor, exporter), one or two medium-sized enterprises, and a few small enterprises. During the fieldwork, meetings were held with both the Myanmar Rice Federation (MRF) and the Myanmar Pulse Trader Association (MPTA), large and medium-sized rice and pulse exporters, and an array of millers and processors, traders, transporters, logistics companies, input distributors, seed producers, and farmers.

7. Figure 2 illustrates the simplified framework used to analyze each value chain. The underlying principle of the analysis was to assess the importance of constraints beyond the farmgate that limited the performance of the value chains.

Figure 2. Framework for analyzing the rice and bean/pulse value chains in Myanmar



8. In analyzing the distribution of benefits throughout the value chain, several hypotheses were tested (hypotheses 1–6 for the rice value chain, and 1–5 for the pulse and bean chain):

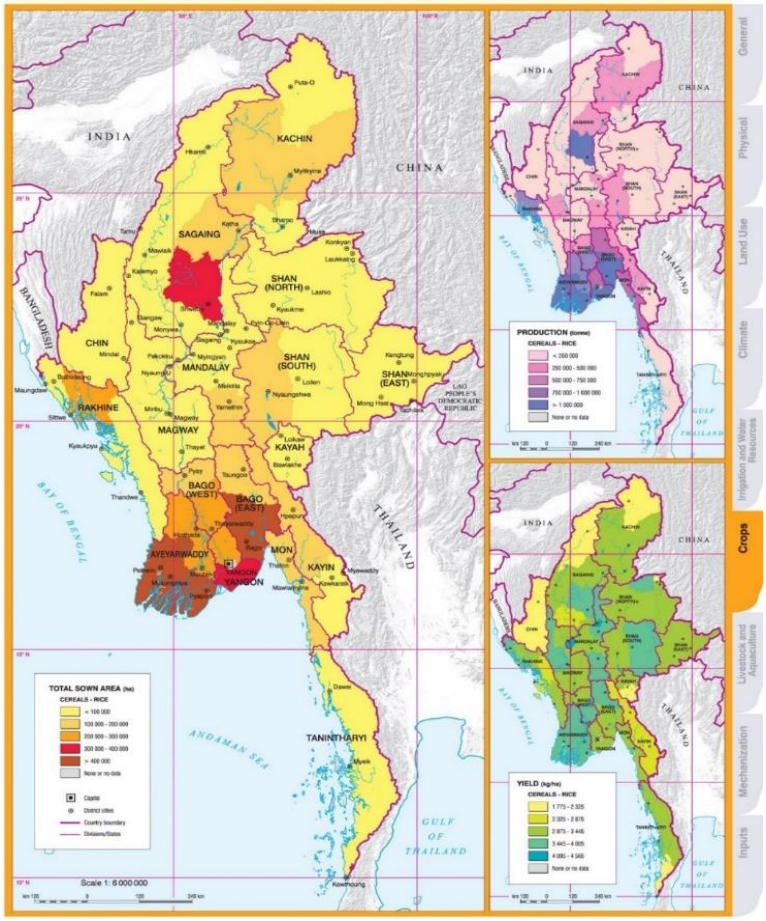
1. Traders' margins are much larger than farmers' margins.
2. Farmers are exploited by all other value chain actors.
3. Many layers of intermediaries exist between farmers and consumers.
4. Traders' capital turnover is high.
5. Logistics costs are very high.
6. The quality of demand matches the quality of supply.

2. Production Trends and Changing Farm Economics for Rice and Pulses in Myanmar

2.1. Rice Production

9. The rice basket production zones in Myanmar are in the delta, mainly in the Ayeyarwady and Bago Regions (Figure 3). The other main production areas are in the irrigated tract of Sagaing Region and in Rakhine State.

Figure 3. Rice basket areas, Myanmar



Source: http://dwms.fao.org/atlases.

10. The rice subsector plays a robust role in the national economy, contributing 14% of overall GDP and 52% of agricultural GDP in 2016, in addition to its role in food security and local diets. Average per capita consumption of rice is 165 kg/year in rural Myanmar and 133 kg/year in urban areas, for a total domestic demand of around 8 million tons.[1] Demand for rice is expected to decrease, however, owing to dietary changes, rising incomes, and the migration of young people out of rural areas.

11. Rice production statistics diverge from one source to another (Table 1). For example, according to United States Department of Agriculture (USDA) data,[2] total production was 20.2 million tons in 2017, whereas Ministry of Agriculture, Livestock, and Irrigation (MOALI) data for the same year place production at 27.2 million tons. Production statistics from FAOSTAT, the Food and Agriculture Organization (FAO) database, are slightly lower (around 26.2 million tons between 2012 and 2015, declining to about 25.7

[1] CSO (2015) and Theingi Myint et al. (2016).

[2] USDA data are available for two years only (2016 and 2017). Harvested rice area was 7.03 million hectares in 2016 and 7.10 million hectares in 2017; production was 19.7 million tons in 2016 and 20.2 million tons in 2017.

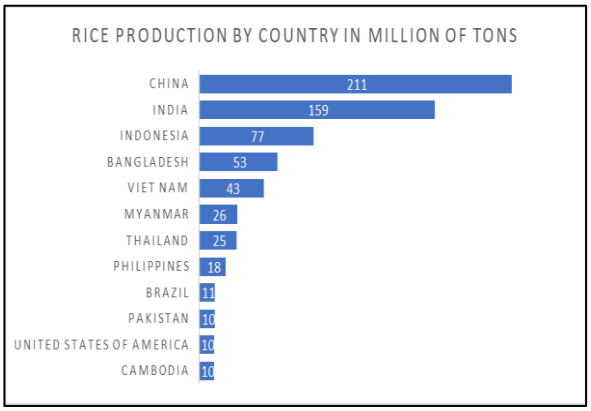
million tons in 2016). Both FAOSTAT and MOALI report similar average rice yields (above 3.8 t/ha), whereas the yield data from USDA are much lower (2.85 t/ha).

Table 1. Rice in Myanmar: Cultivated area, production, and average yields, 2012–17

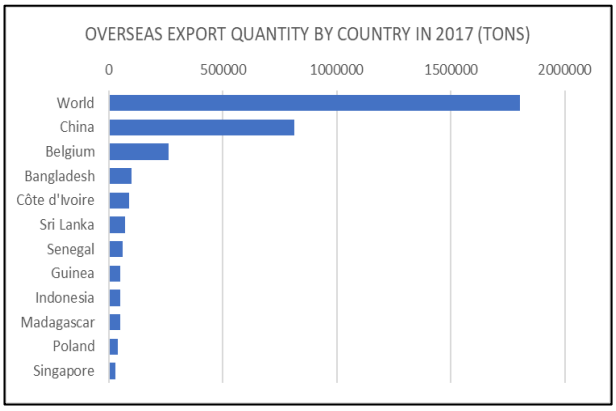
Data source		2012	2013	2014	2015	2016
FAOSTAT	Area (000 ha)	6,989	6,953	6,870	6,769	6,724
	Production (000 t)	26,217	26,372	26,423	26,210	25,673
	Yield (t/ha)	3.75	3.79	3.85	3.87	3.82
MOALI	Area (000 ha)	7,567	7,208	7,264	7,153	7,165
	Production (000 t)	29,010	27,704	28,322	28,193	27,699
	Yield (t/ha)	3.83	3.84	3.90	3.94	3.87

12. Based on FAOSTAT data, Myanmar is the sixth-largest rice producer in the world, although it is not a leading exporter (Figure 4). Myanmar exports rice to several countries, including China, Thailand, and (to a lesser extent) Bangladesh and India. China remains the number-one buyer, accounting for 45% of Myanmar's total exports of 1.8 million tons in 2017.[3] Other major importers include Belgium (broken rice), Bangladesh, Sri Lanka, and African countries. In 2017, Myanmar's rice export earnings rose to US$1.03 billion, up from the average of US$560 million over the previous three years.

Figure 4. Myanmar is the world's sixth-largest rice producer but not a leading rice exporter



Source: FAOSTAT.



Source: ITC.

2.2. The Changing Farm Economics of Paddy Production, 2013–18

13. This section summarizes the recent survey results related to paddy production, highlighting major differences by season, region, and farm management characteristics, and drawing attention to changes in input use, productivity, and profitability[4] since the 2013/14 MAS.

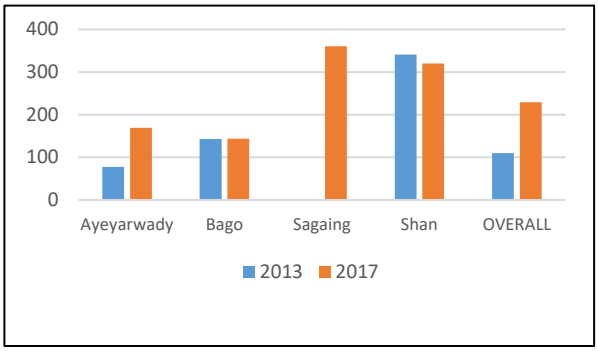
[3] International Trade Center (ITC), http://trademap.org, data retrieved on June 2018.

[4] Net margins were calculated using farm budgets from the 2013/14 and 2017/18 MAS. The methodology for developing farm budgets is described in Annex 2.

14. Farmers experienced an increase in the profitability of monsoon and dry-season paddy over the four years since the initial 2013/14 survey. For the overall panel of surveyed farmers, net margins ($/ha) doubled for monsoon-season paddy (Figure 5) and increased by 11% for dry-season paddy (Figure 6), albeit from a very low baseline. In a reversal of the situation in 2013/14, monsoon-season paddy is now more profitable than dry-season production, mainly because of the somewhat higher yields and prices during the monsoon season and more pronounced declines in labor use. Sagaing Region registered the highest increase in net margins, both for monsoon (34%) and dry-season paddy (17%).

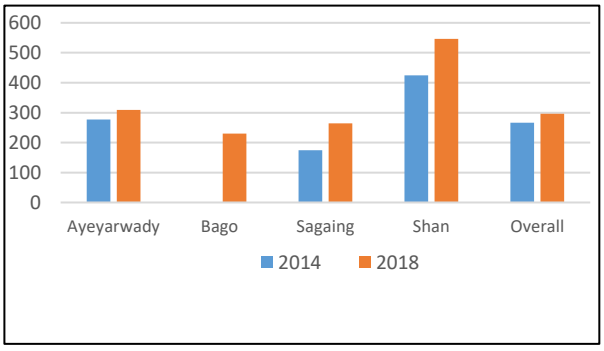
15. Financial returns to labor from monsoon and dry-season paddy production also increased over the four years between surveys. Across the entire sample, the change in labor productivity ($/day) was 124% for monsoon-season paddy (Figure 7) and 84% for dry-season paddy (Figure 8). Sagaing Region experienced the greatest increase in labor productivity for monsoon-season paddy production, while gains for dry-season production were highest in Ayeyarwady. Increased mechanization of various crop operations played a major role in this increased labor productivity, especially on medium and larger farms where mechanization advanced the most.[5]

Figure 5. Net margins for monsoon paddy ($/ha, 2013–17)



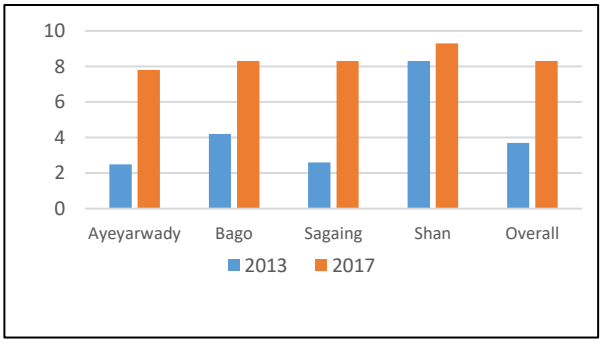
Source: MAS.

Figure 6. Net margins for dry-season paddy ($/ha), 2014–18



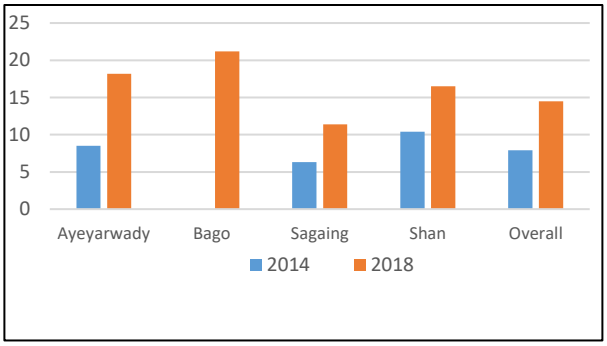
Source: MAS.

Figure 7. Return to labor for monsoon paddy ($/day), 2013–17



Source: MAS.

Figure 8. Return to labor for dry-season paddy ($/day), 2014–18



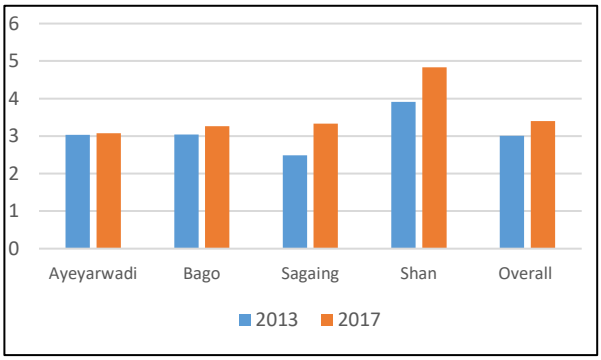
Source: MAS.

[5] In the sampled farms, differences in landholdings are quite large. For example, in Ayeyarwady the average size of a small farm is 1.28 hectares, while a medium farm is 3.03 hectares and a large farms is 8.10 hectares. In Sagaing, average farm sizes are 1.2 hectares (small farms), 2.9 hectares (medium farms), and 7.3 hectares (large farms).

2.2.1. Changes in productivity and factors of production

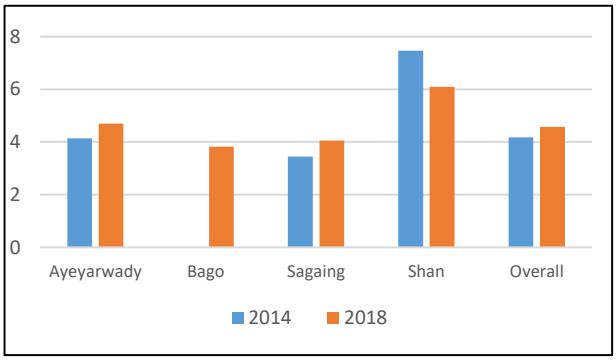
16. Paddy yields improved modestly across the four areas between the surveys. Overall, the average yield increase was 13% for monsoon paddy and 9% for dry-season paddy. The most significant yield improvement occurred in Sagaing Region, where yields increased on average by 34% for monsoon paddy (Figure 9) and 17% for dry-season paddy (Figure 10). In contrast, the largest producing region, Ayeyarwady, experienced only a 2% increase in yields. Yields of monsoon paddy did not differ significantly between male-headed and female-headed farms.[6] Yields of monsoon paddy are also similar across small, medium, and larger farms in the leading production areas. For example, average yields in Ayeyarwady are 2.69, 2.80, and 2.76 t/ha on small, medium, and larger farms, respectively. Dry-season paddy yields, however, are 9% higher on large farms than on small farms; in Bago, that difference is 16%.

Figure 9. Land productivity of monsoon paddy (t/ha), 2013–17



Source: MAS.

Figure 10. Land productivity of dry-season paddy (t/ha), 2013–17

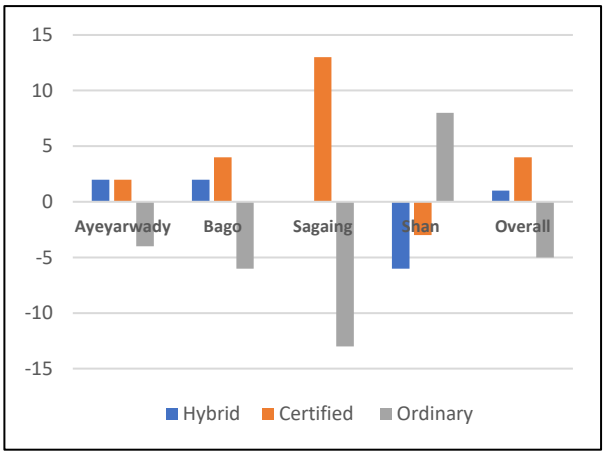


Source: MAS.

17. The yield gain in monsoon paddy is partly attributable to increased use of improved seed, especially in Sagaing Region, where uptake of both hybrid and certified conventional seed has risen considerably, especially on larger farms. In Sagaing, 24% of large farms now use certified seed, compared to 10% for small farms. Elsewhere, the uptake of improved seed has been modest (Figure 11 and Figure 12), although Bago has seen an uptick in the use of hybrid seed on larger farms (now 7%). Farmers adopting improved seed have generally experienced productivity gains, and improving the availability of high-quality rice seed in Myanmar warrants increased attention. For example, overall yields were 12% higher for farmers using improved seed compared to farmers using ordinary seed. Switching from ordinary to certified seed increases net margins of monsoon paddy from $83.1 to $101.9/acre, while hybrid seed users had average net margins of $149.1/acre.

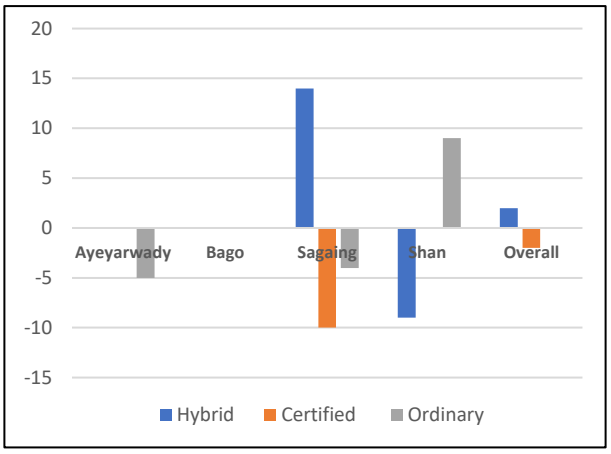
[6] Yields on male-headed farms averaged 3.51 t/ha versus 3.64 t/ha on female-headed farms. Owing to differences in cultivated area—1.83 hectares for male-headed farms and 1.60 hectares for female-headed farms—production is 13% lower on female-headed farms.

Figure 11. Change in type of seed used for monsoon paddy production (%), 2013–17



Source: MAS.

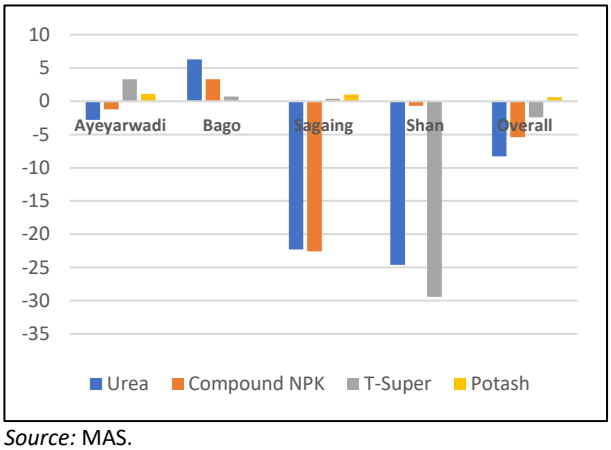
Figure 12. Change in type of seed used for dry-season paddy production (%), 2014–18



Source: MAS.

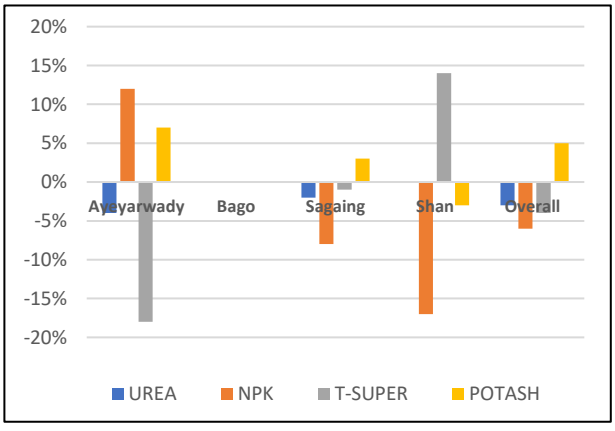
18. Fertilizer use in paddy production remains well below levels for optimal soil fertility management, and many farmers are not applying the proper balance of nutrients. The lack of soil testing and limited knowledge among farmers appear to constrain proper fertilizer use. Paddy farmers in Myanmar tend to overuse phosphorous and underuse potassium. Misapplication of fertilizer is evident from the survey results, which show that increased fertilizer application is associated with a substantial reduction in net margins in the monsoon and dry season alike. The survey found commercial fertilizer use has actually decreased since 2013/14, with the most significant declines occurring in Shan State and Sagaing Region (Figure 13 and Figure 14). It is not clear whether increased use of animal manure is compensating for this decline, although this possibility is unlikely, given the generally reduced use of animals for land preparation.

Figure 13. Change in fertilizer application for monsoon paddy (%), 2013–17



Source: MAS.

Figure 14. Change in fertilizer application for dry-season paddy (%), 2014–18

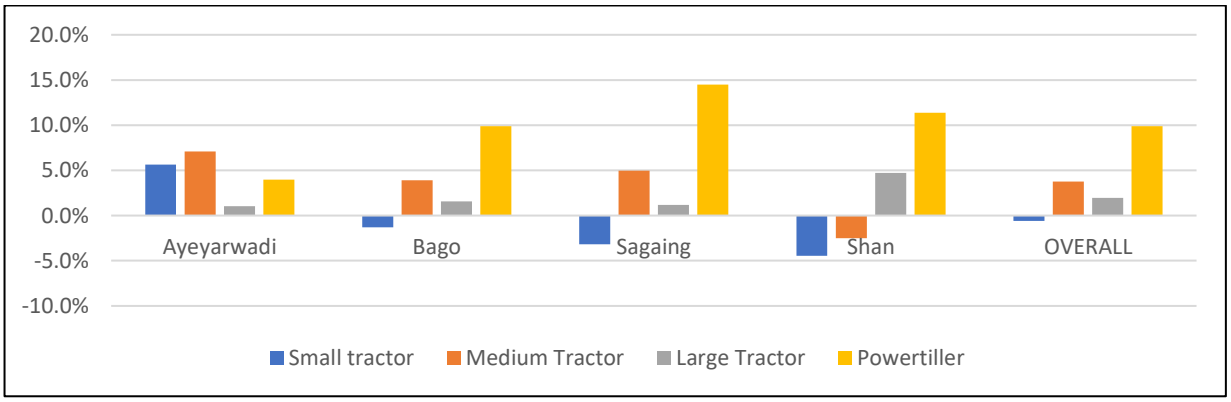


Source: MAS.

19. One potentially disturbing trend is the significantly increased use of agrochemicals in paddy production. In Ayeyarwady, 21% of paddy farmers in the latest survey used agrochemicals, compared with 7% in 2013/14; in Sagaing, the proportion of farmers using agrochemicals rose from less than 1% to 13%. It is not clear whether farmers have increased agrochemical use to save labor (for example, using herbicides to replace manual weeding). While the judicious use of agrochemicals may enable farmers to manage certain risks, Myanmar needs to adopt a cautious approach to promoting their use, given the potential adverse effects on worker safety, community air and water quality, and food safety when agrochemicals are improperly used and stored. In addition, the survey results show that when farmers switch from low to high levels of chemical fertilizer application in paddy production, margins are reduced by 5% for monsoon production and 34% for dry-season production.

20. One of the most notable changes in farm practices in recent years has been the increased use of agricultural machinery (Figure 15). Mechanization has been spurred by outmigration and seasonal labor shortages in some locations and aided by the introduction of relatively cheaper equipment (especially from China) and the emergence of a growing network of equipment suppliers and suppliers of mechanization services. Actual machinery ownership among farmers increased only modestly, except among larger farmers. For example, 63% of larger farmers now own tractors, compared with 10% of small-scale farmers. Small and medium farmers have increased their use of agricultural machinery by hiring equipment or, more commonly, by hiring mechanization services. Nearly 9 out of 10 farmers surveyed now use machines for land preparation, and nearly half use combine harvesters. To maintain the momentum of mechanization, upgrades (and regular maintenance) are needed in community and farm plot access roads. Another beneficial intervention would be to provide vocational training for machine operators and further facilitate equipment leasing.

Figure 15. Change in farm machinery ownership (%), 2013–17



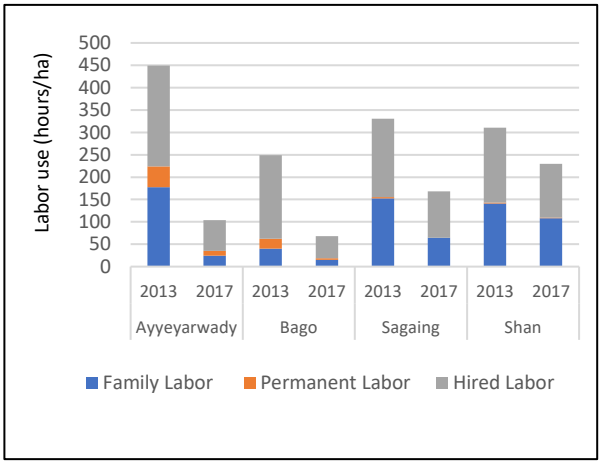
Source: MAS.

21. Increased public investment in irrigation systems in recent years has thus far had little noticeable impact on the availability of irrigation services among the surveyed paddy producers. In fact, the survey data indicate no change in the proportion of farms with access to irrigation during the past four years. In Ayeyarwady and Bago Regions, rainfed rice production predominates, and during the wet season less than 3% of surveyed farmers irrigate (in fact, rice fields must be protected by embankments against overflows from the Ayeyarwady River). Irrigation is much more common in the upland areas. For example, some

65% of rice fields in Sagaing were irrigated during the wet season. Somewhat unusually, small farms in Sagaing have more than double the access to irrigation services than large farms (83% compared to 36%). Improved irrigation services can make an important contribution to higher rice productivity as well as facilitate more diversified cropping systems, including the introduction of higher-value crops such as vegetables.

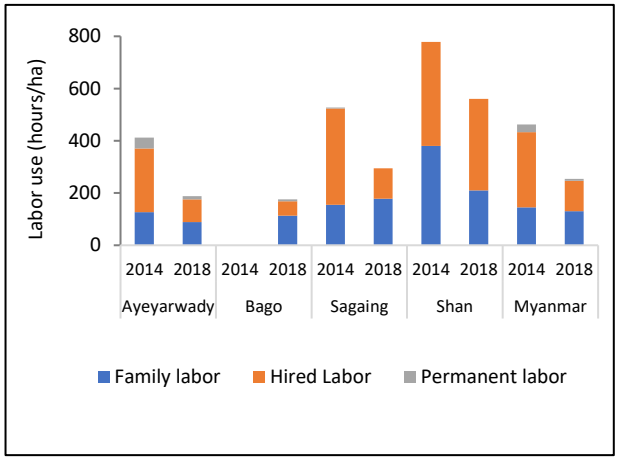
22. Between 2013 and 2017, labor use declined very significantly in paddy production in the monsoon and dry seasons, and the use of both family and hired labor fell dramatically across all regions (Figure 16 and Figure 17). Mechanization has played an important role in this decline, and so has the shift from rice transplanting to direct seeding. Across all farmers surveyed, this significant reduction in labor use has more than doubled labor productivity during the monsoon season, which rose from $3.7 to $8.3 per day.

Figure 16. Change in labor use, monsoon paddy, 2013–17



Source: MAS.

Figure 17. Change in labor use, dry-season paddy, 2014–18



Source: MAS.

23. Reflecting differences in levels of mechanization, the biggest declines in labor use have occurred on large farms. Per unit of land, large farms now use 37% less labor than do small farms (61 person-days/ha versus 104 person-days/ha). Differential changes in the ratio between labor and machines have translated into widening differences in labor productivity among small, medium, and large farms. Even though measured net margins per acre are slightly lower for large farms than for the other two farm-size categories,[7] the net returns to labor are much higher on large farms. For example, during the dry season, the returns to labor are $12.5, $14.3, and $18.6 per day on small, medium, and large farms, respectively. In other words, returns to labor are 49% higher on large farms than on small farms, and 14% higher on medium farms than on small farms. During the monsoon season, the returns to labor are much lower at $7.6, $8.8, and $9.1 per day on small, medium, and large farms, respectively. Labor productivity is 20% higher on large farms compared to small farms.

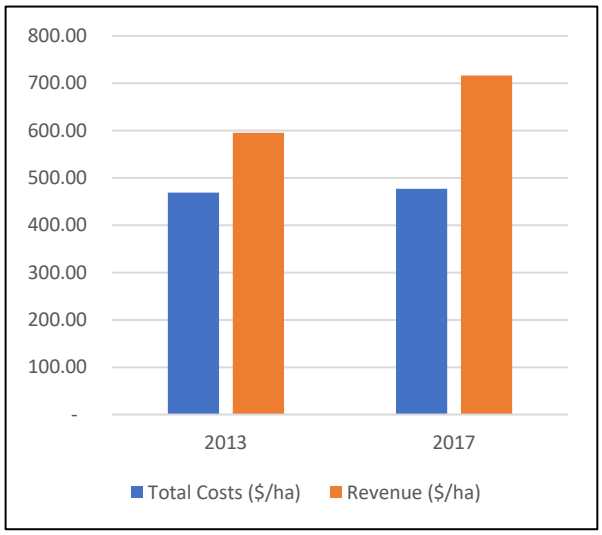
[7] For example, in the monsoon season, net margins per acre are $91 for small farms, $99 for medium farms, and $88 dollars for large farms.

24. Not surprisingly, commercial market engagement is more significant among larger paddy producers than smaller producers. In Ayeyarwady, more than 80% of production is marketed by all farm-size categories, yet in Sagaing there is a significant difference: small farmers market just 53% of their production, whereas medium farmers market 68% and larger farmers market 76%. In several regions, a significantly higher proportion of marketed paddy is sold in dry rather than wet form by medium and larger farmers. Medium and larger producers may have better access to mechanical drying equipment, or small farmers may have lower overall savings and a more pressing need for cash immediately after the harvest.

2.2.2. Changes in production costs and output prices

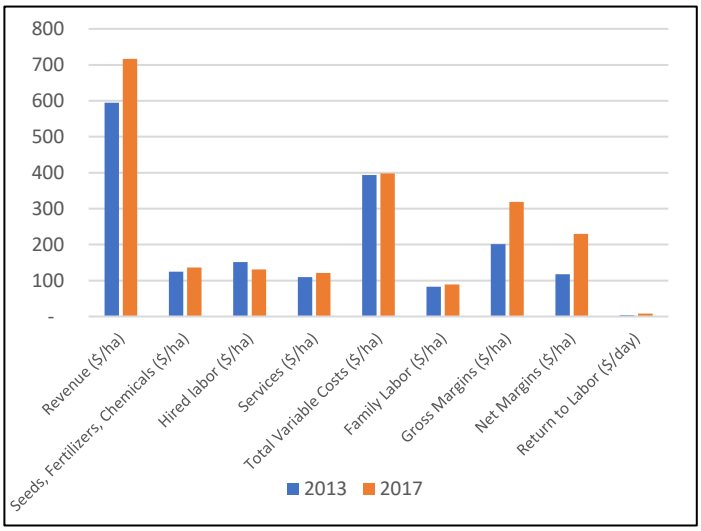
25. In addition to productivity changes and changes in the use of different factors of production, paddy profitability has also been impacted by changes in production costs and output prices. Figure 18–**Error! Reference source not found.** summarize how revenues and costs have changed for paddy producers between the two surveys and across seasons. Over the four years between surveys, there was a small increase in production costs for monsoon paddy and a significant increase in revenues. The cost increase was driven by expenditures on seed, fertilizer, and machinery rental services. On the other hand, the cost of hired labor decreased because rural labor shortages encouraged mechanization. The price of monsoon paddy increased by 48% over the four years between surveys. Together these factors contributed to the increase in net margins of monsoon paddy. In the case of dry-season paddy, the decline in production costs, increase in paddy prices by nearly 10%, and the yield increase contributed to the increase in profitability.

Figure 18. Total revenue and costs, monsoon paddy production, 2013 and 2017



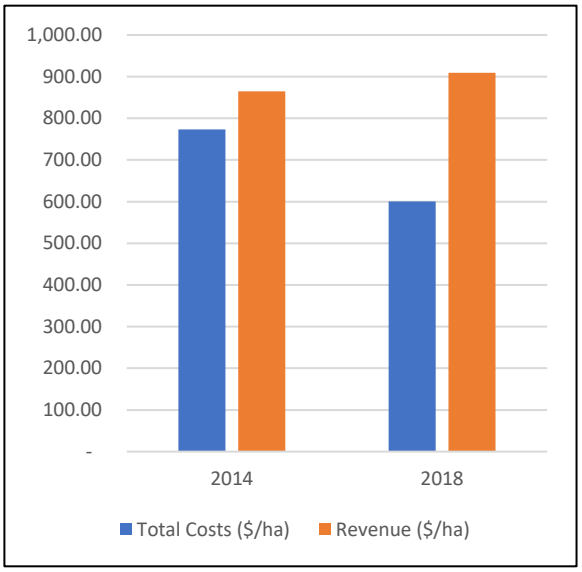
Source: MAS.

Figure 19. Composition of revenue and costs, monsoon paddy production, 2013 and 2017



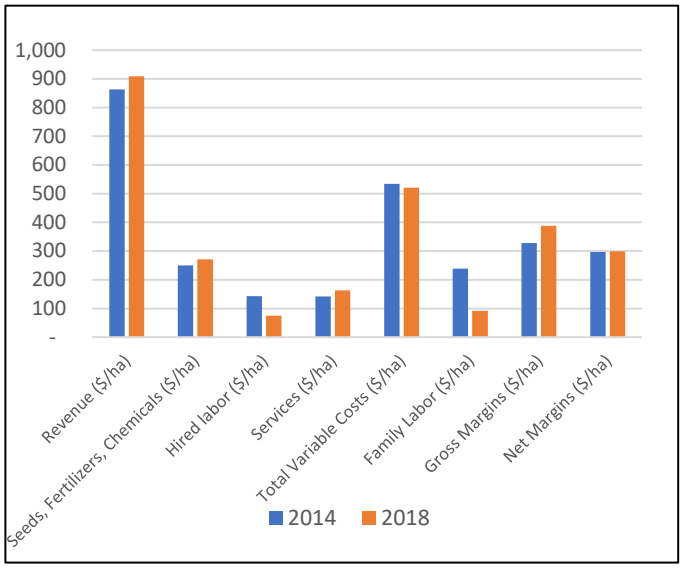
Source: MAS.

Figure 20. Total revenue and costs, dry-season paddy production



Source: MAS.

Figure 21. Composition of revenue and costs, dry-season paddy production

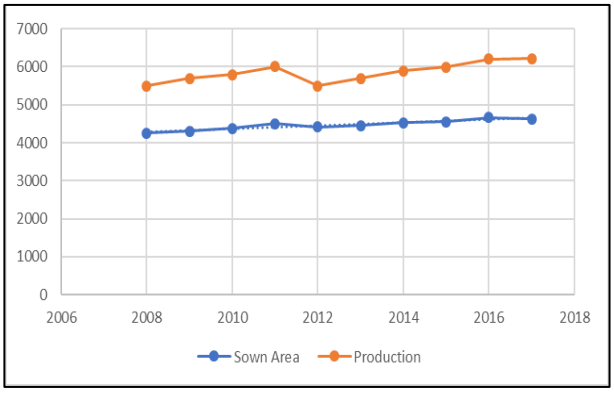


Source: MAS.

2.3. Pulse and Bean Production

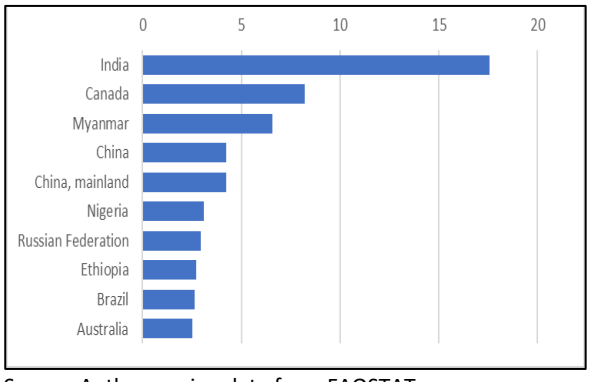
26. Among the ASEAN countries, Myanmar is the leading pulse and bean producer, with 6.2 million tons of production on 11.52 million acres in 2016/17 (Figure 22) and an average yield of 543 kg/acre (1.34 t/ha). Globally, Myanmar is the third-largest producer of pulses after India and Canada (Figure 23).

Figure 22. Sown area and production (000 ha) of pulses and beans, 2008–17, Myanmar



Source: Authors, using data from FAOSTAT.

Figure 23. Myanmar ranks third among the world's pulse-producing countries (production in million t)



Source: Authors, using data from FAOSTAT.

27. About 18 types of pulses are produced in Myanmar, led by black gram and followed by green gram, pigeonpeas, and chickpeas, and including a number of "other pulses." The production of pulses and

beans increased by 2.4% per year in the 10 years between 2008 and 2017, mostly owing to improved yields rather than an expansion in the area planted to these crops, which has held steady. About two-thirds of pulse production occurs during the dry season, predominantly in Sagaing (25%), Bago (21%), Magway (18%), and Ayeyarwady (14%). Farmers may also grow pulses during the monsoon season if the risk of flooding is minimized.

28. Myanmar exports about 23% of pulse and bean production; in 2016/17 it exported 1.42 million tons of pulses valued atUS$1.40 billion (Table 2). Black gram, valued at US$1,197/t, accounted for 48% of the value of pulse exports and 39% of the volume exported; green gram in second place accounted for 25% of the value and 29% of the volume.

Table 2. Overview of pulse and bean exports, Myanmar, 2016/17

TYPE OF PULSE/BEAN	QUANTITY EXPORTED (t)	SHARE OF PULSE/BEAN EXPORTS (%)	EXPORT VALUE (US$ 000s)	SHARE OF VALUE (%)	AVERAGE PRICE (US$/t)
Black gram	561,766	39	672,289	48	1,197
Green gram	406,949	29	349,350	25	858
Pigeonpeas	184,700	13	159,858	11	866
Chickpeas	35,768	3	28,606	2	800
Cowpeas	26,614	2	16,790	1	631
Kidney beans	25,245	2	16,199	1	642
Butterbeans	23,327	2	10,187	1	437
Rice beans	23,369	2	9,964	1	426
Bocate	11,762	1	7,247	1	616
Other pulses	124,816	9	128,344	9	1,028
Total	**1,424,316**		**1,398,834**		**982**

Source: Comtrade and ITC.

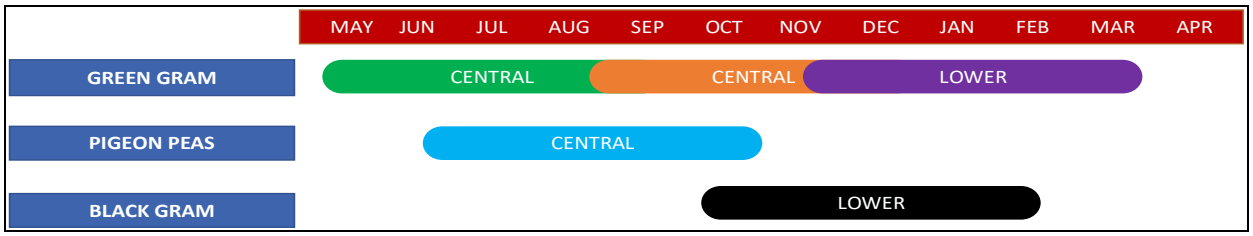
29. The largest importer of pulses and beans from Myanmar is India, which accounted for more than half of all pulse and bean exports from Myanmar by volume. Exports volumes to India have ranged from 40% of all pulse exports in 2013 to 73% in 2016. Volumes dipped to 51% in 2017 when India restricted imports. Similarly, the average price grew continuously by 12% per year in the 15 years to 2016 but dropped by 34% in 2017. Myanmar faced serious problems in selling its pulse production, especially black gram and chickpeas, after India imposed import restrictions. Prices in China, Japan, and Indonesia have remained relatively stable over the years, however.

30. The three regions selected to study the pulse and bean value chain in Myanmar—Ayeyarwady, Bago, and Sagaing—account for more than 56% of the area sown to pulses in Myanmar. Bago is first with 1.03 million acres, followed by Sagaing (0.8 million acres) and Ayeyarwady (0.6 million acres).

31. Bean production in these regions consists largely of mung beans. Kidney beans, lima beans, and rice beans are grown in lesser quantities. The crop cycle varies by the type of pulse and bean. As illustrated in Figure 24, farmers in Sagaing (central Myanmar) may grow green gram in May/June and harvest in

August/September. They may also opt to sow green gram during the monsoon season in September/October and harvest it in December/January, and they often sow pigeonpeas in upland fields during the monsoon season. On the other hands, farmers in Bago and Ayeyarwady (lower Myanmar) usually sow green gram after monsoon rice and harvest it in February/March; they grow black gram mostly during the dry season.

Figure 24. Cropping patterns for the main pulse crops in Sagaing (central Myanmar), Bago, and Ayeyarwady (lower Myanmar)



Source: Adapted from MOALI.

2.4. The Changing Farm Economics of Pulse and Bean Production, 2013–18

32. The findings reported here are based on data collected from 746 farmers who grew at least one type of pulse during the 2017/18 season. These farmers represent 43% of the sample for the survey. Pulses—typically sown in November and December and harvested in February and March—were grown in the 2018 dry season in 8 of the 12 agro-ecological regions (AERs) surveyed.

33. Bean and pulse producers either incurred a loss or earned very low net margins during the 2017/18 production season (Table 3). Producers' net margins per hectare were positive for green gram only, negligible for chickpeas, and negative for black gram (a net loss of $75/ha). In contrast, pulses were much more profitable in 2014: net margins for green gram were 72% lower in 2018 than in 2014, chickpeas were 97% lower, and black gram was 128% lower. Producers' net losses were even larger for some oilseeds such as winter peanut. Table 3 also shows that in 2018, with the exception of green gram, the returns to labor in pulse and bean production were all below the prevailing wage rate, with adverse implications for livelihoods.

Table 3. Yields and profitability of pulses and peanuts, 2014 vs. 2018, Myanmar

	BLACK GRAM		GREEN GRAM		CHICKPEAS		WINTER PEANUTS
	2014	2018	2014	2018	2014	2018	2018
Yield (kg/ha)	761	734	815	885	892	845	823
Price ($/kg)	0.66	0.32	1	0.71	0.47	0.47	0.48
Revenue ($/ha)	494	232	811	625	418	393	398
Gross margin ($/ha)	290	–31	505	223	181	74	2
Net margin ($/ha)	260	–75	464	164	147	4	–234
Labor productivity ($/day)	8.0	1.8	12.5	6.4	5.8	3.2	1.2

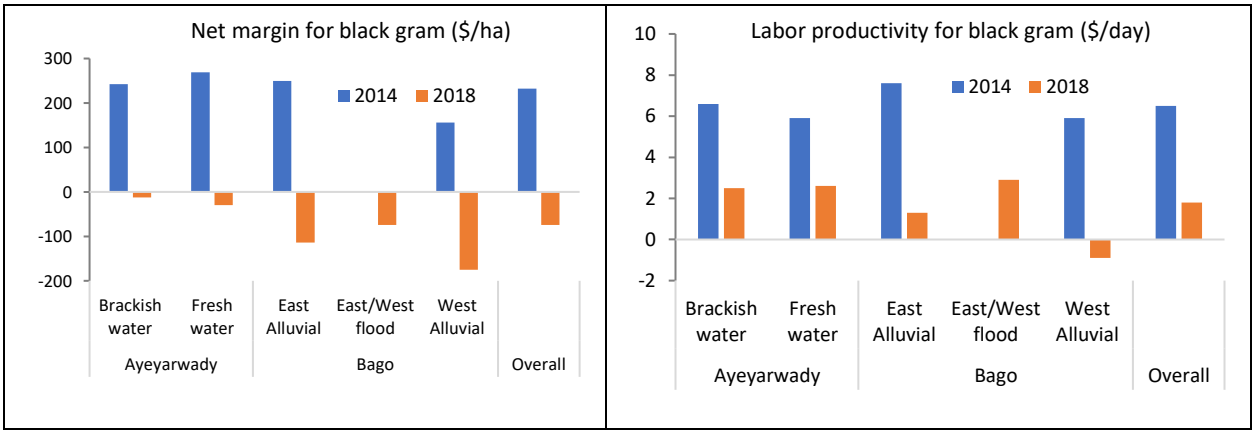
Source: MAS 2013/14 and 2017/18.

34. The survey data also provide insight into the profitability of pulse and bean production by region, agro-ecology, and crop. Despite some variation, profitability was generally lower in all regions in 2018 compared to 2014. For black gram producers, net losses ranged between US$12/ha in the Brackish Water AER to as much as US$175/ha in the West Alluvial AER (Figure 36). Similarly, while returns to labor for black gram producers were generally below the prevailing wage rate across all AERs in 2018, they were negative in the West Alluvial AER. Green gram producers in the Irrigated Tract AER had a lower net margin in 2018 (US$512/ha) than in 2014 (US$786/ha) (Figure 26), yet they still had twice the net margin of green gram producers in the Brackish Water AER ($240/ha) and five times the margin of producers in the East/West AER (US$121/ha). Producers in the East Alluvial AER had negative net margins and a negligible gross margin. The returns to labor for green gram producers were above the prevailing minimum wage, except in the East Alluvial AER, where labor returns were only US$3 per day. Estimated net margins were lower for chickpea production than for green gram (

35.

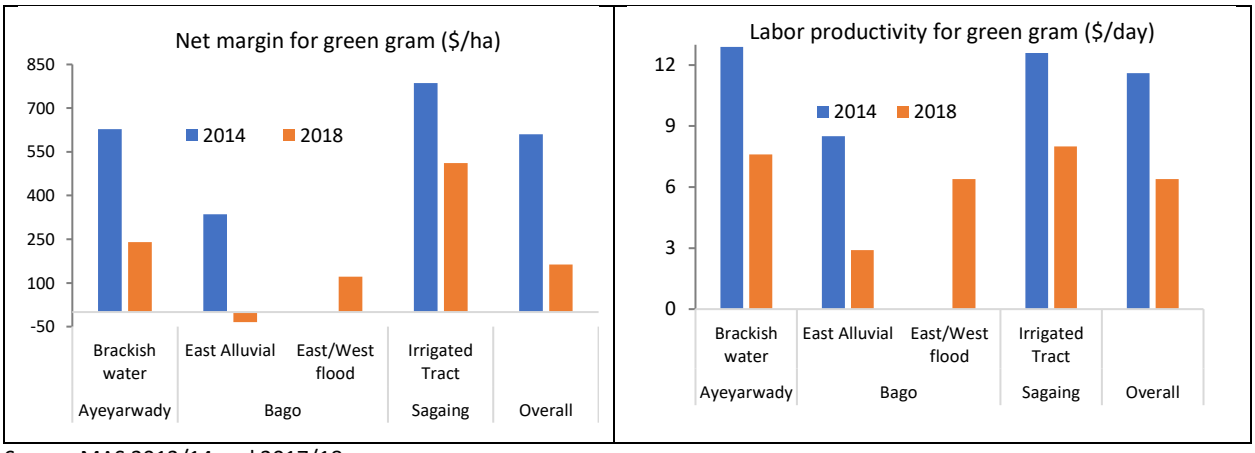
36. Figure 27). Net margins for chickpea producers were negative in the River Area AER and barely above zero in the two other AERs. Returns to labor in chickpea production were below the national minimum wage at $2 per day in the River Area AER, $3 per day in the Dry Land AER, and $4 per day in the Irrigated Tract AER.

Figure 25. Net margin ($/ha) and labor productivity ($/day) for black gram, Myanmar, 2014 and 2018



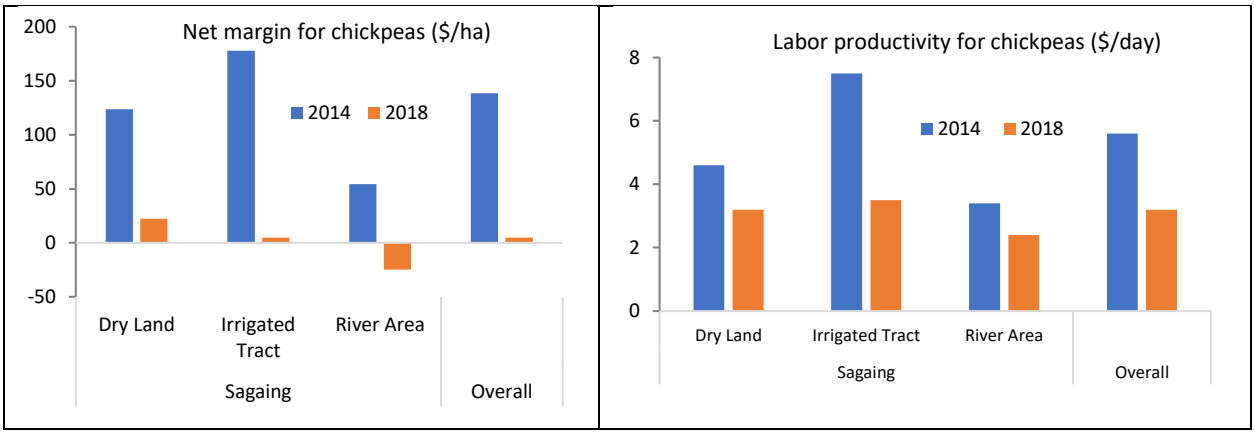
Source: MAS 2013/14 and 2017/18.

Figure 26. Net margin ($/ha) and labor productivity ($/day) for green gram, Myanmar, 2014 and 2018



Source: MAS 2013/14 and 2017/18.

Figure 27. Net margin ($/ha) and labor productivity ($/day) for chickpeas, Myanmar, 2014 and 2018



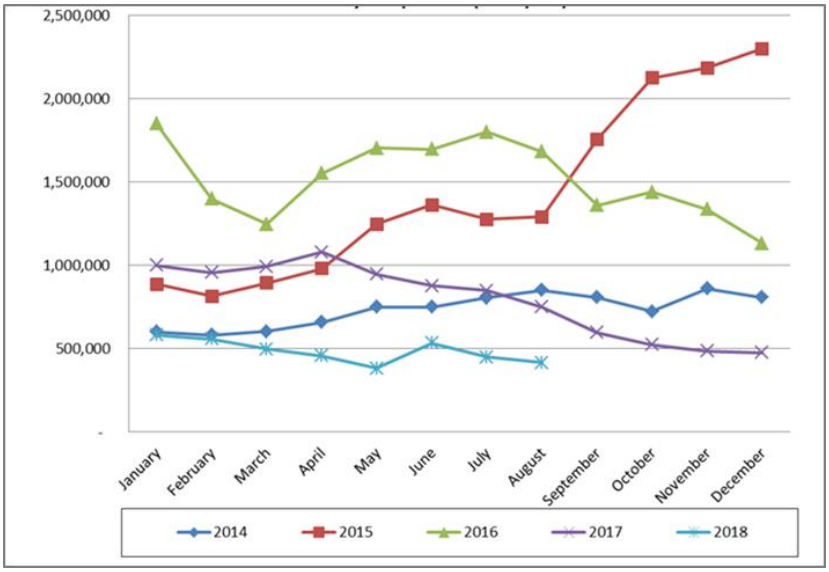
Source: MAS 2013/14 and 2017/18.

37. *Why were the net margins obtained by producers of pulses and beans so low in 2017/18?* The sections that follow discuss the three main factors—price shocks, low yields, and high production costs—that explain low pulse and bean profitability in 2017/18.

2.4.1. *Price shocks*

38. Domestic demand for pulses and beans is small in Myanmar, and domestic prices are highly influenced by activity in the export markets for these crops. For example, because India imports 60–70% of Myanmar's black gram production, the wholesale black gram price within Myanmar depends almost entirely on demand in India. Following a good pulse harvest in Myanmar in 2016/17, the 2017 restrictions imposed on imported pulses by India reduced pulse exports from Myanmar and led to a large drop in domestic pulse and bean prices (**Error! Reference source not found.**). Black gram was hit especially hard. Monthly prices for black gram were lower in 2018 than in any of the previous five years. Chickpea producers also saw low farmgate prices as a result of the Indian import restriction and the availability of surplus stocks from the previous year. The effect of the import restriction was minimized for green gram producers, because the market for green gram is more extensive, including China, Vietnam, Malaysia, Bangladesh, Indonesia, and some European countries.

Figure 28. Monthly black gram prices (Myanmar kyat/t)

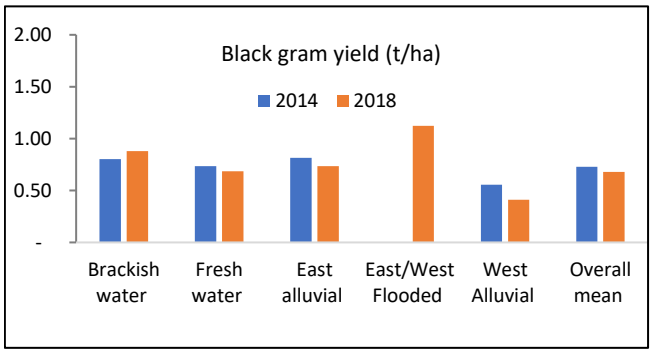


Source: USDA 2018b.

2.4.2. *Low yields*

39. Aside from falling prices, declining yields of black gram (Figure 29) and chickpeas (Figure 30) also explain why farm profitability of these crops is low. With some variations across AERs, since 2014 average yields have declined by about 7% for black gram and 4% for chickpeas; at the same time, however, yields of green gram increased by about 8% (Figure 31).

Figure 29. Productivity (t/ha) of black gram, Myanmar, 2014 and 2018

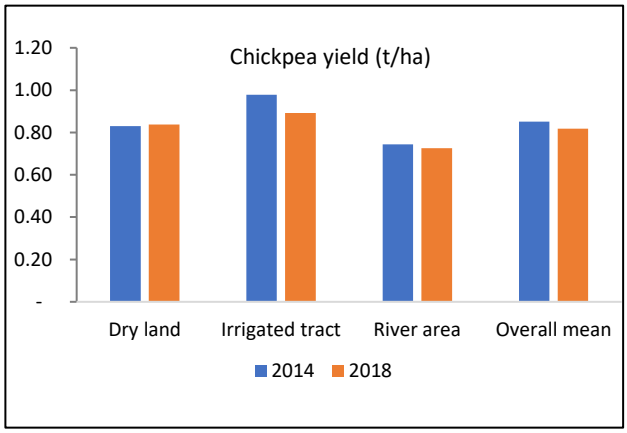


Source: MAS 2013/14 and 2017/18.

40. Some regional variations in yields and farm productivity for these three crops are worth noting. For black gram, the average cultivated area varied from 1.9 ha/farm in Bago to 2.3 ha/farm in Ayeyarwady. Average farm productivity was highest for farmers surveyed in the Brackish Water AER (2.2 t/farm), followed by farmers in the East/West Flooded AER (1.7 t/farm) and farmers in the Fresh Water and East Alluvial AERs (1.4 t/farm). The lowest farm productivity was observed in the West Alluvial AER (0.7 t/farm). These differences are largely driven by the size of average yields rather than by the size

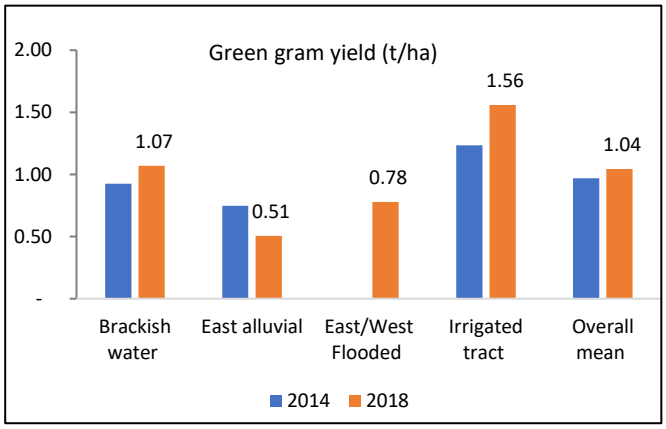
of cultivated area. For example, the area of the average plot allocated to black gram in the West Alluvial AER is comparable to the area allocated in the East/West Flooded AER, but farm productivity in the West Alluvial AER is less than 50% of farm productivity in the East/West Flooded AER.

Figure 30. Productivity (t/ha) of chickpeas, Myanmar, 2014 and 2018



Source: MAS 2013/14 and 2017/18.

Figure 31. Productivity (t/ha) of green gram, Myanmar, 2014 and 2018



Source: MAS 2013/14 and 2017/18.

41. For green gram, average cultivated area varied between 1.6 ha/farm in Sagaing to 2.6 ha/farm in Bago. The average production per farm was highest for farmers in the Irrigated Tract and East/West Flooded AERs at 2.4 t/farm, followed by the Brackish Water AER at 2.0 t/farm. The lowest total production was observed in the East Alluvial AER (0.5 t/farm). The average size of cultivated green gram area was 0.8 ha for small farms, 1.6 ha for medium-size farms, and 4.1 ha for large farms. Average green gram yields ranged from 0.51 t/ha in the East Alluvial AER to 1.56 t/ha in the Irrigated Tract AER. Compared to 2014, yields were higher in 2018, except in the East Alluvial AER, where average yields dropped by one-third.

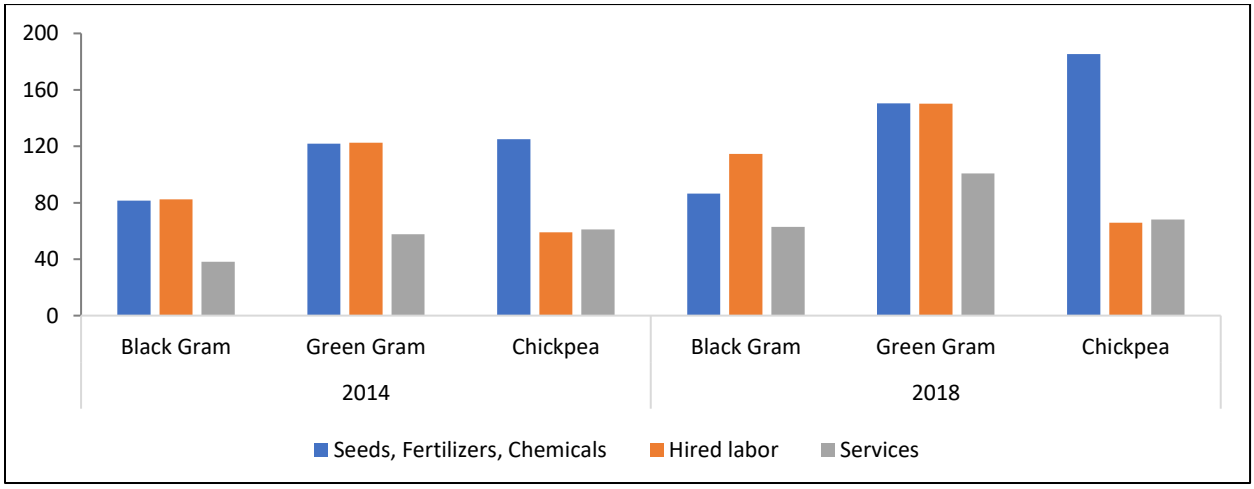
42. For chickpeas, average farm productivity was comparable across AERs at 1.2–1.3 t/farm. Average yields were higher in the Irrigated Tract AER (0.89 t/ha) than in the River Area AER (0.72 t/ha) and Dry Land AER (0.84 t/ha). Since 2014, chickpea yields have declined by about 9% in the Irrigated Tract AER and by 3% in the River Area AER, whereas they remained the same in the Dry Land AER. The area that producers allocated to chickpeas was generally smaller than the area allocated to black and green gram: 1.2 ha in the Irrigated Tract and Dry Land AERs and 1.6 ha in the River Area AER.

2.4.3. High production costs

43. Pulse and bean producers had higher input costs—seeds, fertilizers, chemicals; hired labor; and services—in 2018 than in 2014 (Figure 32). As these crops are sensitive to pests, nearly all green gram and black gram growers applied insecticides in 2018, an increase of 20–30 percentage points compared to 2014. Adoption of herbicides also increased. While fertilizer use was generally limited on pulses and beans, seed costs increased. Partly due to labor outmigration from rural areas and partly due to the limited use of machinery, farmers had to rely on hired labor for crop operations, especially during the harvest.

Labor demand ranged between 40 and 60 days/ha in 2018, resulting in labor costs of US$66/ha for chickpeas (12% higher than in 2014), US$115/ha for black gram (40% higher), and US$150/ha for green gram (23% higher).

Figure 32. Production costs for black gram, green gram, and chickpeas (US$/ha), 2014 and 2018, Myanmar



Source: MAS 2013/14 and 2017/18.

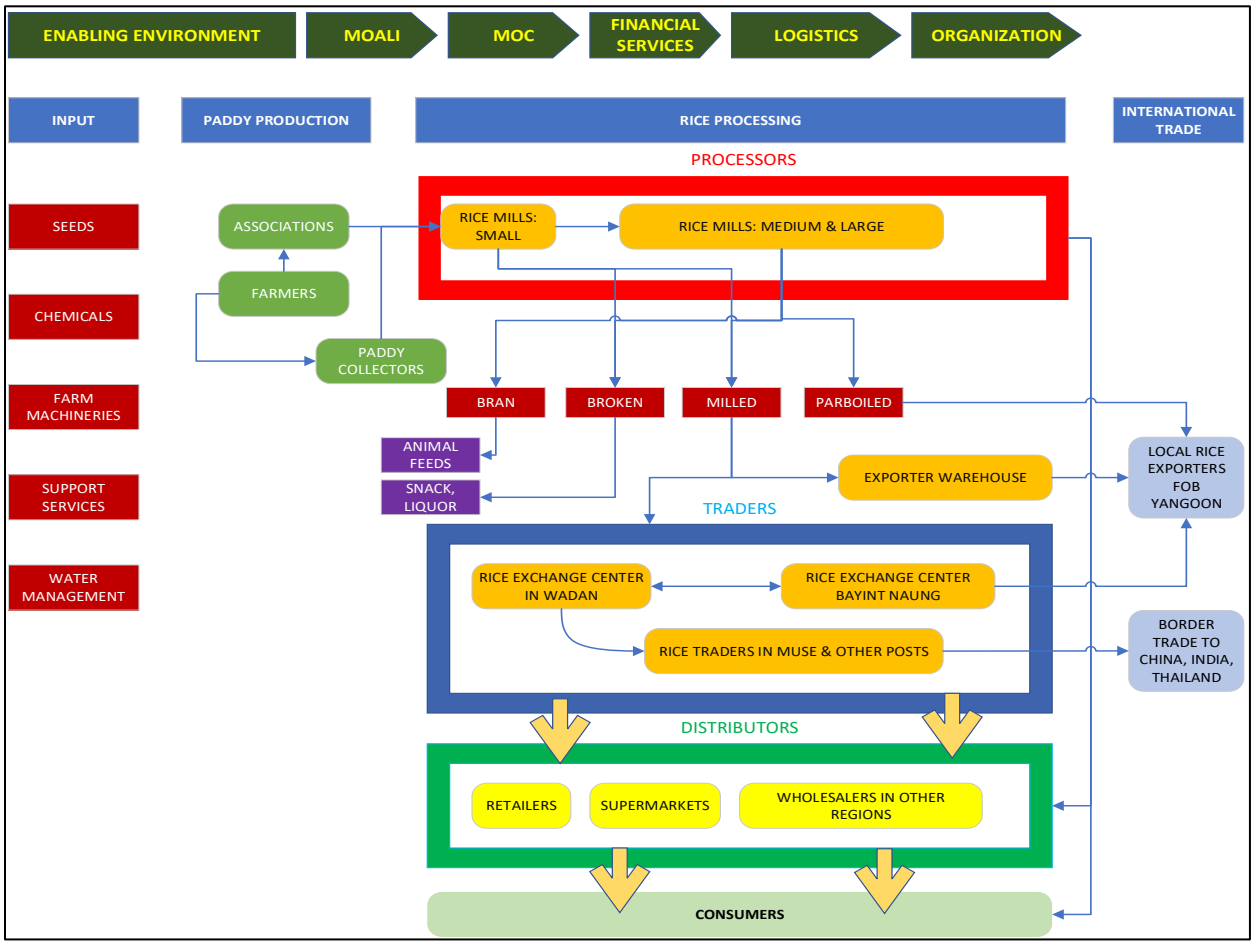
3. Elements of the Rice Value Chain and Prospects for Adding Value

44. This section maps the elements of the value chain for rice in Ayeyarwady—seed producers; suppliers of inputs, equipment, and services; farmers and farmer associations; traders; processors and exporters; distributors; and consumers—and describes the enabling environment for the value chain. The discussion focuses on the strengths, weaknesses, opportunities, and threats pertinent to each element in the chain and recommends pathways to improve performance.

3.1. Mapping the Rice Value Chain in Ayeyarwady

45. The value chain for rice in Ayeyarwady (Figure 33) is quite similar to the value chain for rice more generally throughout Myanmar. The chain is characterized by the presence of several intermediaries, from input suppliers to exporters operating at various stages from paddy collection to rice milling.

Figure 33. Elements of the rice value chain, Ayeyarwady



Source: Adapted from Wong and Eh Mywe Aye Wai 2013.

46. The value chain map encompasses four main subchains:

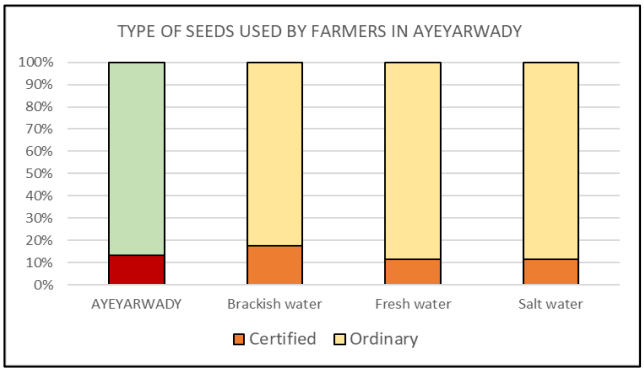
1. *A short milled-rice circuit,* which represents the traditional subchains directly linking farmers and rice hullers. Farmers use this circuit to mill rice for their own household consumption and sell the excess to local collectors. Farmers are estimated to retain about 30% of production for their own consumption.
2. *A first intermediate circuit of paddy for the domestic market,* which has the goal of supplying rice-deficit zones from distribution hubs and includes the highest number of actors: collectors, rice millers, and distributors. The circuit links farmers with collectors, who then sell the paddy to wholesalers and rice mills of various sizes.
3. *A second intermediate circuit,* which supplies informal trade at the borders (in Muse, for example). This circuit may be an extension of the activities of actors involved in the short milled-rice circuit and the first intermediate circuit. Rice millers in this subchain enter into contracts with Chinese buyers.
4. *A long circuit,* which is aimed at rice exports. This circuit relies on modern supply chains that could involve contract farming through which inputs and credit are advanced to farmers. The modern, efficient rice mills operating in this subchain are capable of meeting demand requirements and competing with exporters from other countries. Almost all of these processing units are located in Yangon to benefit from the port facilities.

47. Other forms of processing exist (to manufacture rice noodles, snacks, and liquor, for instance) but do not involve a huge amount of milled rice. Byproducts such as bran go to the feed sector and to a lesser extent are processed (bran oil is one example).

3.1.1. Seed producers

48. The market for rice seed is potentially large. Currently, depending on the season, only 5–11% of Ayeyarwady rice farmers use certified and hybrid seed (Figure 34), but the trend is toward higher adoption of quality seed. For example, 9% of Ayeyarwady farmers surveyed used certified seed in the 2013 monsoon season, and in 2017 that rate had increased to 11%. Similarly, use of certified rice seed in the dry season increased among Ayeyarwady farmers from 1% in 2014 to 5% in 2018. All of the seed producers interviewed for this study reported no problems in selling all of their production. Tin Htut Oo and Tin Maung Shwe (2013) conclude that the low use of certified seed results from a combination of insufficient supply and quality, high seed prices, poor market signals, and farmers' lack of awareness of the advantages of certified seed.

Figure 34. Type of rice seed used by farmers in Ayeyarwady



Source: MAS.

49. Seed multiplication has received strong attention from MOALI. In 2017, the Agricultural Extension Division (AED) supported 877 farmers in 26 townships in Ayeyarwady to form seed grower associations, with the objective of producing certified seed from 1,947 acres of rice fields. That area corresponds to about 20% of the national program target of 10,225 acres.

50. The Department of Agricultural Research (DAR) is the only entity that can produce breeder and foundation seed, which is then multiplied by the Department of Agriculture (DOA) and by authorized private entities to produce registered seed. At the final stage of this seed production chain, contract farmers and private companies produce seed for processing, certification, and ultimately distribution to farmers.

51. The Myanmar Rice Research Station (MRRS) in Yangon produces foundation seed of three varieties: Sin Thu Kha, Ayer Min, and Hmwabi 2. The first two are in high demand from farmers producing for the domestic market, whereas Hmwabi 2 is targeted more toward the export market. MRRS produced 26 t of foundation seed and 258 t of certified seed in 2017 on 300 acres under tubewell irrigation. On average, groups of contract farmers produce about 400 t of seed each year, and individual farmers and farmers working with DOA produce an average of 70 t of certified seed annually. As noted, none of the seed producers interviewed during the fieldwork reported trouble selling certified seed; they were able to sell all of the seed produced to their partners, the private sector, or DOA. Seed tests are conducted in Yangon Central Seed Laboratory, and DOA staff help seed producers collect samples for testing. The testing cost per sample is 10,000 Myanmar kyats (US$7.5).

52. The private sector and DOA provide registered seed, credit, and the technology to produce seed. The lack of irrigation is a huge limitation on seed production in the dry season, because most seed producers would prefer to grow only rice (and not produce seed) during the monsoon season to take advantage of the rains. Other constraints highlighted by seed producers include the lack of working capital and post-harvest processing units and facilities. Private companies encounter difficulties in getting registered seed for multiplication from DOA and DAR, and the range of registered seed varieties offered by DOA and DAR is limited. Seed production costs are high, as much as US$200/acre, and profitability is low, with margins similar to those obtained in ordinary rice production. Seed producers buy registered seed at prices ranging from US$0.28/kg to US$0.35/kg, and the price of foundation seed is US$0.45/kg. At the same time, prices of certified seed are set at US$5.9/basket for an average production of 63 baskets/acre, for total revenue of US$375 and a net profit of US$153/acre. Most seed producers would like certified seed to be priced higher in the market.

53. Table 4 summarizes results of the SWOT analysis for seed producers.

Table 4. SWOT analysis for seed producers, rice value chain, Myanmar

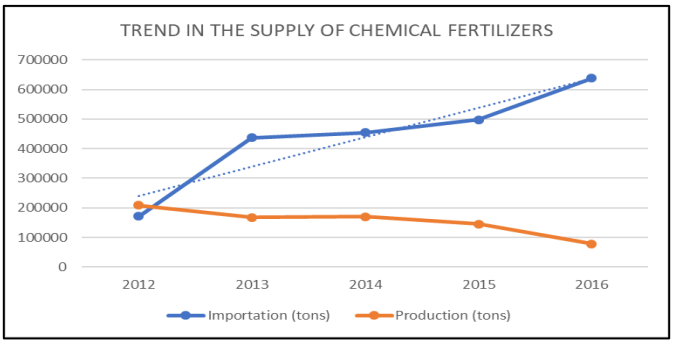
STRENGTHS	WEAKNESSES
• Willingness of private sector to enter the system of seed production and distribution. • Good start of contract farming and the involvement of the private sector. • Good coordination between DAR/DOA and seed producers. • Strong political will—DOA involvement in building capacity of seed producers and associations. • Increasing demand for certified seed. • Existence of seed law.	• Low profitability of seed multiplication—margins are very similar to ordinary rice production. • Insufficient production of registered seed by DAR/DOA. • Limited range of varieties produced by DAR/DOA. No production of seed of traditional varieties, limited production of 90-day variety. • Lack of service providers from production to processing. • Farmers are not fully aware of the advantages of using certified seed. • Lack of irrigation: no seed production during the dry season. • Lack of technical and financial government support to seed producers and private sector. • Not enough investment credit. • No regional facilities for seed certification and testing. • Poor marketing support for seed distribution and use—no market information.
OPPORTUNITIES	**THREATS**
• Seed processing service providers. • Farm machinery service providers. • Attracting international seed company for rice seed production (e.g., hybrid rice seed). • Implementation of a crop insurance program for seed producers. • Cooperation with international research centers.	• Negative impact of climate change (e.g., high seed moisture content at harvest). • Illegal introduction of seed through the border; no quarantine. • Increased competition with seed imported from Thailand, India, and China.

3.1.2. Input suppliers

54. The main inputs for rice production are fertilizers and pesticides (insecticides and herbicides). The Myanmar market is open to imported inputs as only 15% of domestic needs are produced locally. Every year, Myanmar imports 1.2–1.4 million tons of chemical fertilizers, mainly from China and Thailand. Data from FAOSTAT, however, show formal fertilizer imports of less than 640,000 t, increasing at a rate of 39% per year since 2012 (Figure 35). ITC reports a similar level of fertilizer imports—700,000 t, valued at US$305 million in 2017.

55. Input providers in Ayeyarwady are small and located selectively in villages known to buy fertilizers and pesticides. Large-scale input importers and wholesalers provide marketing and promotional materials, and small-scale distributors sell the products to farmers. These suppliers also receive some technical knowledge about the products and their use and pass this advice on to the farmers.

Figure 35. Formal fertilizer imports, 2012–16, Myanmar



Source: FAOSTAT, July 2018.

56. The availability of imported inputs has increased in the past few years, but increased availability has not been accompanied by better quality control. Farmers are expressing more concern about the quality of purchased inputs. Suppliers try to limit their product offerings to those of well-known manufacturers.

57. Problems reported by input suppliers include strong competition, resulting in relatively low margins of 1.5–2.5%. These low margins explain why most input suppliers do not provide discounts, even for a large volume of sales. Only one company interviewed for this study reported giving a 1% discount for very large orders. To keep customers, some suppliers allow buyers to delay payment for up to two weeks. The medium-sized importers are challenged by the dominant position of the two largest input importers, which benefit from economies of scale to push prices down.

58. On the demand side, a slightly lower percentage of rice farmers in Ayeyarwady applied chemical fertilizers in 2017 compared to 2013. Whereas 90% of farmers applied urea in 2013, 81% applied it in 2017, and use of NPK fertilizers fell from 24% to 19%. The use of noncompound fertilizers increased slightly, however, rising from 1% to 6% for potash and from 28% to 33% for T-super. Farmers in the Delta (Ayeyarwady and Bago) applied slightly more fertilizer per acre in 2017 than in 2013: an additional 0.4 and 4.3kg/acre, respectively, for monsoon rice and an additional 6.2 kg/acre for dry-season rice (Table 5). Reduced fertilizer use in other areas (Sagaing and Shan) results in an overall decline in fertilizer use in monsoon rice and a lower overall increase (an additional 2.6 kg/acre) for dry-season rice.

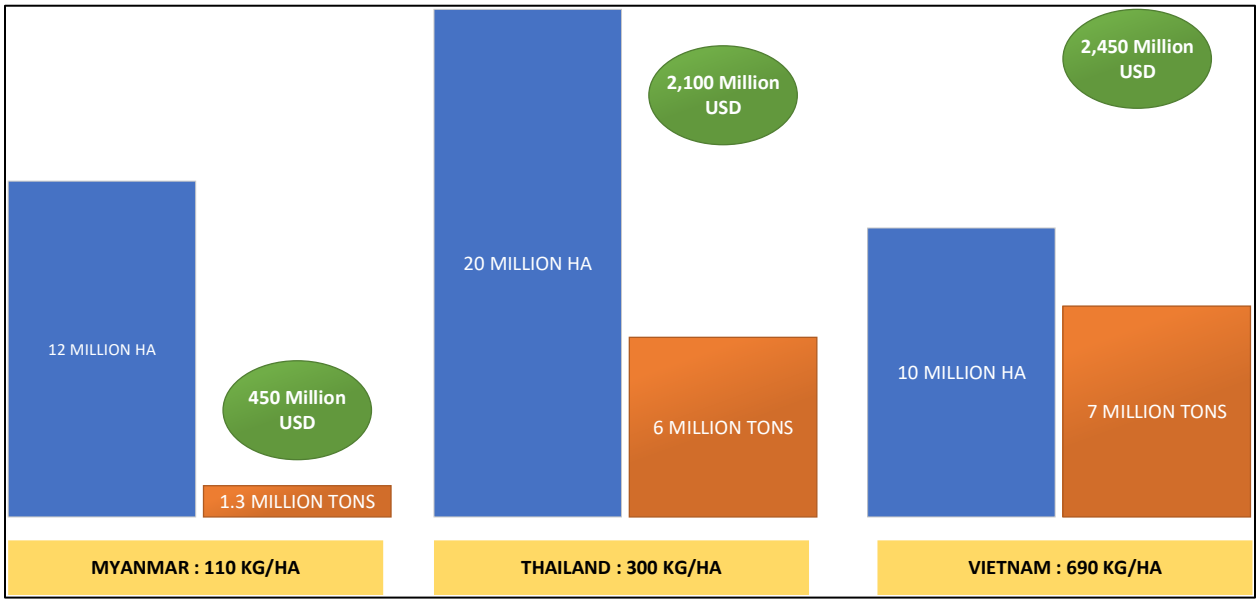
Table 5. Use of mineral fertilizers in monsoon and dry-season rice production, Myanmar, 2013 and 2017 (kg/acre)

	MONSOON RICE		DRY-SEASON RICE	
	2013	**2017**	**2013**	**2017**
Ayeyarwady	28.1	28.5	91.2	97.4
Bago	15.2	19.5		45.7
Overall use of mineral fertilizers	**35.9**	**29.5**	**85.3**	**87.9**
Changes in Ayeyarwady		0.4		6.2
Changes in Bago		4.3		N/A
Overall change in use of mineral fertilizers		**–6.4**		**2.6**

59. An analysis conducted by Myanma Awba Group finds huge potential for increased consumption of inorganic fertilizer in Myanmar. Myanmar is one of the last Asian countries with such potential, because the adoption of inorganic fertilizer remains low at 110 kg/ha on average, compared to 300 kg/ha in Thailand and 690 kg/ha in Vietnam (Figure 36). The current market of about 1.3 million tons is valued at US$450 million, but a simulation shows that if rice production systems in Myanmar used fertilizer at the same average rate as Thailand, the additional demand for fertilizer would equal 2.28 million tons, valued at approximately US$800 million. Three entities are starting to build bulk blending plants in Myanmar—Awba in Yangon, the Myanmar Agribusiness Public Corporation (MAPCO) in Ayeyarwady, and Charoen Pokphand (CP) in Mandalay—and a tender is open to manage one government-owned fertilizer factory.

60. Table 6 summarizes results of the SWOT analysis for input suppliers.

Figure 36. The fertilizer market in Myanmar compared to neighboring countries



Source: Presentation by Myanmar AWBA Group.

Table 6. SWOT analysis for input suppliers, rice value chain, Myanmar

STRENGTHS	WEAKNESSES
• Willingness of private sector to invest in input supply and distribution. • Collaboration with large international companies. • Expansion of irrigation infrastructure will result in higher input use. • Credit provided by Myanmar Agricultural Development Bank (MADB) may be used for intensification.	• Dominant position of two large input importers. • Low-quality inputs imported informally, without quality control across borders. • Lack of awareness in using pesticides, no dissemination of integrated pest management systems. • High price of fertilizers. • No fertilizer use in risky cultivation system (e.g., systems lacking irrigation, drainage). • Use of local varieties that are not responsive to fertilizers. • Local fertilizer plant does not have the competitive advantages of large-scale units in Thailand, China, and Vietnam, even though Myanmar has supplies of natural gas to use as raw material.
OPPORTUNITIES	**THREATS**
• Demand is increasing, along with prospects for the input supply industry. • Myanmar could be a huge consumer of inputs: International input manufacturers are starting to invest in Myanmar. • Use of herbicides is increasing as labor for weed control becomes scarce and expensive.	• Flooding that destroys infrastructure and fields will reduce demand for inputs.

3.1.3. Equipment and service suppliers

61. A World Bank study (World Bank 2016) reported that farm mechanization was low in Myanmar for three reasons: the agricultural wage was still low, rendering wage labor economically more viable than machinery use; medium-term and long-term credit were not available for investment in machinery; and infrastructure for machinery use, sales, and services was lacking. In the interval since that study appeared, these constraints have receded rapidly. As more unskilled labor left rural areas, creating labor shortages at peak times such as transplanting and harvest, farmers' interest in acquiring equipment grew. The use of farm machinery boomed (Pingali 2007) (Table 7), especially after the rice market was liberalized.

Table 7. Number and types of farm equipment, 2013/14–2017/18, Myanmar

EQUIPMENT TYPE	2013/14	2014/15	2015/16	2016/17	2017/18
Power tiller and upland tiller	257,971	286,097	295,214	300,247	305,000
Hydro-tiller (boat type, used mostly in Ayeyarwady)	5,403	6,065	7,424	7,467	9,000
Monowheel 5–6 horsepower tractor			7,532		
Farm tractor for land preparation	13,345	16,738	19,504		
Rice transplanting	122	169	173	286	350
Reaper/thresher	55,104	61,793	64,059	65,000	
Combine harvester (small and conventional)	668	1,680	2,265	2521	3,000
Drying unit			253		

Source: MOALI, Agricultural Mechanization Division.

62. With the rise of mechanization, farm operations have changed significantly. As noted, 9 out of 10 farmers now use mechanized land preparation systems. Mechanization has also brought about dramatic changes in rice harvesting and post-harvest operations: about 50% of farmers now use combine harvesters and 38% use threshers. Farm size and landholding arrangements do not affect the decision to move toward machine-oriented farming practices; small, medium, and large farms all rely increasingly on agricultural machinery. A review of recent changes in mechanization in Myanmar (USDA 2018a) attributes the increase in rice and maize production to higher levels of mechanization as well as higher commodity prices.

63. Average prices of equipment are falling, probably owing to the increase in competition and the introduction of equipment from China, which is relatively cheaper than equipment from Japan. Prices of two-wheeled tractors dropped by 5.8% per year on average from 2006 to 2017, although the decline was less pronounced in the last five years of that period. The average price of a two-wheeled tractor was US$2,500 in 2007 and US$1,500 in 2017. Prices of motorized water pumps have followed a similar trajectory, falling at a rate of 5.1% per year on average over the same period, from US$400 per unit to US$200 per unit. Providers of mechanized services have also reduced their fees over the years.

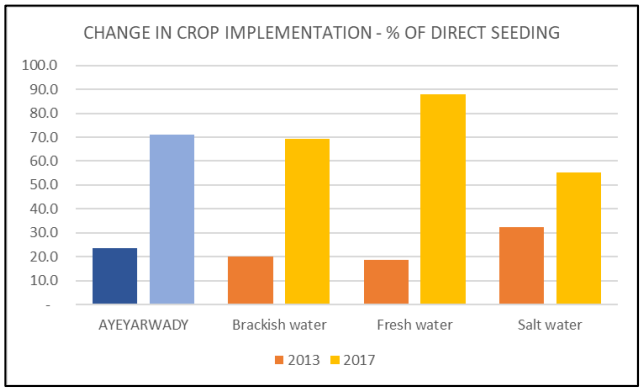
64. Equipment suppliers and service providers are increasingly located closer to farmers. From 2010 to 2016, the number of equipment suppliers in Ayeyarwady increased from 5 to 15, the highest increase anywhere in Myanmar. The government through MOALI is promoting mechanized agriculture to achieve

its objective of exporting 4 million tons of rice in 2020. The Myanmar Agricultural Mechanization Department has established 117 agricultural mechanization stations (Ei Ei Khini 2015); 18 such stations with 251 tractors and 83 combine harvesters are located in Ayeyarwady.

65. DOA is working on land consolidation, which is closely related to increasing the efficiency of using farm machinery. The consolidation project provides good land leveling and access to irrigation and drainage, and farm roads are built to facilitate access to plots by combines and tractors. As part of the Farm Land Reforming Strategy, 56,280 acres were consolidated as of 2017 and then delimited to rectangular plots of 1 acre, including 2,547 acres (4.5% of the total) in Ayeyarwady.

66. Apart from mechanization, farmers rely on direct seeding to cope with increasing labor costs and the scarcity of hired labor. In Ayeyarwady most farmers have shifted from transplanting rice to direct seeding, resulting in substantial changes since 2013 (Figure 37). The proportion of farmers using direct seeding more than doubled in the Salt Water AER, increased more than threefold in the Brackish Water AER, and expanded fourfold in the Fresh Water AER.

Figure 37. Percentage of direct-seeded plots, Ayeyarwady, 2013 and 2017



Source: MAS.

67. Table 8 summarizes results of the SWOT analysis for equipment and service suppliers.

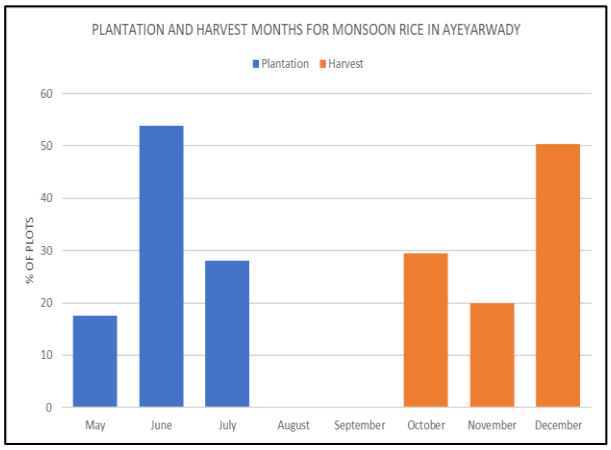
Table 8. SWOT analysis for equipment and service suppliers, rice value chain, Myanmar

STRENGTHS	WEAKNESSES
• Willingness of entrepreneurs to invest in agricultural service provision. • Suppliers are aware of maintenance and after-sale services. • Existence of different types of equipment for various farm sizes. • Land consolidation in process.	• High cost of harvest equipment related to the size of farms. • Lack of medium-term and long-term credit for equipment. • Lack of maintenance services at the village level. • Land consolidation is costly and not likely to be widespread in the next couple of years.
OPPORTUNITIES	**THREATS**
• Demand is increasing, and so are prospects for equipment and service suppliers. • Myanmar is becoming a big market for agricultural equipment. • Sales of spare parts, and the establishment of a factory for farm equipment specific to Myanmar's agricultural conditions.	• Reduction in labor supply (youth leaving rural areas). • Poor road conditions at the field level. • Lack of land consolidation makes use of agricultural machinery inefficient in small, irregularly shaped plots. • Introduction of cheap but poor-quality equipment. • Lack of organic fertilizers because farmers keep fewer draft animals.

3.1.4. Farmers

68. Ayeyarwady has numerous production units and a high level of landholding inequality, and the decision to produce rice depends on the specific characteristics of each production unit. About half of the farmers have less than 5 acres (Cho, Benton, and Boughton 2017). Almost everyone grows rice during the monsoon season, but during the dry season, each household develops specific income-earning strategies. Smallholder farmers may opt to diversify into vegetable production to get the maximum revenue from the available land, whereas farmers with more land tend to produce dry-season rice, if irrigation and levels of salinity permit. Figure 38 depicts the production and harvest cycle for monsoon paddy in Ayeyarwady. Farmers faced challenging weather in the three years prior to the most recent survey, with rain occurring during the harvest, especially if rice was harvested late, in December and January.

Figure 38. Planting and harvest periods for monsoon paddy, Ayeyarwady



Source: MAS.

69. About 85% of the households surveyed in Ayeyarwady were farm households getting their main income from agriculture. The region has a dynamic land market, and about half of the land of survey households was acquired by inheritance and the other half by purchase. Men operated about 85% of the farms (the highest ratio is in Salt Water AER, where men operated 89% of the farms). About two-thirds of farmers had only a primary school education, and 11% had no formal education.

70. Average farm size varied from 7.5 acres in Fresh Water AER to 10.1 acres in Brackish Water AER and 13.5 acres in Salt Water AER. During the monsoon season, 86% of farmers grew only rice, ranging from a low of 60% in Fresh Water AER to 99% in Brackish Water and Salt Water AERs. Average rice yields varied significantly from one AER to another in 2017. Yields were very low in Salt Water AER at 765 kg/acre (1.9 t/ha), although farmers in that AER had a higher land endowment of 6.8 acres on average. Fresh Water AER was in the middle range for yields, with an average yield of 1,289 kg/acre (3.2 t/ha) and land endowment of 4.63 acres. Farmers in Brackish Water AER had the highest average yield—1,626 kg/acre (4.0 t/ha)—and land endowment (4.95 acres). Compared to five years ago, rice yields have increased by 10% in Brackish Water AER, remained stationary in Fresh Water AER, and decreased by 23% in Salt Water AER. At the Ayeyarwady level, there was only a slight yield increase of 3% between 2013 and 2017.

71. Farmers generally use more modern inputs for the less risky dry-season rice production. They shift to local varieties and low input levels for monsoon rice, because they cannot control the water supply (rainfall) and levels of water salinity. Domestic consumers are used to (and thus prefer) the taste of local varieties. Most farmers use seed selected from their production and buy ordinary seed from villagers and local merchants. Only 11% of farmers in Ayeyarwady used certified seed for monsoon rice and 5% for dry-

season rice, but as noted, adoption of quality seed is on the rise.[8] As discussed in the input supplier section, most farmers used inorganic fertilizer at low rates (21.4 kg/acre of nitrogen, 11.5 kg/acre of phosphate, and 8.4 kg/acre of potash for monsoon rice production). Indeed, farmers use higher amounts of inputs for dry-season rice, but the data are not yet available.

72. Transplanting and harvesting rice both require huge amounts of labor, and farmers are shifting to mechanized options for these operations. The most commonly used agricultural equipment is water pumps (96.5% of farmers), operated largely by diesel engines (97%) owing to lack of electricity. Mechanization is quite advanced for harvest and post-harvest operations, but the mechanization of transplanting has not been a huge success, as too much delicate work is required before mechanical transplanting can take place. If farmers are in a contracting scheme with rice millers, the company can invest in the materials and equipment required for farm operations and provide a complete package to farmers.

73. Farmers sold 74% of their monsoon paddy production and 93% of their dry-season production. About 87% of farmers sold to paddy traders and collectors. Only 11% sold directly to rice millers (5% in Brackish Water AER and 12–13% in the two other AERs). Farmers in Brackish Water and Salt Water AERs sold their paddy at the farmgate, whereas farmers in Fresh Water AER brought the paddy to the nearest town. The region lacks drying units, so farmers sell wet paddy to traders and millers right after the harvest.

74. MOALI has supported the creation of farmer associations, but to date they have not been active in paddy production. The consultations for this study involved several groups of rice farmers, but none has been established as an association. The MRF has tried to promote the Myanmar Farmer Association, which had about 200,000 members as of 2016. The Myanmar Farmer Association is intended to take the lead in defending the interest of farmers in discussions at the policy level and to build the capacity of its members to attain better living conditions. Associations have been more successful in seed multiplication. AED is supporting more than 3,130 farmers in 199 villages to produce quality seed through seed grower associations, and Ayeyarwady has 877 farmers in 26 seed associations.[9]

75. The level and quality of advisory and financial services for farmers present additional challenges.

76. Investment, productivity, and profitability are major issues for rice farmers. With yields ranging from 40 to 60 baskets/acre, farmers in Ayeyarwady have clear scope to increase yields by investing in productivity-enhancing inputs, along with infrastructure such as embankments to protect against flooding and the intrusion of saline water. Yet farmers lack technical and financial support to improve productivity. Public advisory services have been declining in recent years (Myint Myint Aye 2017). The AED has about 7,500 extension staff, and in 2017 Myanmar had about 1 public extension agent for every 5,000 acres of crops, roughly 1 agent for every 585 farms. As for financial services, the Myanmar Agricultural Development Bank (MADB) makes credit available to small-scale farmers, but their input use—and

[8] Up from 5% for monsoon rice and 1% for dry-season rice in 2013/14, according to World Bank survey data.

[9] AED also plans to establish Myanmar Agricultural Cooperatives in seven villages, but they are all outside Ayeyarwady.

productivity—remain low. Because small farmers do not get enough income from rice production, they are moving toward higher-value activities such as aquaculture, salt production, and livestock production.

77. At the same time, there are collateral issues that farmers cannot overcome on their own. As the rice basket of Myanmar, Ayeyarwady will have to contend with the adverse effects of climate change, which are already affecting farmers. Other constraints include water for irrigation, the lack of quality seed and fertilizer, transportation costs, rising labor costs owing to competition in the urban industrial sector, and other factors beyond the farm that affect overall profitability in the rice subsector.

78. Table 9 summarizes results of the SWOT analysis for rice farmers.

Table 9. SWOT analysis for farmers, rice value chain, Myanmar

STRENGTHS	WEAKNESSES
• Demand in the global market is increasing. • Existence of support from MRF. • Some investment in embankments and irrigation/drainage. • Improvement in road conditions.	• Low profitability of rice production compared to cash crops such as vegetables, sesame. • High production costs for rice compared to pulses. • Lack of irrigation and drainage systems, resulting in risk-averse behavior in using inputs. • Lack of technical support and services. • Not enough investment credit. • No market information available to farmers.
OPPORTUNITIES	**THREATS**
• Production of high-value rice for niche markets. • Implementation of crop insurance program against climate change risks. • Export of rice products, not commodities.	• Increasing costs of production. • More frequent floods and drought due to climate change. • Cyclones.

3.1.5. Paddy traders

79. Intermediaries play important roles in value chains that lack vertical coordination. Four types of intermediaries are generally involved in the rice value chain in Myanmar: assemblers at the village level, paddy collectors at the township level, milled rice wholesalers, and milled rice retailers. Some projects seek to improve organization in the value chain to reduce the number of intermediaries, such as the LIFT Delta project in Labutta, which is developing a business model directly linking rice brokers to farmers, eliminating the need for assemblers and collectors. The cost of similar interventions to reach thousands of smallholder farmers could be high, however, resulting in higher risks for brokers.

80. In the absence of strong monitoring and effective contract farming arrangements, the alternative is to rely on traditional assemblers and collectors. Most traders are independent operators, using their own working capital and selling rice to millers who are willing to meet their price. A few groups of assemblers act as employees of collectors and rice millers and get a percentage of profits, varying from 1% to 2% of total sales. Intermediaries also distribute milled rice to small and remote villages, as well as the district and township markets. Large retail stores are not yet common in several locations of Myanmar, even though a few entities such as City Market and Sein Gay Har have emerged in recent years.

81. Since intermediaries tend to be located closer to farmers, the confidence established between sellers and buyers could be one benefit of their activity. Given the poor road infrastructure linking villages and townships and the unorganized value chain, intermediaries may also be efficient in using the most appropriate means of transportation to lower the costs of intermediation between farmers and larger operators such as millers. However, as an additional layer within the value chain, intermediaries increase the final costs of goods, or (when consumer prices are not flexible) reduce farmgate prices.

82. Traders are very active in using the Myanmar Rice Exchange and wholesale markets in Yangon. The MRF rents the Myanmar Rice Exchange facility from the Yangon Port Authority, and it is the largest wholesale market in Myanmar. Most sellers of milled rice are from Ayeyarwady, while about 90% of the buyers are from Yangon and the rest from other regions of Myanmar. Indeed, Yangon is a megalopolis with a demand for milled rice estimated at 2,000–2,500 t/day.

83. Small traders, who constitute 60% of the traders at the Myanmar Rice Exchange, buy less than 15 t/day. They distribute this rice directly to consumers and to small distributors (usually in villages). Average daily transactions for large and medium-sized traders can reach 50–100 t. In recent years, improved road quality has led suppliers to bring milled rice to the exchange by truck rather than via waterways and boats. Traders report no issues in finding transportation services and warehouses along the highway from Yangon to Labutta.

84. Within the Myanmar Rice Exchange, suppliers are organized by township, which corresponds to specific varieties and quality of rice. Prices are recorded every day, and the management posts price trends to inform buyers and suppliers. Price information is also posted on Facebook. Agreement among traders is by word of mouth for most small transactions. For procuring large quantities, however, the parties enter into a formal contract. Payments at wholesale markets are all in cash, with some cases of delayed payment (up to two weeks). There is no practice of advance payment.

85. The main concern among traders is the outlook for rice production in Myanmar, which depends on producers' continued willingness to grow rice even though production costs are increasing, and the global price remains stationary. Rice quality is another big issue. The high moisture content of paddy purchased from farmers results in more broken grains. Traders also encounter delays at Yangon port because of the lack of infrastructure, equipment, and facilities.

86. Table 10 summarizes results of the SWOT analysis for rice traders.

Table 10. SWOT analysis for traders, rice value chain, Myanmar

STRENGTHS	WEAKNESSES
• Demand from China is increasing: Objective to export 4 million tons in 2020, half to China. • Farm roads are improving. • Myanmar Rice Exchange is available at several locations. • Price information available from MRF.	• Lack of support from the government in the form of laws and regulations, standards and norms. • Unreliable quality of paddy: moisture, foreign matter content, other impurities. • High cost of credit. • High cost of procurement from thousands of smallholder farmers.

OPPORTUNITIES	THREATS
• Prospects for producing fragrant rice for the high-end domestic market.	• Quality of rice produced does not match characteristics in demand.

3.1.6. Processors and exporters

87. Rice processors are members of the MRF, a platform created in 2012. MRF leaders successfully promoted a huge increase in rice exports to China; exports rose from very little in 2010 to 752,000 t in 2012 and 813,000 t in 2017, beyond the trade occurring at the border. MRF is working with other stakeholders to improve the benefits for farmers in producing rice. The president of the federation stated that his number one concern was that farmers were uninterested in commercializing rice and thus neglected rice production. In 2018, a forum organized by MRF recommended that the floor price for paddy at the farmgate should be 5,000 kyats per basket.

88. Rice millers collect paddy from January to May, although some may collect paddy year-round in locations with dry-season paddy production. Rice millers generally have no control over the quality of paddy procured, unless they have entered into a contract with farmers. Procured paddy has a high moisture content, the grain of different varieties is mixed, and the grain is contaminated with foreign matter such as stones, straw, and dirt. Most rice mills lack sufficient storage at the factory site, especially when several farmers arrive at the same time to sell wet paddy. The maximum duration of storage is estimated at 3–4 months. For rented warehouse facilities, owner requests payment each semester. The high moisture content of paddy implies the need for large drying units, which are lacking in most rice mills.

89. Medium-sized rice mills cope with these problems by relying on the clusters of small mills that de-husk paddy and produce raw rice, which they sell to the medium-sized mills for polishing and final treatment. The production of raw rice for the domestic market accounts for up to half of all transactions by rice mills. The fact that raw rice comes from numerous small mills increases the number of intermediaries between farmers and final consumers, but because these mills are located closer to production sites, they offer the opportunity to avoid transporting unhusked paddy from farmers to millers. On average, each large rice mill procures 30,000 t of paddy per year; 50–70% of that volume comes from farmers and the rest from intermediaries.

90. Paddy quality is controlled before milling begins. Small equipment is used to gauge moisture content and test for the percentage of broken grains, and the paddy is visually examined for purity, foreign matter, chalkiness, black spots, and color. Millers truck the milled rice to buyers. Transporting 1 t of paddy from the mill to Yangon costs around 10,000 kyats, and from the mill to Muse near the Chinese border costs 76,000 kyats.

91. The number of rice mills and the availability of high-quality rice mills have increased in recent years. As of 2016, Myanmar had about 140 high-quality rice mills with complex operating units such as color sorters, destoners, friction polishers, abrasive whiteners, and so on (Table 11). All rice mills visited for this study were established after 2009, with more investment in higher-quality mills after 2011. The

processing capacity of the modern rice mills visited in Yangon was 5–6 t/hour (equivalent to 50–60 t/day or less than 20,000 t/year), which is relatively small compared to mills in competing countries.

Table 11. Numbers and types of rice mills, Myanmar

	QUALITY RICE MILLS		25–35% BROKEN		RICE HULLERS		TOTAL	
	Number	Capacity (t/day)	Number	Capacity	Number	Capacity	Number	Capacity
Ayeyarwady	139	4,495	448	11,159	3,927	19,804	4,514	35,458
% of Ayeyarwady	73%	58%	77%	100%	34%	48%	37%	59%
Rest of Myanmar	190	7,809	585	11,187	11,546	41,272	12,321	60,268

Source: MRMA.

92. The Myanmar Rice Millers Association (MRMA) has categorized rice mills by size. Nearly all of the rice mills in Myanmar (99.2%) are either very small mills with a capacity of less than 2 t/day (more than 91.5%) or small mills capable of processing 15–40 t/day (7.3%). The high-end mills include medium-scale mills processing 40–100 t/day (107 units or 0.6% of all mills) and large-scale mills processing over 100 t/day (20 units or 0.1% of all mills). Six mills produce parboiled rice specifically for export. In general, head rice recovery is 46–54%, broken rice is 11–15%, bran around 7–10%, and husks 22–25%.

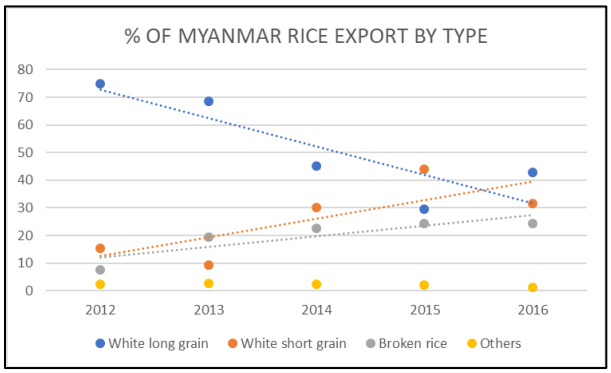
93. A modern rice mill may cost US$1.2 million for two lines consisting of an ordinary rice mill processing 5 t/hour and a polisher processing 5 t/hour. This investment excludes the cost of land, which was estimated at US$50–60 per square meter. The total working capital for a large rice miller depends on the number of cycles. Some rice mills buy, store, and sell once per season and thus require a large amount of working capital, up to US$5 million, of which 70% is loaned at 12% interest. Some mills opt for several cycles of buying and selling without storage, so their working capital needs are lower. In such cases, working capital of US$1 million may be used to procure 5,000 t of paddy, and the cycle starts again after it is sold. Rice millers adopting this system pay a higher price for paddy on average (US$210/t), owing to the seasonality of market prices of paddy. On the other hand, rice millers opting to store paddy can buy the maximum amount at harvest time at a lower price (US$175/t) but must pay the interest on loans for working capital and the costs of storage.

94. For exporters, the government has set a unique tax of 2% of revenue in 2015. Rice millers report margins of 4–6.5% before taxes. Rice is either exported from Myanmar through the border with China, Thailand, India, and Bangladesh or through “normal trade” via sea freight from Yangon to countries in Africa, the Middle East, Europe, and elsewhere in Asia. Data from the Ministry of Commerce show rice exports of 3.5 million tons in 2017/18, of which 1.8 million tons were exported through border trade and 1.7 million tons through normal overseas trade. USDA reports that during the 2016/17 rice campaign, exports were 1.6 million tons, down from 1.68 million tons in 2013/14, 1.73 million tons in 2014/15, and 1.8 million tons in 2015/16. The share of border trade in rice exports has decreased from 900,000 t in 2013/14 to 600,000 t in 2016/17.

95. The government and MRF rice export targets were 2 million tons for 2016/17 and 4.8 million tons for 2020. Exports of white long-grain rice were 68–72% of Myanmar's rice exports in 2012/14 but fell to 30% in 2015/16, when flooding damaged production, and rose to 43% in 2016/17 (Figure 39). At the same time, exports of white short-grain and broken rice have been rising; each accounted for 30% of exports in 2016/17. China, Belgium, and Indonesia are the main destinations for broken rice.

96. Processors' main concerns are to increase access to finance and markets. Currently, they pay 12% on loans from local banks, while their competitors from Thailand and China benefit from lower interest rates in their home countries. Concerns over logistics are related to delays at Yangon port, where traffic is poorly organized. Trucks are often halted by several tolls and then must work at night because containers circulate during the day on the roads. Processors would also like to improve their equipment and scale up to achieve higher efficiency, especially now that the market is moving toward China, which requires rice of higher quality compared to the West African export market.

Figure 39. Rice export trends, 2012–16, Myanmar



Source: Ministry of Commerce.

97. Table 12 summarizes results of the SWOT analysis for rice millers and exporters.

Table 12. SWOT analysis for millers and exporters, rice value chain, Myanmar

STRENGTHS	WEAKNESSES
• Chinese market is opening. • Willingness of the government to support the sector. • Possible scalability of rice mills, from medium to large. • Has specific target of 4.8 million tons of rice exported in 2020.	• Too many low-quality rice mills, resulting in low ratio rice/paddy. • Reliance on nonrenewable energy to run rice mills. • Lack of organization at Yangon port. • Lack of adequate advanced drying and storage facilities. • Lack of contract farming models which allow procurement of high-quality paddy (homogenous, high purity, high conversion factor). • High interest rate from domestic banks.
OPPORTUNITIES	**THREATS**
• Increase in quality and quantity of Chinese demand.	• Competition in the market for high-end rice from Thailand, Cambodia, India. • Competition from Vietnam on cargo rice.

3.1.7. Rice distributors

98. Rice is mostly distributed in Myanmar through two types of operators: wholesalers, which sometimes are millers, and retailers with shops at local markets. In the small number of markets visited for this study in January 2018, about 40–70% of the retailers were women. Some retailers reported being in the business since the 1980s and starting by selling a few bags of rice every day. On average, the retailers interviewed had 30–50 customers every day, each buying 10–50 kg of milled rice. The main varieties

distributed for the domestic market are Paw San, Hnan Kar, Ae Ma Tha long grain, Nga Sein, Ain Thwe Latt, and Sin Tu Kha. Competition is becoming stronger as many new operators are entering the business.

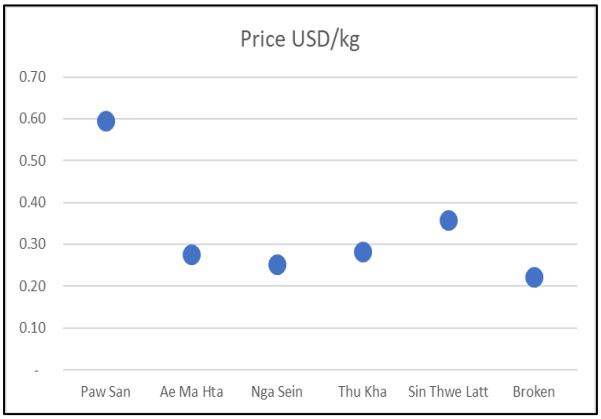
99. Retailers have to establish confidence in business relations with wholesalers, which often means that they work with only a limited number of trusted suppliers. Most retailers cannot access formal credit from commercial banks and rely more on suppliers to delay payment by 1–2 weeks. On average, the total investment for small retailers is estimated at US$7,500, but the investment could reach US$250,000 for wholesalers. The requirement for working capital is lower on average because the shorter cycle of the business allows retailers to use the same capital several times over. Small retailers use US$3,500–7,000, while wholesalers may have more than US$35,000 in working capital.

100. Reported margins are 1,500–2,000 kyats per 50-kg bag, which represents about 8% of the price of milled rice. The operational costs (transportation, loading/unloading, and handling) are estimated at 1,500–2,500 kyats per bag. Rice prices vary greatly by variety (Figure 40).

3.1.8. Consumers

101. The economy of Myanmar is undergoing structural changes with the opening of the country to foreign investors. More young people are attracted to employment in urban areas, agriculture is shifting toward machine-oriented technologies, and food consumption patterns are diversifying with the shift from rice to other types of food. Reflecting the diversification of diets, between 1989 and 2015, the average household expenditure on rice dropped from 33% to 13% in rural areas and from 22% to 10% in urban areas (Figure 41).[10] Domestic consumption of rice fell slightly from 10.25 million tons in 2016/17 to 10.20 million tons in 2017/18 (USDA 2018a). In its 2030 vision, MOALI aims for total rice production of 19.4 million tons, of which 60% would be for domestic consumption (food, seed, losses). The forecast considers a reduction of 0.19% per year per person in rice consumption due to rising urbanization, increasing incomes, and thus more diversified diets. Total demand for rice for domestic consumption is expected to continue to rise, however, because of rising population growth.

Figure 40. Average retail price (US$/kg) of milled rice varieties, Myanmar



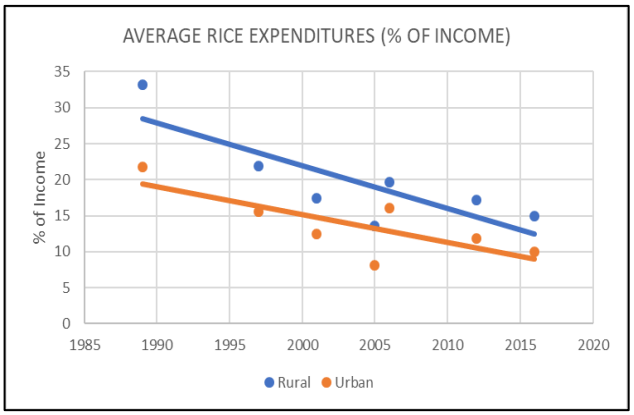
Source: Interviews for this study, January 2018.

102. Data from USDA show that since 2010, annual consumption of milled rice equivalent increased by about 100,000 t/year, from 10.10 million tons to 10.75 million tons (Figure 42). The ending stocks range between 400,000 t and 668,000 t.

[10] An exception occurred in 2007/08, when the global food crisis led to higher prices of staple foods.

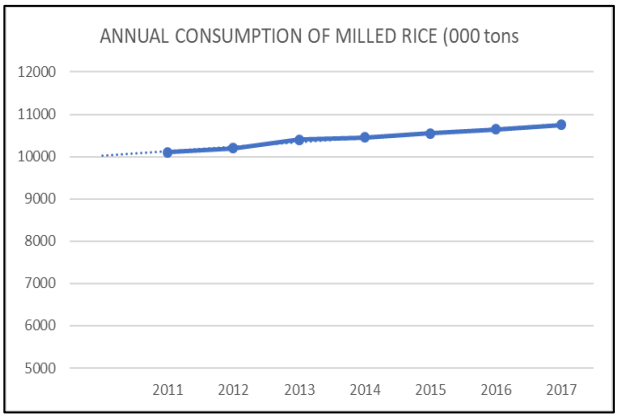
103. In recent years, rice has constituted about 73% of the dietary intake for the urban population and 80% for the rural population, and has accounted for 25% of the food budget for richer households and 50% for poorer households. Average per capita consumption was about 133 kg/year in urban areas and 164 kg/year in rural areas (CSO 2015 and Theingi Myint et al. 2016). On aggregate, this level of consumption corresponds to a requirement of 2 million tons for the urban population and 6 million tons for the rural population. Levels of rice consumption appear very similar among urban and farm households, independent of income brackets and farm size, although poorer landless households in rural areas tend to consume more rice than their peers with higher incomes.[11] The government policy of maintaining a low rice price (in effect until recently) favored poor consumers but hurt rice farmers. In early 2018, the government with rice stakeholders set a floor price for paddy of 5,000 kyats per basket.

Figure 41. Average expenditure on rice as a percentage of household income, 1989–2016, Myanmar



Source: Author, based on data from CSO 2015 and Theingi Myint et al. 2016.

Figure 42. Annual consumption (000 t) of milled rice equivalent, 2011–17, Myanmar



Source: USDA.

104. At one time the government was experimenting with rice fortification to tackle micronutrient deficiencies, which are a risk owing to the dominance of rice in local diets. Fortification was considered a better option to prevent micronutrient deficiencies than the promotion of animal products, pulses (already a part of local diets), fruits, and vegetables. The main target population for fortified rice lives in rural areas and consumes their own production, however, so they are not likely to benefit from fortified rice. Only a portion of urban dwellers and a few rural farmers who are net sellers of rice could benefit from this option.

105. On the other hand, consumption of meat and other animal products is increasing in Myanmar. Consumption of chicken meat (currently 6 kg per person per year) increased by 15% from 2012 to 2014 (FAOSTAT). Domestic producers supply only 50% of the demand for dairy products. The production of

[11] Landless households in rural Myanmar account for 30% of households.

crops such as maize and soybeans to ensure a sufficient quantity of animal feed could become an interesting alternative for farmers.

3.1.9. Enabling environment

106. The enabling environment for the rice value chain in Ayeyarwady includes a series of institutions and services, many of which also influence the pulse and bean value chains. The sections that follow provide an overview of the enabling environment for both value chains and point out aspects that are especially pertinent to rice. The aspects of the enabling environment that are particularly relevant for pulses and beans are covered in Section 4.1.6.

107. ***MOALI.*** The DOA, DAR, and Agricultural Mechanization Division are the closest subdivisions of government that farmers may access from their production sites. At the regional level, DOA has several divisions (Agricultural Extension, Agricultural Mechanization, Seed, Irrigation, Water Resource Utilization, and Land Use). Each has its specific role, but in general DOA is the main body responsible for extension services (promoting adoption of technical packages, including mechanization and modern inputs), as well as seed production, inspection, and certification. DAR is the institution responsible for agricultural research and innovation. DAR produces all foundation and pre-basic seed and maintains a collection of traditional rice varieties that could be introduced to the international market as Myanmar-specific products. MOALI is responsible for increasing and improving rural infrastructure, mainly for irrigation (dams, river pumping, tubewells), drainage, and flood protection (embankments). Recently, the Agricultural Mechanization Division has promoted the increased use of farm machinery for agricultural production and post-harvest tasks.

108. ***Financial services.*** Large stakeholders such as rice millers and exporters generally have better access to financial services than smallholder farmers and small traders. More banks are willing to loan to rice millers, as they are more likely to have the types of collateral required by lenders. On the other hand, farmers and farmer associations cannot meet their needs for finance because of the collateral constraints.

109. MADB, an entity under the control of the Ministry of Planning and Finance, is the main source of loans for rice farmers. The bank grants loans of 150,000 kyats per acre to farmers having less than 10 acres. Farmers with larger holdings may receive no more than 1.5 million kyats. In total, MADB allocates about 1 trillion kyats (US$700–750 million, depending on the exchange rate) to smallholder farmers every year.

110. The starting point for farmers to obtain credit is the village credit authority, which analyzes farmers' request for loans according to the size of their landholdings. To benefit from the credit, farmers have to form an association of at least three households, which will be mutually responsible for repaying the loan. (In the 2018/19 season, MADB started offering loans to individuals and not just associations.) The loan ceiling is 150,000 kyats per acre for the monsoon season and 100,000 kyats per acre for the dry season, for a repayment period of 6 months. The interest rate was 8.5% per year as of 2017/18 and was to be reduced to 6.5% per year in 2018/19. The operationalization of MADB loans remains a challenge for farmers, because loan disbursements are often late. Farmers turn to informal lenders (with interest rates

reaching 72% per year) to accommodate their credit needs and then use the MADB loan to repay the prior credits with high interest rates.

111. The repayment rate for MADB loans is relatively high (above 95% based on data from 2012/13), but the process of recovering loans in default is quite cumbersome. MADB requires farmers to have a land title to access loans, and the loan recovery process involves the court and administration departments. MADB will initiate that process only after exhausting all other possible ways to recover the credit, which could take several months. In 2017, the management of MABD was transferred to the Ministry of Planning and Finance from the Ministry of Agriculture. An assessment made by LIFT and the World Bank in 2012 highlighted several weaknesses of MADB, among them the concentration of its portfolio on the working capital for smallholder rice farmers, the lack of prudential norms in delivering credit, and the difficulty faced by MADB staff in managing and monitoring loans to hundreds of thousands of farmers without adequate information technology.

112. Table 13 summarizes the results of the SWOT analysis for the credit sector.

Table 13. SWOT analysis for the credit sector, rice value chain, Myanmar

STRENGTHS	WEAKNESSES
• Existence of special bank for agriculture. • Strong support from the government through MOALI. • Covers most of the agricultural zones within the country. • Repayment based on community mutual responsibility. • Easy.	• Loan limited to smallholder farmers and to working capital vs. investment. • Lack of diversification of loan portfolio to agricultural activities other than rice production. • Control of MOALI over MADB financial operations. • Subsidized interest rate may result in poor financial viability for MADB.
OPPORTUNITIES	**THREATS**
• Demand for loans in agriculture is increasing. • Development of the entire value chain will result in even higher demand.	• Loan subject to uncertainty from climate change, pest attack, and disease. • Removal of subsidy will bring interest rates to the market level, but will discomfort farmers.

113. ***Ministry of Commerce***. The Ministry of Commerce through Myanmar Agricultural Produce Trading has set an objective of supporting agriculture to diversify and improve the quality of agricultural raw materials and processed products to increase export potential and competitiveness. The Ministry of Commerce is working to reduce barriers to international trade by providing tax incentives to exporters and importers. In 2013, it established the National Export Strategy (NES) with support from local stakeholders and foreign donors. The NES, which is implemented by Myanmar Agricultural Produce Trading, aims to reduce the trade deficit of Myanmar by diversifying exports, supporting private sector involvement in trade, promoting export processing zones, reducing trade barriers, and simplifying procedures for exporting products and importing inputs. The rice value chain is a priority for NES.

114. Other departments at the Ministry of Commerce also contribute to the efficiency and performance of agricultural value chains. The Directorate of Trade is responsible for company registration, delivery of the certificate of origin, trade policy and regulation, trade facilitation, and trade liberalization.

The Department of Commerce and Consumer Affairs issues export and import licenses, checks products at borders, and ensures fair competition and consumer protection.

115. ***Other ministries.*** The Ministry of Industry and Ministry of Health are also involved in agribusiness value chains. The Ministry of Industry licenses and registers industrial units. The Ministry of Health focuses on quality control for agricultural products and supports delivery of the HACCP certification.

116. ***Logistics.*** Since 2012, more trucks have crossed the border into Myanmar and more shipments have arrived from overseas because of increased imports of agricultural products. Transporters encounter delays in loading and unloading as well as difficulties in managing containers. At the same time, more foreign logistics companies are entering the Myanmar market, resulting in stronger competition. Train freight transportation exists and is easy to use, but it takes more time than truck transport at comparable costs. For example, moving 1 ton of product from Yangon to Mandalay costs 27,000 kyats for a two-day trip by truck, 24,000 kyats for a 3-day trip by train, and 20,000 kyats for an 8-day trip by barge. It seems that entrepreneurs in Myanmar do not benefit from the low cost of nonroad transportation, even though road transportation has several drawbacks. Government policy on toll fees is not transparent. Many tollgates do not have regular standardized fees (for example, along the route from Yangon to Mandalay). At some checkpoints, transporters spend a long time in the queue waiting to pass through the tollgate.

117. Recommended improvements in transportation include the increased use of information and communication technology (ICT) to reduce costs and save time. For example, Myanmar customs now uses online computer software (MARS) to manage customs clearance. Road conditions should be improved in many parts of the country, especially from Yangon to Pyay, Mon, Ayeyarwady, Mandalay, and Shan State. Lastly, the government should invest in reducing congestion at Yangon port.

118. ***Professional organizations.*** The MRF, created in 2012, aims to support and strengthen the Myanmar economy through the development of the rice industry. As the main intermediary between stakeholders in the rice subsector and the government, MRF is the main interlocutor of the government on rice sector development and provides policy recommendations to the government. MRF encompasses and advocates on behalf of several subsectoral associations, including MRMA (rice millers); the Myanmar Rice and Paddy Traders Association; the Myanmar Paddy Producers Association; the Myanmar Farmer Association; the Myanmar Fertilizer, Seed and Pesticide Entrepreneurs Association; and the Rice Specialization Companies.

119. The MRF supports small farmers to shift from subsistence to commercial farming through the implementation of contract farming, the creation of commodity exchange and wholesale markets, and the promotion of mechanization. MRF also works with rice millers to further improve their performance, diversify production, and increase efficiency through the use of renewable energy (for instance, selling electricity produced from rice husks). On the market side, MRF is active in expanding Myanmar exports through government-to-government, business-to-business, and public-private partnership approaches and in disseminating technical, market, and price information to its members.

3.2. Adding Value to the Rice Value Chain

120. Three main factors are critical for upgrading and adding value to the rice value chain: (1) improved availability and access to new seed and varieties; (2) improved quality to increase the competitiveness of Myanmar rice in regional and global markets; and (3) improved efficiency in rice milling.

3.2.1. Improved availability and access to new seed and varieties

121. Farmers will need better access to seed of a greater range of improved varieties if the rice value chain is to meet new demands from domestic and international consumers. Local consumers, especially urban and young people, are demanding more ready-to-eat, rice-based meals. Myanmar used to sell low-quality rice to African and some European countries that preferred 25% broken rice, but the current strategy is to focus on Chinese and European markets that prefer high-quality rice.

3.2.2. Improved quality to increase competitiveness in regional and global markets

122. For rice from Myanmar to compete in regional and global markets with rice from countries such as Cambodia, Thailand, and Vietnam, farmers will need to switch to rice varieties with characteristics that the market demands (especially higher quality). At the farm level, the use of certified seed may increase rice quality as well as profitability. Paw San is a fragrant rice with particular potential in local and global markets. It has an aroma and taste similar to Indian basmati and Thai jasmine rice and received an award in 2011 for best quality worldwide.

123. Improvements in quality must be accompanied by attention to food safety. The increasing mechanization of post-harvest operations results in more homogenous paddy, but the lack of drying and storage facilities still exposes paddy to impurities (foreign matter) and increases the proportion of broken grains. Lack of an integrated pest management approach could also increase pesticide residues in paddy and preclude export to high-end markets with more strict food safety requirements.

124. Quality is also compromised because the standard practice of traders is to assemble a mixture of paddy varieties from a multitude of small farmers by the truckload or in warehouses in villages and townships. The paddy is sold directly to wholesalers and millers without adding any value (drying, grading), and there is no quality-based price.

125. A move toward more vertical integration would increase efficiency as well as quality in rice production. It could take the form of contract farming, in which rice millers and wholesalers provide quality seed and inputs to ensure that farmers' produce has the specific characteristics demanded by the market.

3.2.3. Improved efficiency in rice milling

126. Ayeyarwady has about 4,514 rice mills of different sizes, but only 139 (3%) can process paddy into high-quality rice, and 9% produce medium-quality rice. The ratio for the entire country is even lower (1.5% and 5%, respectively). Investments to improve the quality and capacity of rice mills are required for Myanmar to compete effectively in the global rice market and reach a more diverse clientele. Modern rice

mills are more efficient—their processing yields and the quality of the output are higher—and allow millers to benefit from economies of scale in rice processing. By delivering a more homogenous product, these mills improve compliance with market requirements.

127. Improving the efficiency of milling operations requires attention to a number of issues in the post-harvest segment of the value chain: the need for medium and long-term financing; greater capacity of managers to plan paddy procurement, storage, and sales; and affordable electricity. MADB could reorganize and then propose a new financing line of credit for large investors. Investors could also tap into international development finance and equity investment firms such as InfraCo, DEG (the German Investment Corporation), and FMO (the Dutch Entrepreneurial Development Bank). Because most suppliers of rice in Myanmar are smallholders, modern supply chain management information systems are required to plan the supply and storage of raw materials. This approach involves contract farming, which would result in lower production costs and improved market access for farmers, and on the other hand would supply homogenous output for rice millers. This system would also reduce the number of intermediaries, which would further contribute to higher prices for farmers. Electricity production of up to 2–3 megawatts is feasible from rice bran. The power plant would supply electricity to the rice mills but could sell electricity to neighboring villages during off-peak hours.

3.3. Distribution of Benefits in the Rice Value Chain

128. In analyzing the distribution of benefits in the rice value chain, six hypotheses were tested:

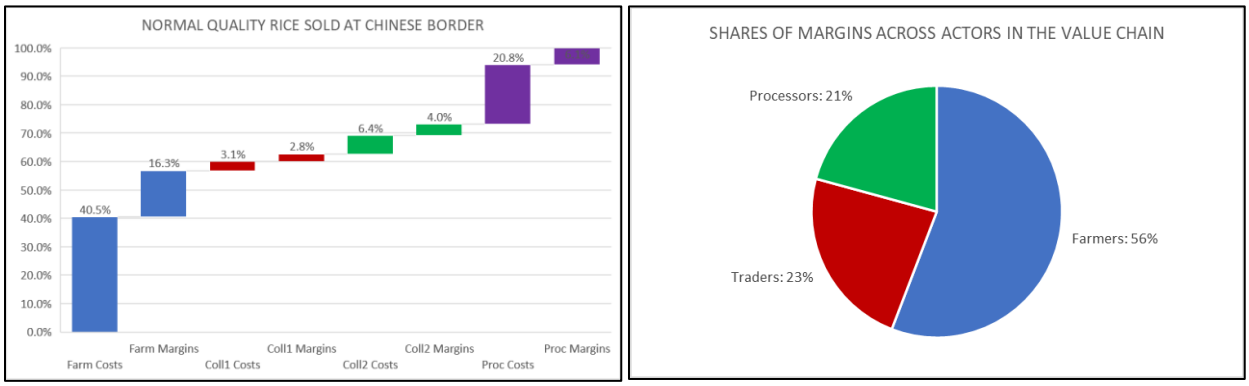
1. Traders' margins are much larger than farmers' margins (rejected).
2. Farmers are exploited by all other value chain actors (rejected).
3. Many layers of intermediaries exist between farmers and consumers (accepted).
4. Traders' capital turnover is high (accepted).
5. Logistics costs are very high (accepted).
6. The quality of demand matches the quality of supply (rejected).

129. The analysis is based on the price structure for 1 ton of paddy sold through the border trade at Muse (to Yunnan, China), the domestic market for low-quality rice (such as Nga Sein), and the domestic market for high-quality rice (Paw San). Farm production costs and margins are calculated from the primary data collected in Ayeyarwady by the World Bank in 2017/18. Estimates of other costs and margins are based on average prices recorded from interviews with key informants in January 2018, including the president of the MRF, rice millers in Bago and Yangon, and rice traders and distributors in the main rice exchange market and smaller markets close to Yangon. Other data were supplied through interviews with wholesalers and discussions with traders at the wholesale market in Yangon.

130. For rice sold at the Chinese border, the quality requirements of Chinese consumers are key. These exports are mostly informal. In some cases, Myanmar rice millers receive advance payment from importers and act as their agent in collecting and milling paddy. There are no standards for rice sold at the border, but the percentage of broken rice, grain length, and other characteristics of the milled rice are predetermined by the buyers.

131. The average export price for Myanmar rice was $572/t in 2017, but the price varied considerably based on quality, surpassing $700/t for high-quality rice exported to Bangladesh, the European Union, Ivory Coast, and South Africa but falling to $259/ton for broken rice exported to the European Union and some African countries. No data were available on costs and margins for specific types of rice. Figure 43 shows the distribution of benefits in the value chain for normal-quality rice sold at the border (Muse).

Figure 43. Distribution of benefits in the rice value chain for rice sold at the border (Muse)



132. The distribution of benefits in the domestic rice value chain differs for normal-quality rice (Figure 44) and high-quality rice (

133.

134.

135. Figure 45). Farmers selling high-quality rice in the domestic market receive margins that are 30% higher than those obtained by their peers selling normal-quality rice. Farmers selling normal-quality rice earn about 33% ($69/t) of the final value of the rice, while those selling high-quality rice (Paw San) obtain 36% ($94/t) of the final value.

Figure 44. Distribution of benefits in the rice value chain for low-quality rice sold in the domestic market

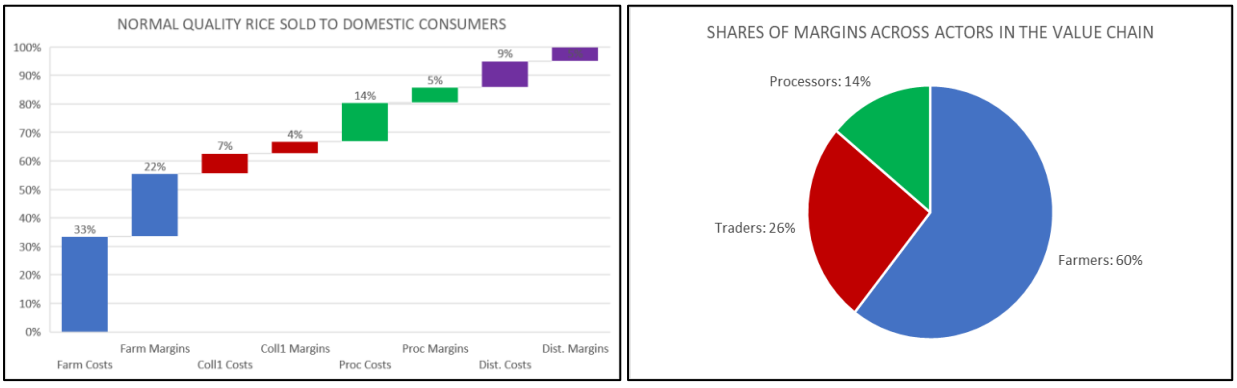
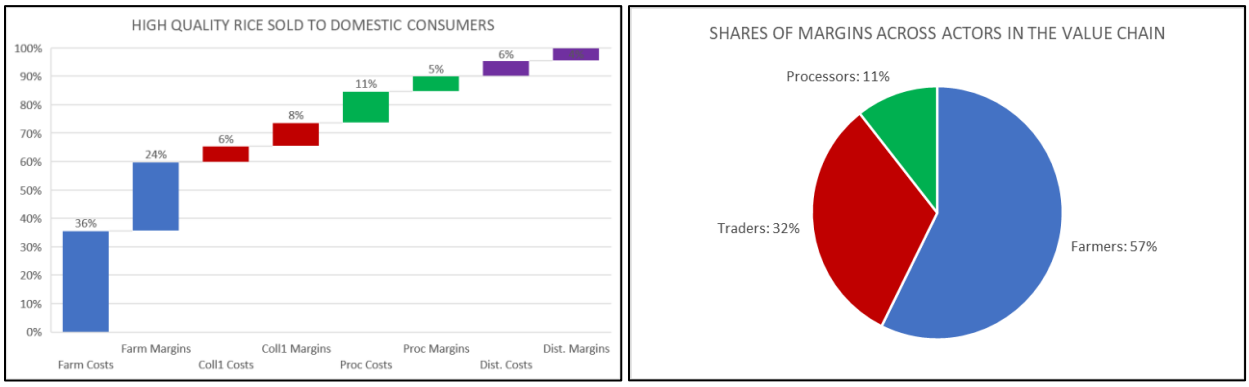


Figure 45. Distribution of benefits in the rice value chain for high-quality rice sold in the domestic market



136. Among all of the rice value chain actors, farmers gain the highest share of the margins (56–60%), although farmers also bear the highest costs: production costs range from 33% of the final milled rice price for low-quality rice to 40.5% for normal-quality rice. Farmers are better off producing high-quality rice such as Paw San, which could sell for twice as much as low-quality rice in the domestic market. On average, the final price for low-quality white rice such as Nga Sein is $309/t, the price of long-grain white rice sold in Muse at the Chinese border is $340/t, and the price of Paw San sold for domestic consumers is $387/t.

137. In analyzing the share of margins, data for traders of paddy and traders of milled rice were aggregated, even though these two types of traders occupy different position in the value chain. (For example, larger collectors may use assemblers at the village level, who may work on commission.) Overall, traders receive 23–32% of the total margins; the lowest is for rice sold at the border and the highest is for Paw San. For rice sold at the border, processors receive 21% of the margins, since they get all the value-added from processing and exporting. Processors also get a higher final price from the informal Chinese importers and incur lower financial costs, since the buyers give a cash advance to purchase the produce. Transaction costs are also reduced because processors do not have to incur medium-term or long-term storage costs.

138. The first hypothesis (that traders' margins are much larger than farmers' margins) is rejected because farmers generally obtain the highest margins in the rice value chain (56–60%). Since the size of their production units is small, however (5.9 acres on average), farmers' overall net margins are low, ranging from US$328/farm for low-quality rice to US$550/farm for Paw San.

139. The second hypothesis (farmers are exploited by all other value chain actors) can be accepted when analyzing gains per unit. With an average 1,000 t collected per unit, one trader may expect net margins of up to US$45,000, which is 100 times higher than the net gain of one farm. Similarly, a miller operating a modern mill processing an average 20,000 t of rice per year would expect to get margins of US$350,000–400,000, which is 1,000 times higher than the net margin of one farm.

140. The third hypothesis (many layers of intermediaries exist between farmers and consumers) is accepted. At a minimum there are two intermediaries in the value chain—one on the paddy side, and another at the milled rice side—who reduce the price paid at the farmgate. Currently very few farmers contract with rice millers/exporters, which would reduce the numbers of intermediaries.

141. The fourth hypothesis (traders' capital turnover is high) is accepted, even though traders are able to conclude several cycles of buying and selling during each season. Given the amount of paddy involved, however, their capital turnover is high.

142. The fifth hypothesis (logistics costs are very high) is accepted, especially in the case of storage and export, which results in higher costs for exporters. As noted, sales at the border result in lower margins for processors, because prices are set by Chinese wholesalers. Myanmar processors would be able to get higher margins if they could identify adequate export markets for high-quality rice such as Paw San.

143. Finally, the sixth hypothesis (the quality of demand matches the quality of supply) is rejected. Myanmar produces low-quality rice for the international market, even though it has potential to produce higher-quality varieties comparable to those marketed internationally by Thailand and India.

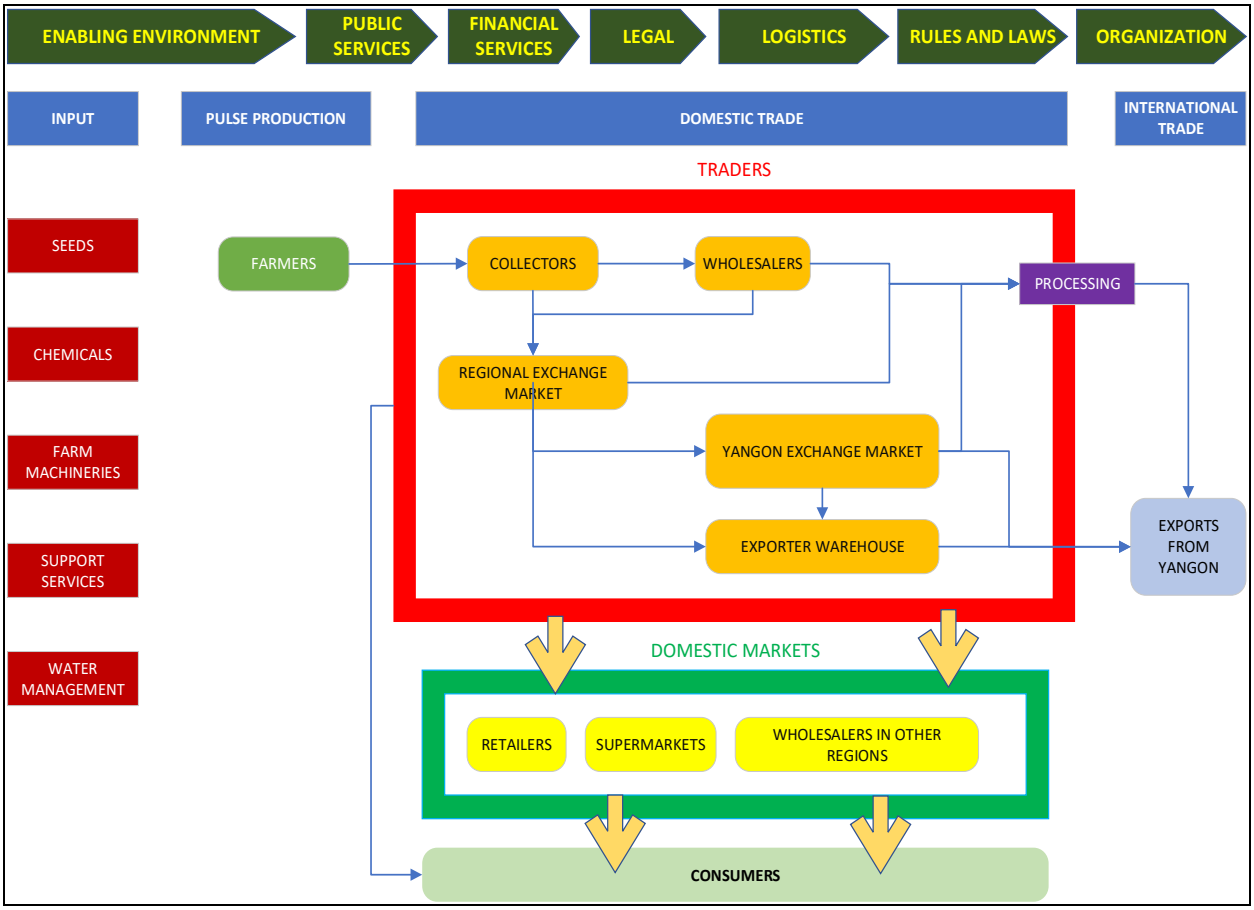
4. Elements of the Pulse and Bean Value Chain and Prospects for Adding Value

144. This section maps the value chain for pulses and beans in Ayeyarwady, Bago, and Sagaing—the seed sector, input suppliers, farmers, traders and exporters, and processors—and describes the enabling environment for the value chain. The discussion focuses on the strengths, weaknesses, opportunities, and threats pertinent to each element in the chain and recommends pathways to improve performance.

4.1. Mapping the Pulse and Bean Value Chain in Ayeyarwady, Bago, and Sagaing

145. Figure 46 presents the value chain for pulses in Ayeyarwady, Bago, and Sagaing. The chain encompasses intermediaries from input suppliers to exporters, passing through the regional and Yangon pulse exchange markets. Processing is very limited and serves both the export market (split chickpeas) and the domestic market (noodles and sprouts, among other products).

Figure 46. Elements of the pulse and bean supply chain in Ayeyarwady, Bago, and Sagaing



Source: MPBSMA 2013.

146. The domestic market involves several agents, including farmers, collectors, small and large wholesalers, retailers in local and urban markets, and the pulse exchange markets in Monywa (for Sagaing) and Yangon (for Ayeyarwady and Bago). Yangon consolidates exports, including exports to India, and Mandalay is the hub for exports at the borders, which move overland by road. The international and the domestic prices of green gram, black gram, and pigeonpeas are closely linked.

4.1.1. Seed sector

147. Use of improved seed for pulse production is very low, due to the lack of certified seed in the market and farmers' unfamiliarity with the advantages of using quality seed. During the 2014/15 production season, less than 0.5% of the black and green gram area was sown with high-yielding pulse varieties. A somewhat greater share of the pigeonpea and chickpea area (2.15–2.75%) is sown to high-yielding varieties. The total quantity of pulse seed available for the 2014/15 campaign was 200 t, equivalent to a total sown area of 4.5 million acres. Interviews for this study included a group of farmers in Monywa who multiplied seed; they report receiving registered seed from DOA sufficient to sow 60 acres. In 2016/17, the group produced 16 t of certified seed and increased production to 26 t in 2017/18. Profits from seed multiplication are about 15–20%.

148. DAR farms produce breeder seed for pulses and beans, from which DOA and DAR produce foundation and improved seed. Farmers assess the quality of this seed to be poor, however, noting its lack of homogeneity and labeling.

149. Table 14 summarizes results of the SWOT analysis for seed producers.

Table 14. SWOT analysis for seed producers, pulse and bean value chain, Myanmar

STRENGTHS	WEAKNESSES
• Increasing demand for certified seed. • Existence of seed law.	• Insufficient production of registered seed by DAR/DOA. • Farmers are not fully aware of the advantages of using certified seed. • High use of seed saved from own harvest. • Poor technical capacity of farmers in pulse production (most use traditional methods). • Lack of technical and financial support from the government for seed producers and the private sector. • No regional facilities for seed certification and laboratory testing. • No marketing information on seed distribution and use. • Private sector is unwilling to enter the seed production and distribution system. • Relatively weak political will: No DOA involvement in building capacity of seed producers and associations. • Lack of interest in seed processing services.
OPPORTUNITIES	**THREATS**
• Attracting international seed companies for pulse seed production (e.g., hybrid seed). • Implementation of crop insurance program for seed producers. • Cooperation with international research centers.	• Illegal introduction of seed through the border; no quarantine.

4.1.2. Input suppliers

150. Input suppliers do not sell high-quality and high-yielding seed of pulse varieties. If any seed is available for sale to farmers, it consists only of selected grain. Foliar fertilizers are commonly used inorganic fertilizers. Farmers reported a huge need for pesticides; they treated their pulse crops several times and often were confused about which treatment to adopt.

151. Table 15 summarizes results of the SWOT analysis for input suppliers.

Table 15. SWOT analysis for input suppliers, pulse and bean value chain, Myanmar

STRENGTHS	WEAKNESSES
• Willingness of private sector to invest in input supply and distribution. • Collaboration with large international companies. • Same inputs and equipment are used for pulse production and rice production.	• Dominant position of two large input importers. • Informal import of low-quality inputs, without quality control across borders. • Lack of awareness in using pesticides; no dissemination of integrated pest management systems. • Use of local varieties that are unresponsive to fertilizers; low intensification means low demand for modern inputs.
OPPORTUNITIES	**THREATS**
• Myanmar could be a huge consumer of inputs: International input manufacturers are starting to invest in Myanmar. • Increased use of herbicides as labor for weed control becomes scarce and expensive. • Increased use of foliar fertilizer for pulses.	• Falling pulse prices make input use less profitable. • Reduced demand for inputs because of the high risk of crop loss from flooding, which destroys infrastructure and fields.

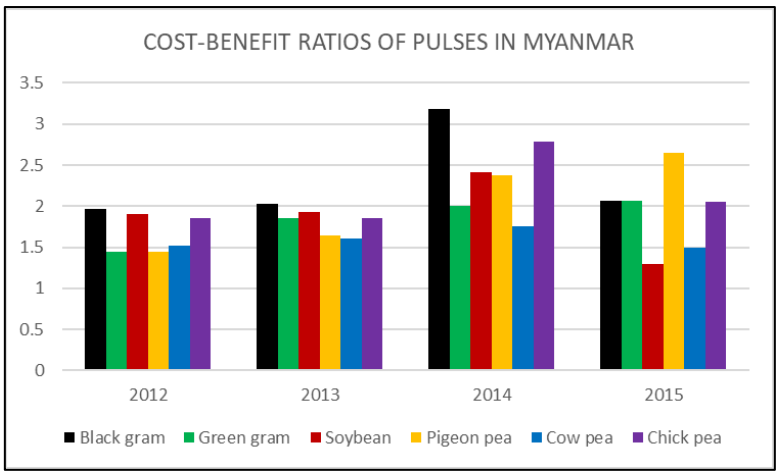
4.1.3. Farmers

152. Farmers tend to use few modern technologies, very basic traditional techniques, and simple equipment to produce pulses, which are relatively easy to grow. The lack of certified seed is one of the largest issues for pulse and bean production. Common practices include broadcasting seed, pesticide treatment, and manual harvesting. Farmers usually sell their produce to nearby traders, either collectors at the village level or larger assemblers at the closest township. Very few farmers clean or sort produce before selling it, as traders are not willing to pay a premium for such manual operations.

153. Black gram is grown during the dry season after the harvest of monsoon rice, enabling the crop to benefit from the residual moisture in the soil and ensuring that irrigation is not a limiting factor. The most common practice is to prepare the land for pulses after the rice harvest and then sow the seed, but farmers may also choose to sow black gram before the rice harvest (a technique that was common before the use of combine harvesters). Another option is zero tillage, in which farmers broadcast pulse seed directly into the rice residue left on the field. This practice, which allows farmers to reduce the turnaround time between rice and pulse crops, is used by farmers if the risk of drought is high.

154. Overall, black gram offers the highest cost-benefit ratios (Figure 47), around 1:2.00 during the four years shown in the figure and reaching 1:3.18 in 2014/15. Soybeans had the most variable cost-benefit ratio, ranging from 1:2.41 in 2014/15 to 1:1.30 in 2015/16, and cost-benefit ratios for cowpeas were the lowest overall.

Figure 47. Cost-benefit ratio for pulse and bean production, 2012–15, Myanmar



155. Because sales of pulse production plummeted in 2017/18, harvested area decreased from the usual level of 4.4–4.6 million hectares in 2014 to 3.8 million hectares in 2018/19. Production follows the same trend, dropping from 5.0–5.2 million tons in the years prior to 2018/19 to 3.8 million tons in 2018/19 (USDA 2018b).

156. Table 16 summarizes results of the SWOT analysis for pulse and bean farmers.

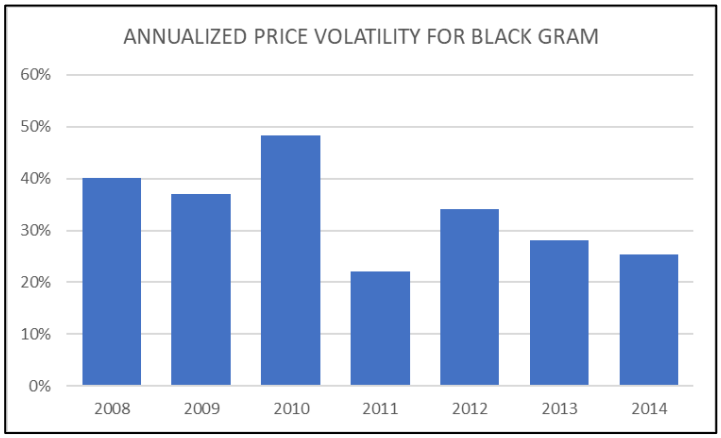
Table 16. SWOT analysis for farmers, pulse and bean value chain, Myanmar

STRENGTHS	WEAKNESSES
• Higher profitability of production compared to rice; lower cost of production reduces the need for finance. • Lower demand for irrigation water. • Improvement in road conditions. • Pulses are easy to grow. • Source of protein for domestic consumption.	• Too many varieties in the market, but all ordinary seeds; lack of certified seeds. • Lack of support from trader associations. • Lack of irrigation and drainage systems results in risk-averse behavior for input use. • Lack of technical support and services. • Not enough investment credit. • No market information available to farmers. • Lack of market intelligence to advise farmers on the type of pulses to grow. • No viable alternative crops (so far). • Farmers cannot shift to other crops across years: lack of seed, lack of production techniques, uncertainty over markets. • No government and private sector cooperation on information exchange and dissemination.
OPPORTUNITIES	**THREATS**
• Demand in the global market is increasing. • Chinese market needs to be analyzed. • Implementation of crop insurance program against climate change risks. • Export to other countries. • Shift to industrial crops (e.g., soybeans, sunflowers).	• Increasing costs of production. • More frequent floods and drought due to climate change. • Negative impact of cyclones (flooding). • Government has no clear plan for pulse value chain development.

4.1.4. Traders

157. The collector buys directly from farmers with cash payment. Prices are determined by the buyer based on an assessment of the quality of the produce (purity, moisture content, cleanliness) and the prices agreed with wholesalers. Buying at harvest is risky since pulse prices are highly volatile. For example, the volatility of black gram prices in Yangon reached a high of 48% in 2010, dropping to 22% in 2011 (Figure 48). Also, Yangon prices trail prices in Mumbai, India, which reflect changes in demand in India. In the summer of 2015, a surge in demand in India triggered increases of 70% in the price of black gram and 40% in the price of pigeonpeas in Myanmar. At the opposite end of the spectrum, India's restrictions on pulse imports resulted in a dramatic decline in prices in Myanmar.

Figure 48. Annualized black gram price volatility in Yangon, 2008–14



Source: San Thein and San San Yi 2016.

158. Sales of black gram are highest from March to April, while the sale period for green gram is more flexible, extending from January to May. About 80% of farmers sell their pulse production during these periods. Medium-sized traders buy an average 8,000 t of pulses each year; their needs for storage and transport require total investment capital of US$120,000. Their working capital need is about US$150,000, of which 50% is a loan and the rest own capital. Traders procure 70% of their supply from intermediaries and 30% directly from farmers, and they sell 100% to wholesalers.

159. Table 17 summarizes results of the SWOT analysis for pulse and bean traders.

Table 17. SWOT analysis for traders, pulse and bean value chain, Myanmar

STRENGTHS	WEAKNESSES
• Demand from China is increasing. • Farm roads are improving. • Well-managed and functioning pulse exchange market at regional level and Yangon. • Price information available.	• Lack of government support for laws, regulations, standards, and norms. • Unreliable quality of pulses: moisture, foreign matter content, purity. • High cost of procurement from thousands of smallholder farmers. • Lack of information on prices and global demand.
OPPORTUNITIES	**THREATS**
• Expansion of export to other Asian countries: diversification of clients.	• Unstable policies of India regarding pulse and bean imports.

4.1.5. Exporters and processors

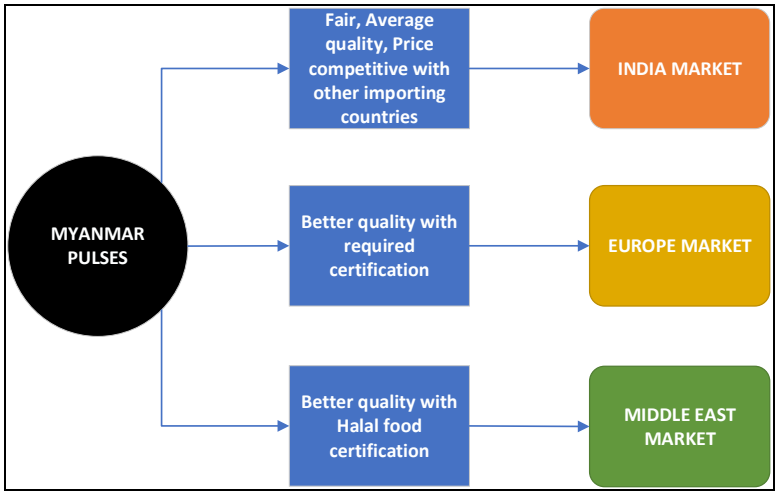
160. Exporters mainly obtain their supplies from wholesalers, who assemble pulses from collectors in zones with excess production and then sell to exporters. Some wholesalers work on commission, whereas

other are independent actors that set their own prices. The independent wholesalers have more flexibility in selling their produce but are unlikely to get a financial advance from exporters.

161. The amount of pulses and beans that is processed is relatively limited compared to the volume that is marketed. Chickpeas are split for the Indian market and used to make flour and noodles; most of the factories are in Monywa. For other pulses, processing is limited to cleaning, grading, and packaging. Processing units capable of meeting the quality and efficiency standards required to compete in the global market are rare. Most processors are still family-owned companies, conducting business in a traditional way and lacking any type of certification such as HACCP. Figure 49 describes the level of quality and certification required by various export markets for pulses produced in Myanmar.

162. Pulses are cleaned and graded before export to match ready cargo stage (RCS) specifications. During this process, losses are about 2.0–2.5%. The RCS quality for pulses depends on moisture content; percentages of seed infested with weevils, broken grain, and sister grain; and the color and the homogeneity of the grain.

Figure 49. Quality and certification requirements in export markets for Myanmar pulses



Source: San Thein and San San Yi 2016.

163. Specific certifications are required to access European and Middle Eastern markets. Myanmar should be able to comply with these requirements, but doing so will demand close collaboration between exporters, traders, and farmers. The role of the government is to establish a memorandum of understanding with each importing country that specifies the conditions for Myanmar pulses to enter the market of the importing country and ease bilateral trade.

164. In 2016/17, Myanmar exported 1.42 million tons of pulses and beans valued at US$1.40 billion. Those exports consisted mostly of black and green gram sold to neighboring countries, dominated by India and China. Black and green gram together account for about 68% of Myanmar pulse and bean exports in terms of volume and 73% in terms of value, because of the higher unit export price for black gram. Beans (kidney beans, butter beans, and rice beans) account for an insignificant share of pulse and bean exports (90,000 t) and represent only 6% of the exported volume and 3% of the value (US$45 million). Myanmar also exports 185,000 t of pigeonpeas, valued at US$160 million (11%). The difficulties faced by exporters include high transportation costs and inefficiency at Yangon port (such as inefficient management of containers).

165. Table 18 summarizes results of the SWOT analysis for pulse and bean processors and exporters.

Table 18. SWOT analysis for processors and exporters, pulse and bean value chain, Myanmar

STRENGTHS	WEAKNESSES
• Chinese market is opening. • Farmers are used to growing pulses—behavior hard to change.	• Lack of organization at Yangon port. • Lack of adequate advanced drying and storage facilities. • Lack of contract farming models for producing high-quality pulses (homogenous, high purity, high conversion factor). • High interest rate from domestic banks. • Lack of interest in government-to-government trade with India; prices too low in 2017.
OPPORTUNITIES	**THREATS**
• Market penetration strategies to secure other buyers.	• Export market depends on Indian production.

4.1.6. Enabling environment

166. Section 3.1.9 provided a general overview of the enabling environment for agricultural value chains in Myanmar. This section will emphasize aspects of the enabling environment that are most pertinent to the pulse and bean value chain.

167. ***Government institutions.*** Unlike rice farmers, pulse and bean farmers receive little government attention and support. DAR maintains a collection of traditional pulse varieties that could be introduced to the international market as Myanmar-specific products. To reduce the use of pesticides in pulse production, which in turn would reduce production costs and limit the risk of high pesticide residues, DAR could consider producing and promoting high-yielding pulse varieties that are also disease resistant. The Ministry of Commerce through the Department of Trade Promotion has published quality specifications for more than 25 varieties of pulses and beans, including the maximum percentages of foreign matter, weevil-infested seed, damaged and brown seed, sister beans/pulses, small and big seed, and moisture content. The Ministry also established the NES, which regards the pulse and bean value chain as one of its priorities.

168. ***MPBSMA.*** The Myanmar Pulses, Beans, and Sesame Seeds Merchants Association (MPBSMA) was created in 1992 to represent the interest of stakeholders in the sector. The association is active in managing and operating crop exchange (CEX) centers such as the Bayinnaung market in Yangon and centers in Pathein and Monywa. Members who are suppliers (farmers, collectors) find buyers and negotiate contracts in the CEX centers by displaying samples of their products. The management publicly displays prices (minimum, maximum) by type of product and disseminates price information by internet and phone. Trade disputes are also taken into the CEX, which works to resolve them through a working group investigation and an executive committee.

169. Prices of pulses in Mumbai are both volatile and unpredictable. From 2008 to 2010, the average price of black gram skyrocketed from a low of US$550/t to US$1,100/t, then slowly declined and stabilized around US$600–700/t from 2012 to 2014 (E*Trade 2014). Prices of black gram in Yangon closely tracked changes in Mumbai prices, and prices of pulses in Myanmar are at their lowest point in years owing to India's import restrictions. Data from USDA show that black gram prices started to slide in July/August

2016, so that by August 2018, black gram was less than US$320/t, compared to US$600–750/t in 2014/15 and over US$1,000/t in 2016/17.

170. ***Market and price information.*** Almost all stakeholders in the pulse and bean subsector say that unreliable market and price information is a challenge for them. Even though CEX centers supply price information and the private sector distributes weekly prices for various crops, price forecasting information is missing. Forecasting information is relatively costly (from 5,000 kyats per month), which limits access, especially for farmers. Farmers are the first to suffer from this lack of information, because they have to make planting decisions long before market information is disseminated (if it is disseminated at all). Traders cannot make commitments with suppliers, since prices and quantities of the important export commodities (black gram, green gram, and pigeonpeas) are determined by Indian importers. The Government of India imposed a quota on pulse and bean imports of 200,000 t in 2016/17, and in 2017/18, it set quotas on mung beans (150,000 t), green gram (150,000 t), and pigeonpeas (200,000 t). The quota for mung beans represents only 37.5% of annual production and about 30% of availability, taking 2016/17 stocks into account. The Government of Myanmar and MPBSMA are taking the lead in bilateral talks with the governments of India and other countries in the region such as Nepal, Pakistan, and Bangladesh.

171. ***Financial services.*** Unlike the rice subsector, the pulse subsector receives little attention from financial services. Pulse and bean cultivation has lower total variable costs compared to dry-season rice, so farmers can usually grow these crop with minimum cash outlays, especially if they opt for zero tillage. After India limited pulse imports in late 2017, however, pulse producers that met the criteria were eligible to receive loans of up to 100,000 kyats per acre during the dry season.

172. An assessment of MADB recommended giving more support to non-rice crops to reduce the bank's exposure to risk arising from its heavy emphasis on lending to rice producers. One difficulty encountered by MADB in lending to producers of dry-season crops is the delay in loan repayments by producers of monsoon rice. Until 2017, no members of a farmer group receiving a loan could obtain a new loan if anybody in the group had defaulted. This situation led to weeks of delay in dry-season loans. MADB started offering individual loans in 2018, so individuals who do not default will be able to apply for a fresh loan.

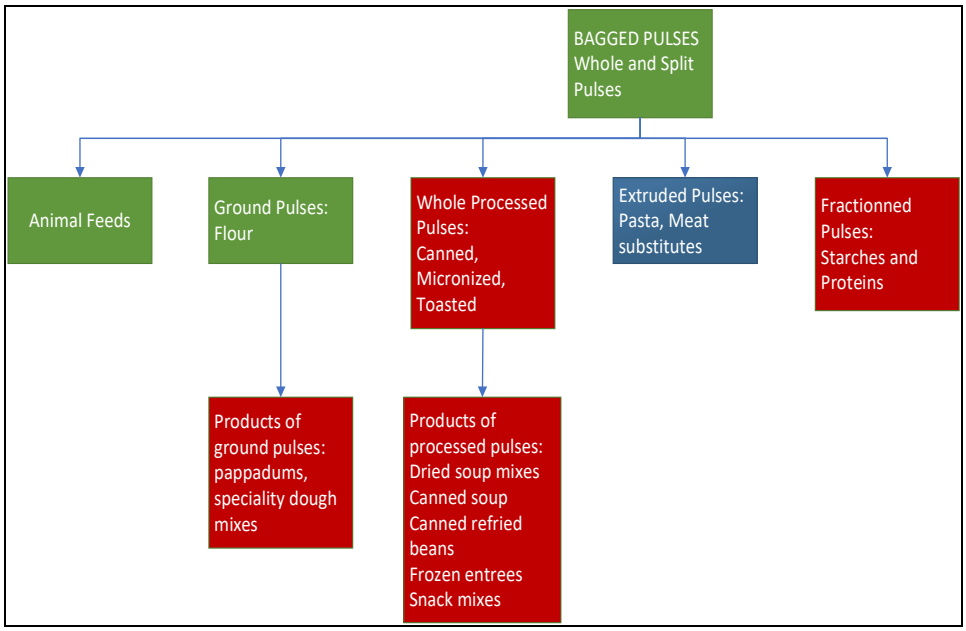
173. ***Logistics.*** Exports of pulses and beans require tens of thousands of containers, which cannot be filled with imported products, complicating the management of empty containers returning to Myanmar. For that reason, shipping companies are imposing surcharges on transportation costs, adding to the already high costs of warehousing and cargo management. Problems with logistics at Yangon port are similar those mentioned previously for rice. Facilities at Yangon port must be improved, especially given the projections of millions of tons of additional agricultural exports in the next five years.

4.2. Adding Value to the Pulse and Bean Value Chain

174. Less than 10% of pulse and bean production is processed; the rest is traded as raw material after cleaning and sorting (Republic of the Union of Myanmar, undated). Processing units for pulses and beans are limited to dry packaging, canning, soup production, and flour and powder production, but the 2015–

19 strategy to add value to pulse and bean production identifies other processing activities that could be promoted to increase exports of higher-value products. These activities include the production of noodles, meat substitutes, starch, proteins, canned and micronized beans, toasted pulses, frozen meals, and snacks (Figure 50).

Figure 50. Current and potential processing options to add value to pulses and beans



Source: Republic of the Union of Myanmar, undated.

4.3. Distribution of Benefits in the Pulse and Bean Value Chain

175. In analyzing the distribution of benefits in the pulse and bean value chain, five hypotheses were tested:

1. Traders' margins are much larger than farmers' margins (rejected, except for black gram).
2. Farmers are exploited by all other value chain actors (rejected, except for black gram).
3. Many layers of intermediaries exist between farmers and consumers (accepted).
4. Traders' capital turnover is high (accepted).
5. Logistics costs are very high (accepted).

176. Farm production costs and margins are calculated based on data collected for pulse production in the 2018 dry season (hence the negative margins for black gram). Estimates of other costs and margins are based on interviews with informants at MPBSMA and traders from the CEX centers in Bayinnaung, Monywa, and Yangon.

177. Findings differ significantly for black and green gram because of the recent drastic decline in black gram prices. For black gram, hypotheses 1 and 2 were accepted, not rejected, owing to the low market price for this crop. Farmers suffered the most, with losses reaching 20% of revenue, although traders and

exporters still obtained positive margins (Figure 51). For green gram, however, the largest share of margins went to farmers (Figure 52), who obtained small but positive margins ($66/acre, equivalent to $185/t of produce).

Figure 51. Distribution of benefits in the pulse value chain for black gram sold for export

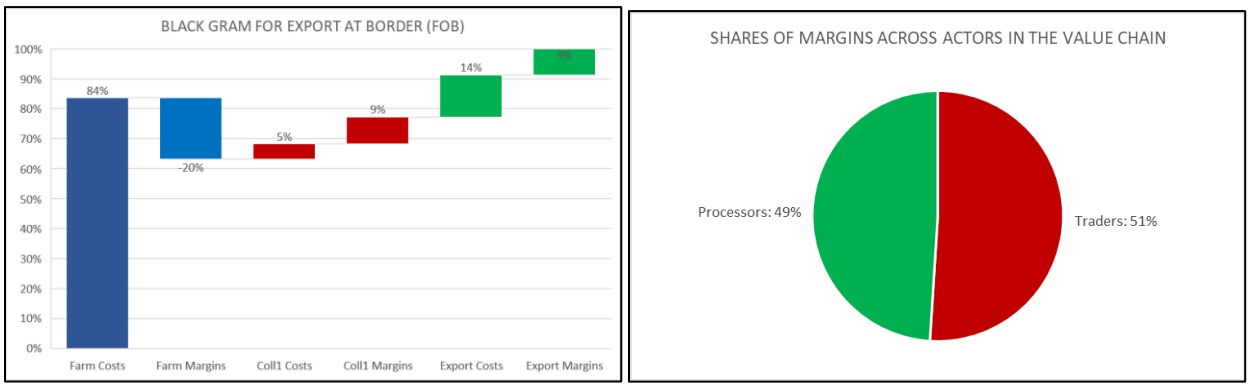
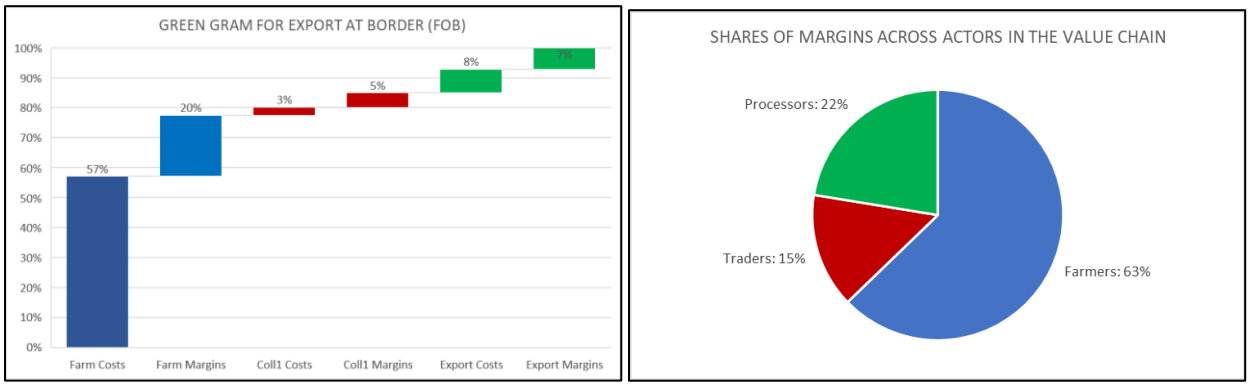


Figure 52. Distribution of benefits in the pulse value chain for green gram sold for export



178. For hypotheses 3–5, results of the analysis of benefits was similar to the results for the rice value chain. Hypothesis 3 (many layers of intermediaries exist between farmers and exporters) is accepted. Because there is no vertical coordination in the pulse and bean value chain, and farmers have inadequate storage facilities, they must sell all of their produce at harvest time. Hypothesis 4 is also accepted. Traders have high capital turnover since they are consolidating products from smallholder farmers, although pulse traders have fewer purchase/sale cycles than rice traders because of the limited length of the pulse harvest. With respect to hypothesis 5 (accepted as well), logistics costs are just as high for the pulse and bean value chain as for the rice value chain, because they involve border trade and (to a lesser extent) sea freight at Yangon port.

5. Conclusions

180. The rice and pulse/bean value chains remain important for the economy of Myanmar even as agriculture and diets become more diversified and opportunities for nonfarm employment increase. These subsectors account for the majority of the cultivated land, the value of agricultural crop output, agricultural livelihoods, food calories consumed, and agricultural trade in Myanmar. The performance of farmers who grow these crops and of the broader value chains for these commodities remains highly relevant to Myanmar's food and nutritional security as well as the competitive position of its economy.

181. The findings from the latest field survey reported here show some progress in the farm productivity and/or profitability of rice, pulses, and beans, although the magnitude is, for the most part, quite small. Farmers continue to have poor access to improved seed, irrigation services, and advisory services, and they continue to make very limited effective use of fertilizer. Between the earlier and most recent surveys, the only two significant shifts in farmers' practices is the increase in mechanization and the use of agrochemicals. Mechanization is a positive response to emerging labor constraints arising from migration from rural areas and/or increased nonfarm work opportunities. Increased use of agrochemicals is being driven by uncertainty but may also be related to labor constraints, particularly if the pattern involves increased herbicide use in place of labor for weeding. With mechanization, labor use in the production of rice, pulses, and beans is dropping sharply and contributing to much higher levels of recorded labor productivity both in physical and monetary terms. This trend, at least, is encouraging. For farmers who are not primarily land constrained—namely, farmers classified here as "medium" (2–4 ha) or "large" (> 4 ha)—it is likely that differences in labor productivity will drive future land use and farm specialization decisions.

182. The findings from the qualitative value chain assessments point to a more limited set of "strengths" than "weaknesses," although again, the emergence of a deeper market for the provision of mechanization services serves as an important outlier. Increased investment in larger modern rice mills is also an encouraging development, although a vast share of rice milling is still undertaken by many thousands of very small mills using antiquated equipment, resulting in low efficiency and a final product of poor quality. Both the internal and export-oriented logistics for all three commodities remain underdeveloped and cost more than similar logistics services in countries with which Myanmar competes. In sum, value addition in these value chains remains very modest, a major missed opportunity.

183. Shortcomings at the farm level and downstream create a vicious cycle that points to the need for multiple interventions. Low use of quality seed and the absence of effective farmer organizations create expensive transaction costs and many other difficulties for millers and traders seeking high-quality paddy, pulses, and beans. At the same time, low milling efficiencies, weak logistics, and limited value addition constrain the ability of value chain players to offer sufficient incentives to farmers to provide raw material of higher quality.

184. With effective investments in increasing productivity and improvements in the enabling environment for value chain development, Myanmar can position itself to respond well to emerging

market opportunities, both regionally and domestically. Myanmar has considerable potential to intensify production and raise yields, both without detrimental impacts on the environment. Besides increasing yields, public investment should enhance quality, including product suitability for processing and for export to high-income countries (that offer better prices). With increasing demand for plant-based protein, Myanmar has opportunities to gain from investments in safe and high-quality pulse-based products that appeal to the growing middle class and urban consumers in the region. Advancing the productivity and profitability of paddy, pulse, and bean producers will require not only increased knowledge, improved practices, and improved access to services at the farm level, but also improved value chain efficiencies to ensure competitiveness and increase the incentives for market-oriented production. Table 19 (for rice) and Table 20 (for pulses and beans) summarize the priority areas in which Myanmar can take action to seize these opportunities—diversify its trading partners, target higher-value markets, and develop its domestic markets.

Table 19. Pathways to improve the rice value chain in Myanmar

CHAIN ELEMENT	PROPOSED ACTIONS
RESEARCH/EXTENSION SERVICES	• Provide training and equipment to the Department of Agricultural Research (DAR) and Department of Agriculture (DOA) for setting up demonstrations of equipment and demonstration plots for modern technologies. • Establish a training center for equipment operation and maintenance. • Set up a quality testing lab for fertilizer, pesticide, and seed. • Work with international seed, pesticide, and equipment companies to benefit from experiences and get funding. • Provide training to small-scale input suppliers on the use of pesticides, fertilizers.
SEED MULTIPLICATION, INPUT SUPPLIERS	• Continue support of existing seed multipliers and promote the creation of new professional seed farms and seed multiplier associations. • Encourage foreign and domestic investors to increase rice seed production. • Promote contract farming between rice millers/traders and farmers for seed production. • Identify a scheme to facilitate and reduce the costs of seed certification for the domestic market. • Provide enough funding to DAR/DOA to produce more foundation and registered seed. • Provide training and equipment to DAR/DOA for seed production monitoring and certification. • Encourage local production of small equipment, and adapt it to conditions in delta areas. • Consolidate orders to benefit from economies of scale in importing farm machinery and inputs. • Use information and communication technology (ICT) to support traders and farmers.
RICE PRODUCTION	• Promote contract farming between rice millers/traders and farmers, and use farm machinery services and input credit to reduce the financial burden on farmers. • Promote and support the establishment of farm machinery service providers. • Continue land consolidation, with irrigation and drainage systems. • Support farmer associations to acquire and use large farm machinery. • Organize producers to concentrate the needs for machinery in the same period for contiguous plots. • Improve irrigation and promote the use of/subsidize investment in individual tubewell irrigation systems. • Build and maintain farm roads to facilitate access by large machines to plots.

CHAIN ELEMENT	PROPOSED ACTIONS
	• Promote integrated pest management to optimize the use of chemicals. • Use ICT to make services and inputs more accessible to farmers. • Work with financial service providers/Myanmar Agricultural Development Bank (MADB) to facilitate access to long-term credit to buy farm machinery. • Enhance farmers' awareness of the advantages of using certified seed. • Work with stakeholders to set up demonstration and training session for farmers.
COMMERCIALIZATION	• Work with financial service providers/MADB to develop a good financial product for traders. • Work with exporters—specifically, with the Myanmar Rice Federation (MRF)—to learn buyers' preferences. • Work with MRF to assess the needs for warehouses at the regional level.
PROCESSING OF FERTILIZERS	• Assess the profitability and competitiveness of domestic fertilizer plants. • Expand domestic production of fertilizers to reach scale. • Encourage foreign and domestic investors to implement seed processing units at different locations.
PADDY PROCESSING	• Improve the quality and efficiency of rice mills. • Promote better organization of the supply chain to reduce intermediaries. • Assess the use of renewable energy for small rice huskers at the village level, to substitute for fuel.
RICE EXPORT	• Improve organization and infrastructure at Yangon port. • Conduct market research for high-quality rice. • Promote Paw San rice (recognized for high quality in a global competition) for export.
SECTORAL	• Establish a value chain competitiveness index and monitor the performance of the value chain over time. Make financial support to value chain initiatives contingent upon improvement in the competitiveness index. • Establish value chain development funds to promote farmer-enterprises and partnerships. • Organize annual value chain fairs, exhibits, seminars, workshops, conferences, and training both in Myanmar and abroad, aimed at increasing access to markets for agri-food products from Myanmar.

Table 20. Pathways to improve the performance of the pulse and bean value chain in Myanmar

CHAIN ELEMENT	PROPOSED ACTIONS
RESEARCH/EXTENSION SERVICES	• Provide training and equipment to DAR/DOA for setting up demonstrations of equipment and demonstration plots for modern technologies. • Encourage local production of small equipment that could be used for harvesting pulses. • Use ICT and new technologies such as drones to manage production (e.g., for pest treatment, optimal harvest date). • Set up a quality testing lab for fertilizer, pesticide, and seed. • Provide training on the use of pesticides to small-scale input suppliers.
SEED MULTIPLICATION, INPUT SUPPLIERS	• Develop a program to intensify seed production, from the research entities to the seed multipliers. • Promote the creation of new seed farms and seed multiplier associations. • Encourage foreign and domestic investors to increase seed production. • Promote contract farming between exporters/traders and farmers for seed production and for pulse production. • Identify a scheme to facilitate and reduce the costs of seed certification for the domestic market. • Provide enough funding to DAR/DOA to produce more foundation and registered seed.

CHAIN ELEMENT	PROPOSED ACTIONS
	• Provide training and equipment to DAR/DOA for seed production monitoring and certification. • Encourage local production of small equipment, and adapt it to condition in delta areas. • Consolidate orders to benefit from economies of scale in importing farm machinery and inputs. • Use ICT to support traders and farmers.
PULSE PRODUCTION	• Promote contract farming between exporters/traders and farmers to reduce the financial burden on farmers and improve access to credit for dry-season production. • Promote and support the establishment of farm machinery service providers. • Organize production to concentrate the needs for services in the same period for contiguous plots (e.g., pest treatment). • Promote the use of/subsidize investment in individual tubewell irrigation system to allow pulse production in upland areas. • Promote integrated pest management to optimize the use of chemicals. • Use ICT to make services (inputs, trade) more accessible to farmers. • Work with financial service providers and MADB to tailor specific credit products for dry-season pulse production. • Enhance farmers' awareness of the advantage of using certified seed. • Work with stakeholders to set up demonstration and training sessions for farmers. • Set up demonstration plots using the correct application of fertilizers, high-yielding varieties, and farm machinery.
COMMERCIALIZATION	• Consolidate orders to benefit from economies of scale. • Work with exporters to learn buyers' preferences. • Establish an intelligence unit to forecast global trends in pulse markets and advise farmers on the type of crops to grow.
PROCESSING OF FERTILIZERS	• Identify possibilities for producing foliar fertilizers in Myanmar. Demand must be large, given the size of pulse production.
PULSE PROCESSING	• Improve the quality and efficiency of mills, and obtain Hazard Analysis and Critical Control Point (HACCP) certification if required.
EXPORT	• Improve organization and infrastructure at Yangon port. • Improve information exchange at regional and Yangon/Monywa exchange markets.
SECTORAL	• Establish a value chain competitiveness index and monitor performance of the value chain over time. Make financial support to value chain initiatives contingent upon improvement in the competitiveness index. • Establish value chain development funds to promote farmer-enterprises and partnerships. • Organize annual value chain fairs, exhibits, seminars, workshops, conferences, and training both in Myanmar and abroad, aimed at increasing access to markets for agri-food products from Myanmar.

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Annex 1: The Myanmar Agricultural Survey

1. The analysis in much of this study uses primary data from the Myanmar Agricultural Survey (MAS). Data from this panel survey, conducted in 2013/14 and 2017/18, provide insights into farm outcomes related to profitability, production, and their determinants over a four-year period.

2. The methodology for the 2017/18 survey round was similar to the data methodology used in the first round.[12] The survey areas continued to be in Ayeyarwady, Bago, and Sagaing Regions and Shan State. These areas represent the relatively rich AERs and farming systems in Myanmar. In each of the four survey regions/states, three representative ecosystems were chosen, suggesting that the survey covers 12 region-specific AERs.

3. The targeted crops were paddy (monsoon and dry season) and pulses, beans, and oilseeds (cool/dry season). Farm data were collected at two separate periods during the 2017/18 agricultural season. The data for monsoon rice were obtained in November–December 2017, and data for dry-season rice and for nonrice crops were collected during March–May 2018. Of the 1,728 selected farmers, 346 grew rice during the second season (dry-season rice).

4. The interviewers in the 2017/18 survey revisited the same farm households surveyed in 2013/14. Attrition in the second round was low at 88% (1,521 of 1,728 households). The missing households were replaced by 206 new households in the second round. These households were from the same villages, had resided there for at least two years, had similar land endowments and farming systems, and were willing to participate fully in the survey. The analysis therefore uses data obtained from a total of 1,728 farm households within Ayeyarwady, Bago, and Sagaing Regions and Shan State.

5. Note that the survey households come from 100 villages with comparatively better access to transportation and irrigation facilities, so the findings must not be interpreted as averages for the country. Rather, they provide insight into the production economics of relatively better-performing farms in Myanmar. They represent the upper tier of farmers, those using higher application rates of fertilizers and better-quality seed, and likely having better access to services such as credit, equipment rental, and irrigation.

6. A three-stage process was used to select the sample. First, two townships were randomly selected within each of the 12 region-specific AERs, resulting in the selection of 24 townships. Second, four village tracts were randomly selected from each township. There were two region-specific AERs in which five and six village tracts were included, for a total of 99 villages. Third, households were randomly selected from each of the small, medium, and large farm-size categories, with the number of farmers in each category proportional to the number of each category of farms in that village. The sampling frame has a population of double-cropping farmers rather than all farmers in the village. Table A1.1 shows the sample size and

[12] Sampling and other data collection details are similar to the previous study, and interested readers may refer to that study (World Bank 2016).

selected descriptive statistics for each region/state. The townships within each state or region were organized under three clusters defined by geographical area and zone-specific agro-ecological characteristics. The Ayeyarwady Region comprises four AERs, including Salt Water, Brackish Water, and Fresh Water. These areas are part of the larger Delta Region Agro-ecological Zone. West Alluvial, East Alluvial, and the East and West Flooded lands are the specific AERs in Bago Region. The AERs of Sagaing include Irrigated Tract, Dry Land, and River Areas. Bago and Sagaing Regions belong to the larger Dry Agro-ecological Zone. Finally, Shan State belongs to the Mountainous Region (the Shan Plateau) Agro-ecological Zone and includes Southern Interior, Northern Interior, and Border Area AERs.

Table A1.1. Survey sample descriptive statistics

AGRO-ECOLOGICAL ZONE	REGION/STATE AND AGRO-ECOLOGICAL-REGIONS	NUMBER OF HOUSEHOLDS	HOUSEHOLD SIZE	ILLITERACY RATE (%)	ELECTRICITY ACCESS (%)	CELLPHONE OWNERSHIP (%)	FARM SIZE (HA)
Delta	**Ayeyarwady**	**480**	**4.35**	**10**	**81**	**87**	**4.20**
	Brackish Water	160	4.11	11	87	86	4.07
	Fresh Water	160	4.36	8	92	88	3.04
	Salt Water	160	4.59	11	66	88	5.48
Dry	**Bago**	**384**	**4.98**	**14**	**98**	**95**	**3.95**
	East Alluvial	128	5.73	13	98	95	3.45
	East/West Flooded	128	4.84	21	98	97	5.05
	West Alluvial	128	4.35	8	98	94	3.34
	Sagaing	**504**	**5.37**	**18**	**99**	**90**	**3.94**
	Dry Land	168	5.3	19	100	89	4.40
	Irrigated Tract	168	5.07	16	99	91	3.67
	River Area	168	5.73	19	98	89	3.73
Mountainous	**Shan**	**360**	**5.12**	**57**	**100**	**96**	**2.85**
	Border Area	120	5.36	51	100	99	0.90
	Northern Interior	120	5.08	60	100	97	2.80
	Southern Interior	120	4.91	60	100	93	4.86

Source: 2017/18 MAS.

7. This study used the survey data to assess key indicators of farm performance, such as agricultural productivity and profitability. In doing so, it examines the main drivers of this performance to provide some insights into the potential for agricultural transformation. Data on these key agricultural performance indicators are compared with data from the 2013/14 MAS as well as data from neighboring countries (where comparative data are available).

8. The analysis for monsoon rice focuses on cultivated area, production, and yields and the use of modern inputs, labor, and services. Monsoon rice farm budgets are also presented. The data are from a specific rice field among many that households may have and do not represent all rice activities of that household. The data include information on 1,377 plots corresponding to 1,377 rice farmers of the total sample of 1,728. Rice is produced on almost all (99.8%) of the sample farms in Ayeyarwady, 97.9% in Bago, 96.5% in Sagaing, and 100% in Shan.

Annex 2: Methodology to Estimate Farm Budgets

1. Farm profitability was analyzed by constructing farm budgets. To facilitate comparisons, the same methodology used for the 2013/14 survey data was used for the 2017/18 data. The methodology was applied to all of the crops surveyed in 2017/18: monsoon rice, dry-season rice, and dry-season non-rice crops.

2. Total revenue is calculated by multiplying the yield (quantity produced by surveyed farmers) with farmgate prices. Yields and farmgate prices are reported in wet paddy equivalent. In cases where farmers did not sell their products, prices were estimated using the median farmgate prices for the agro-ecological zone.

3. Variable costs are broken down into four subcategories:

    1. Modern inputs, comprising seed, chemical fertilizer, manure, and pesticide.
    2. Cost of hired labor.
    3. Cost of services, which include the cost of rental of materials and equipment, expenditures on fuels for own equipment, the costs of rental of draft oxen, and other costs often linked to post-harvest and transportation costs.
    4. Computed cost of working capital is proxied by one-half of the monthly median interest rate for six months in each zone.

4. Fixed costs include the costs of family and permanent labor. These costs are imputed and estimated as man-hours of labor allocated to farm production, multiplied by the average wage rate for hired labor for similar tasks (seedbed, land preparation, crop management, harvest, and post-harvest). If the cost of hired labor is missing, then the average hourly rate for all tasks is imputed to family labor.

5. The cost of seed is computed using the amount of seed and the actual prices for farmers purchasing hybrid and certified seed, and for those buying noncertified seed from different sources. For farmers using their own production, the median prices of dry paddy at the agro-ecological zone are used. In sum, seed is monetized whether it is purchased or self-supplied.

6. To get the expenditures for using mechanized equipment, the cost of services for farmers owning agricultural equipment were excluded from the calculation of the average expenditures on services. For example, the cost of using tractors for plowing is estimated from the rental cost of the tractor and the plow for nonowners. This approach was adopted to avoid a downward bias on the cost of services. Indeed, farmers owning tractors will enjoy a return on their investment and usually spend a lower amount for the same type of services. Following the same logical approach, only the costs of the rental were used for operations using draft oxen.

7. The cost of working capital can be proxied by the cost of the median interest rate for six months within each agro-ecological zone. However, not all farms are borrowing money, and the best proxy of the

cost of working capital, in this case, is one-half of the median six-month interest rate against the total cost of inputs, hired labor, and services.

8. Using these data, the farm budget provides three main profitability indicators: net margin, gross margin, and return to labor (Figure A2.1). Gross revenue is the total amount received by the farmer for the production (per acre). The total variable cost is the sum of the expenditures on seed (purchased or own), fertilizer, and pesticide; the expenditures on services (cost of rental); the expenditures on hired labor; and the calculated cost of working capital. The difference between the gross revenue and the total variable costs constitutes the gross margin. The net margin is calculated as the difference between the gross margin and the imputed cost of family and permanent labor.

9. The third indicator (return to labor) is computed by dividing the gross revenue net of costs of inputs and services by the number of days of labor spent on farm production independently of the source (family, hired, or permanent). This amount represents the return per day of labor spent on agricultural production. For the sake of comparison with other data, the farm budget tables also present the gross and net margins in $/ha and average yields in t/ha, using a conversion factor of 0.814 from wet paddy to dry paddy.

Figure A2.1. Components of farm budgets and profitability indicators