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Quality upgrading in Myanmar's rice sector

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Rice Project Final Report

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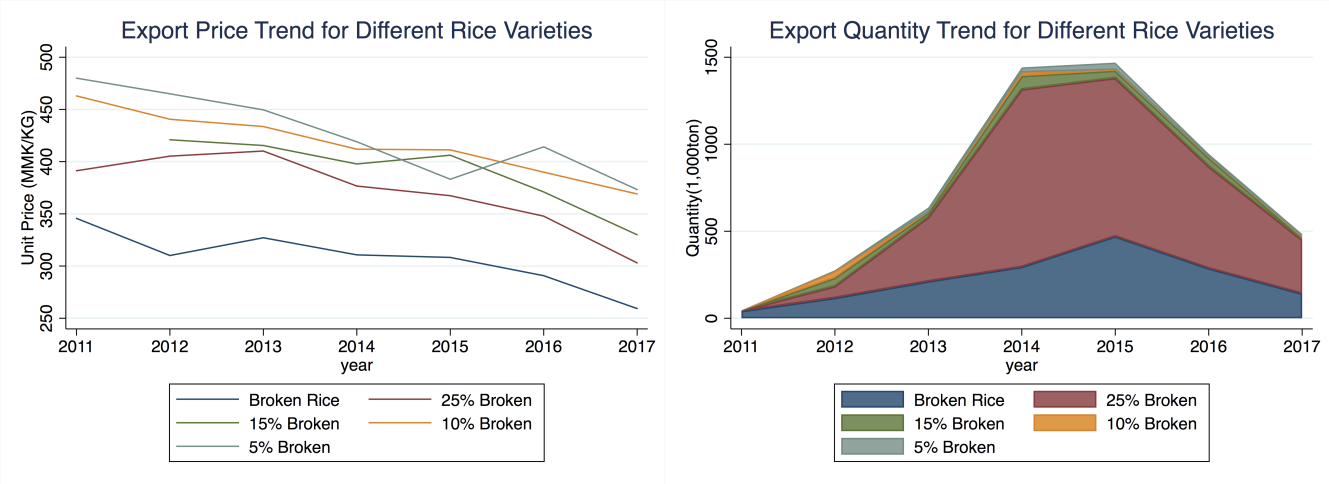
1 Introduction

1.1 Background

Rice industry has a long tradition in Myanmar and is one of the pillars of economy. Until 1963, Myanmar was the largest rice exporter in the world. While Myanmar still produces some of the most highly valued varieties, quality, exports, and productivity have all lagged in recent decades. With more countries investing in rice industry these years, Myanmar rice industry faces much more fierce competition on the international market, especially on the high-quality rice market. For example, though Myanmar Paw Sam rice was awarded the world's best rice at the Rice Trader's World Rice Conference in 2011, Thailand's jasmine rice or Sushi rice from Japan seem to be more famous worldwide. Using customs export data between year 2011 and 2017, it shows that the average export unit price of rice is decreasing in recent years. In addition, among all rice varieties, Myanmar currently is mainly exporting low quality rice, such as whole broken rice and 25% broken rice, instead of lower broken-rate rice which enjoys higher prices on the international market (Figure 1). Therefore, how to design policies to give relevant stakeholders correct incentives and achieve the quality upgrading can be crucial.

Figure 1: Summary Statistics of Paddy Purchasing



Notes: This figure shows the export of rice between year 2011-2017.

1.2 Objectives of the study

This report is part of the broad collaboration scheme between the International Growth Centre (IGC) and the Ministry of Commerce (MoC), to help better understand the status quo and barriers faced by the rice industry in Myanmar, especially providing insights for making industry upgrading polities, and designing larger-scale research project in the future. As a summary, this study aims to understand and answer the following questions.

1) What is the structure of the value chain of rice industry in Myanmar?

2) How much do relevant stakeholders in the rice industry care about quality, and how many incentives are given to product high-quality rice currently?

3) What can be done to increase the final quality of rice, and what are the barriers faced by players along the value chain?

Based on prior research and ind-depth focus group discussions with officials and stakeholders in rice industry, this study chose to survey rice millers, who are one of the key players and intermediate links along the value chain.

2 Approach and Methodology

To order to understand the status quo of the rice industry in Myanmar, the research team adopted a two-step method, involving a set of preliminary in-depth interviews and focus group discussions (FGDs) with MoC officials, selected rice millers, traders and farmers, and other relevant stakeholders. This was then followed by a quantitative survey of rice millers.

2.1 FGDs with Relevant Stakeholders

In-depth Focus group discussions with MoC officials and other relevant stakeholders provided insights on the following information:

- Challenges and experiences in trying to achieve the quality upgrading in rice industry
- Rice millers, traders and farmers' perspectives of the barriers in the rice industry
- Current incentives and future potential for achieving quality upgrading

2.2 Quantitative Survey

The quantitative survey was conducted at mill level and in the following three regions across 51 townships: Ayeyarwaddy Region, Bago Region, and Yangon Region. The purpose of this survey is to understand the status quo and challenges of the rice industry in Myanmar at a broader scale. In order to get a representative sample of mills, all medium and large-size mills located in 51 townships were first randomly selected from a mill list registered for the fiscal year 2017 - 2018 retrieved from the Department of Consumer Affairs under the Ministory of Commerce. Myanmar Rice Federation (MRF) then provided with an updated mill list in these selected 51 townships. In the end, a total of 1025 mills were sampled, and we finished the survey for 657 mills.

Following approval of the Institutional Review Board (IRB), the quantitative survey tool was developed into an application for mobile data collection. A total of forty field staff implemented the data collection. The team comprises one field supervisor, five team leaders, thirty enumerators, three back-check enumerators, and one admin officer. Enumerators' training was conducted by a

Table 1: Survey Completion

	Sampling Plan			Actual Survey		
Region	Original Govt. List	New List from MRF	Total	Original Govt. List	New List from MRF	Total
Ayeyarwad	453	70	523	270	70	340
Bago	206	105	311	114	105	219
Yangon	155	36	191	63	35	98
Total	814	211	1025	447	210	657

research associate for four days in Yangon. A Field Management Plan was developed with the data collection team to set up clear mechanisms for survey monitoring, quality checks and field level trouble shooting protocols.

3 Study Findings

3.1 Overview of Rice Mills

Among all the 657 mills that finished the survey, their daily milling capacity (in 24 hours) and annual cost was asked. There exist significant variations across mills in terms of milling capacity and cost. For example, big mills can be hundreds of times bigger than small mills (Table 2).

Table 2: Summary Statistics of Milling Capacity

	Mean	Min	25%	Med	75%	Max	SD	N of obs
Milling Capacity (In Ton)	58.39	1.50	25.00	45.00	75.00	750.00	55.95	634
Sun-Drying Area In Sqmeter	3906.33	7.43	148.64	2023.43	4046.86	40468.60	5603.62	273
Sun-Drying Capacity (In Ton)	23.22	0.00	6.25	12.50	23.00	500.00	52.45	169
Machine-Drying Capacity (In Ton)	36.85	0.35	15.00	27.25	50.00	250.00	34.05	378
Paddy Storage Capacity (In Ton)	2466.77	17.50	500.00	1250.00	3750.00	15000.00	2786.12	630
Rice Storage Capacity (In Ton)	938.17	0.00	106.00	270.00	810.00	13500.00	1707.69	613
Expected Storage Loss Per Month (%)	1.75	0.00	1.00	1.00	2.00	12.00	1.62	627

Notes: This table shows the basic summary statistics of milling capacity, mostly in tons; the milling and drying capacity are in terms of 24 hours.

Other places to notice include that first, in terms of drying, those mills that use drying machines have higher drying capacity on average. Second, the loss in storage does not seem to be quite high, and most mills have some degree of storage capacity.

Table 3: Summary Statistics of Annual Cost

	Mean	Min	25%	Med	75%	Max	SD	N of obs
N Of Permanent Workers	7.06	1.00	3.00	5.00	10.00	26.00	5.26	538
Cost Of Permanent Workers	148.93	10.00	54.00	108.00	200.00	800.00	136.33	531
N Of Temporary Workers	19.97	2.00	10.00	16.00	30.00	60.00	12.56	609
Cost Of Temporary Workers	324.71	6.30	100.00	240.00	450.00	2000.00	307.97	604
N Of Unpaid Workers	2.05	1.00	1.00	2.00	3.00	5.00	1.12	109
Grid Electricity	182.11	0.00	0.00	100.00	300.00	1000.00	212.83	637
Generated Electricity	44.31	0.00	0.00	0.00	38.00	500.00	93.13	614
Transportation	75.96	0.00	0.00	0.00	50.00	1500.00	198.27	589
Input Taxes	15.12	0.00	2.50	5.50	15.00	474.00	39.09	490
Input Fees	52.56	0.00	0.00	0.00	49.50	1500.00	141.56	536

Notes: This table shows the basic summary statistics of the annual cost of operation. The cost unit is per 100,000 MMK.

With respect to the annual cost of mill operation, the two most costly parts are wages to labors and cost of electricity. Given that rice milling is a seasonal industry, millers are more likely to hire

temporary workers than permanent workers. Second, for electricity, millers can choose between using grid electricity, or generating electricity on their own, or both. It seems that bigger mills are either using both or using grid electricity, since it might be not enough if generating all electricity on their own. Third, though most millers are not providing any inputs for farmers (input fees in Table 3), such as fertilizers or pesticides, there still exist around 25% millers are doing this and most of them are bigger millers based on the survey. Finally, in the survey, millers were asked if they were renting any type of equipment and if yes, how much they paid for renting. Surprisingly, more than 90% of millers were not renting any equipment. This might be because most milling machines were designed only for processing rice, and all millers needed the machines almost at the same time. Therefore, it would be hard to rent when needed. This, on the other hand, showed the challenges for some small millers are that they could only choose between buying the machine themselves or not being able to use the machine.

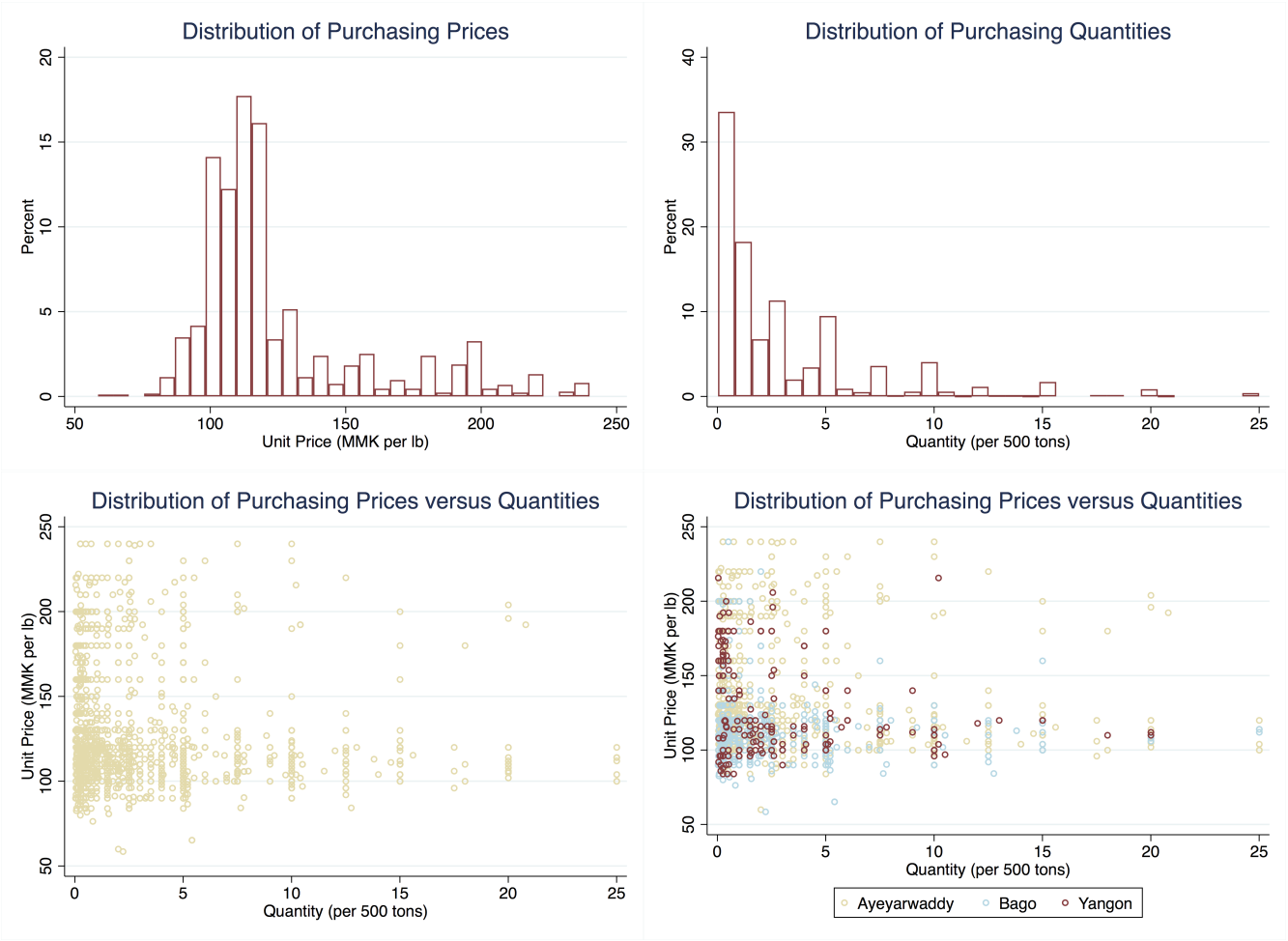
3.2 Understanding paddy purchase patterns

In the purchasing section of mill survey, each miller were asked to list all the paddy varieties purchased in the past 12 months and the price and quantity for each variety. Among surveyed millers, 65% of them purchased 2 or 3 varieties each season. Most millers purchased paddy at similar prices, around 120 MMK per lb (Figure 2). The unit price of paddy is more affected by its variety and quality level, instead of the total quantity purchased. For example, it does not seem to be the case that bigger millers buy more expensive rice varieties at higher prices. In addition, there does not seem to exist significant differences across the three regions, though the unit price is slightly higher in Ayeyarwad on average.

3.3 Understanding rice sales patterns

Similarly, in the sales section, each miller were asked to list all the paddy varieties sold in the past 12 months and the corresponding prices and quantities. Compared to paddy purchases, the price range is wider for rice sales, where some millers were able to sell their rice at a much higher price though they bought paddies at similar prices as other millers (Figure 3). In addition, it is

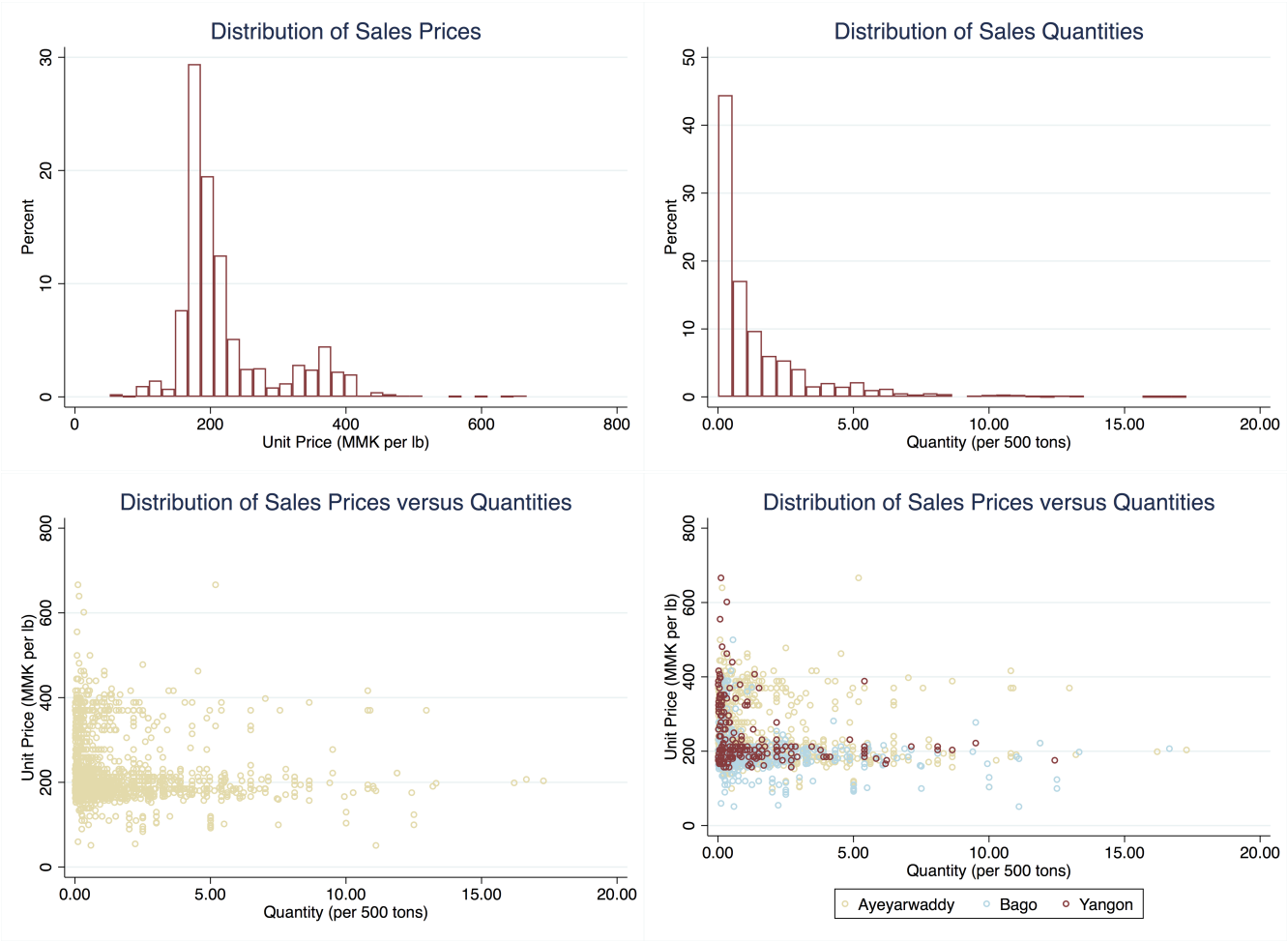
Figure 2: Summary Statistics of Paddy Purchasing



Notes: This figure shows paddy varieties purchased between August, 2018 to August, 2019. The lowest 1% and highest 1% were dropped to avoid outliers.

interesting to notice that there are two peaks in terms of unit price, one around 200 MMK per lb and the other around 400 MMK per lb.

Figure 3: Summary Statistics of Rice Sales

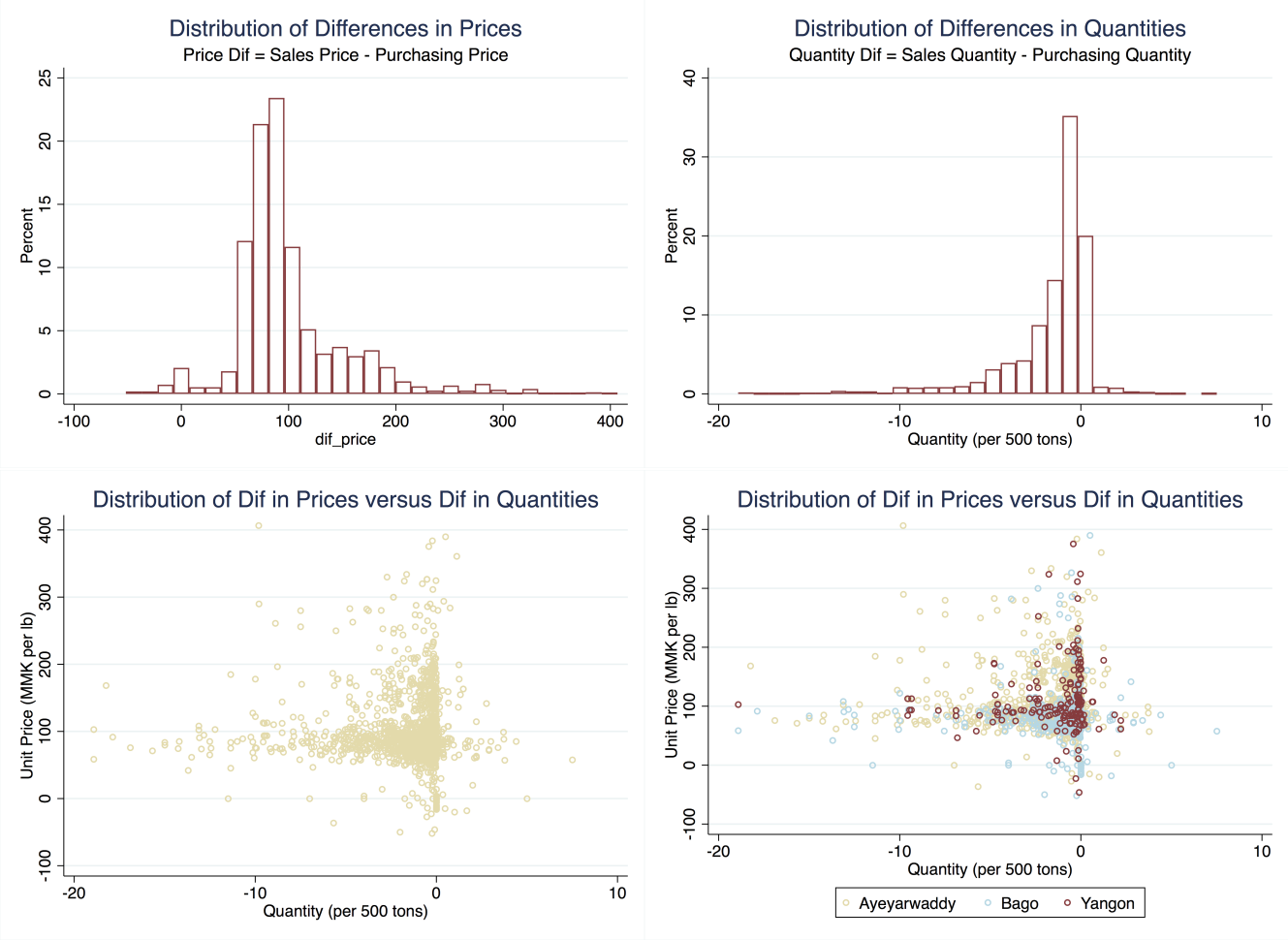


Notes: This figure shows paddy varieties sold between August, 2018 to August, 2019. The lowest 1% and highest 1% were dropped to avoid outliers.

More details can be found in Figure 4, where the differences in the unit prices and quantities of rice sold and purchased at variety-miller level were shown. As expected, after processing, the unit price of rice sold is higher and the quantity of rice sold is lower than the paddy purchased due to drying and some processing loss. Interestingly, most mils could increase the unit price by around 100 MMK per lb. Some mills were able to achieve higher value added, and this does not seem to be at the cost of lower quantity. This, on the other hand, shows that the paddy quality is

not the only determinant of the final rice quality, and millers can add either higher or lower value through different ways of processing.

Figure 4: Summary Statistics of Rice Sales



Notes: This figure shows differences in the unit prices and quantities of rice sold and purchased between August, 2018 to August, 2019, at variety-miller level. The lowest 1% and highest 1% were dropped to avoid outliers.

3.4 Understanding paddy processing patterns

First, based on in-depth interviews with relevant stakeholders in the rice industry, eleven processing steps were identified as being commonly used by millers to product paddy all the way into paddy. Then in the mill survey, all millers were asked whether they ever conducted any of the steps, and if yes, how many times they usually conducted each step. From table 4, most steps are being

conducted by more than 95% surveyed millers. Differences across millers are that first, some millers chose sun-drying, while others chose machine-drying (table 5). There are still 23% mills that were not conducting any drying currently. In that case, they might only purchase paddies that have already been dried by either farmers or traders. Second, wet/mist polishing and color sorting are the two steps which have not been adopted by most millers. These two places may breed the potential for further quality upgrading.

Table 4: Number of millers conducting each step

	Among all surveyed millers	
Step	N of millers	% of millers
pre-cleaning	622	94.67%
sun-drying	250	38.05%
machine-drying	349	53.12%
de-husking/ dehulling	646	98.33%
paddy separation through bilat seive	555	84.47%
polishing/ whitening the rice	645	98.17%
seiving the rice	640	97.41%
wet/mist polishing	304	46.27%
color sorting	229	34.86%
bagging	610	92.85%
weighting	624	94.98%

Table 5: Common Method for Drying

	N of millers	% of millers
Sun-drying	155	23.59%
Machine-drying	254	38.66%
Both	95	14.46%
None	153	23.29%

Another important variation across millers is that though many of them have already conducted one step, the number of time they conduct the step may still differ. For example, as showed in table 6, the paddy separation step may be conducted only once by some millers, but can also be conducted multiple times in order to increase the whole kernel rate.

In addition, when purchasing paddies, millers would also conduct some quality inspections by instruments (table 7). The two most commonly used instruments were moisture meters which can tell the moisture rate of paddies, and small mills which can process a sample of paddies and estimate the whole kernel rate. Based on the miller survey data, the median price of moisture

Table 6: Number of times millers conducting each step

	Among millers who used this step			
Step	Mean	Median	Min	Max
pre-cleaning	1.36	1	1	11
sun-drying	1.09	1	1	3
machine-drying	1.12	1	1	3
de-husking/ dehulling	1.31	1	1	8
paddy separation through bilat seive	1.61	1	1	20
polishing/ whitening the rice	1.68	2	1	11
seiving the rice	1.74	1	1	8
wet/mist polishing	1.12	1	1	3
color sorting	1.22	1	1	7
bagging	1.05	1	1	2
weighting	1.04	1	1	3

meter is 40,000 MMK, around $33, and on average, each miller has 2 meters; the median price of small mill is 320,000 MMK, around $230, and on average, each miller has only one small mill.

Table 7: Ownership of Quality Measurement Instruments

	N of millers	% of millers
Only Small Mill	10	1.52%
Only Moisture Meter	156	23.74%
Both	374	56.93%
None	117	17.81%

3.5 Potential for Quality Upgrading

For both paddy and rice, two most important quality dimensions are the moisture rate and the whole kernel rate. In the survey, millers were asked to self-report the quality levels of the paddy they purchased and the rice they sold (table 8 and table 9). For each quality (from high, medium to low), the required moisture rate and the whole kernel rate, and the corresponding prices were also asked. Though there still exist variations in terms of requirements within each quality level, which means that millers have not formed broad consensus, different quality levels can still be easily identified. In addition, millers were indeed paying and paid higher prices for higher-quality paddy and rice as the reward . This can be more clear in table 10 and table 11.

Another natural question to ask is that whether millers can increase the final rice quality through their processing steps, or the rice quality is totally dependent on the quality of the paddy

Table 8: Quality Levels: Moisture Rate

	Mean	Min	25%	Med	75%	Max	SD	N of obs
				Paddy Purchases				
				Quality Level 1				
Moisture Rate	15.01	11.00	14.00	14.00	15.00	30.00	2.40	543
Purchasing Prices	121.59	47.62	104.00	112.00	120.00	360.00	34.15	541
				Quality Level 2				
Moisture Rate	17.67	12.00	16.00	17.00	18.00	30.00	2.76	323
Purchasing Prices	118.36	0.00	100.00	110.00	120.00	256.52	33.86	324
				Quality Level 3				
Moisture Rate	21.94	14.00	20.00	20.00	25.00	35.00	3.84	191
Purchasing Prices	116.51	0.00	96.00	102.00	116.00	960.00	71.44	191
				Rice Sales				
	Mean	Min	25%	Med	75%	Max	SD	N of obs
				Quality Level 1				
Moisture Rate	14.05	0.00	14.00	14.00	14.00	25.00	1.63	277
Sales Prices	211.15	90.00	179.25	197.18	217.59	563.64	71.02	271
				Quality Level 2				
Moisture Rate	16.57	12.00	15.00	16.00	18.00	25.00	2.07	87
Sales Prices	213.06	148.15	175.93	185.19	212.96	490.00	66.73	86
				Quality Level 3				
Moisture Rate	19.27	13.00	16.00	20.00	22.00	35.00	4.11	51
Sales Prices	197.71	148.15	166.67	180.18	201.39	351.85	54.37	48

Notes: This table shows that for each quality level, the Moisture Rate thresholds set by millers. The price is unit price, which is MMK per lb. Moisture Rate is among 0-100 percentages.

input. If they can, how much can they improve. Figure 4 has already provided some positive answers. More evidences can be found in table 12 and table 13.

In table 12, by adding these additional steps, which have not been conducted by all millers, can increase the sales price given the purchasing price (which can be the proxy for paddy quality) and rice variety at some degree, especially for color sorting this step. However, it is also worth noticing that adding these steps results in lower volume of rice to be produced given the purchased quantity and rice variety. This means that millers would be facing the trade-off between higher price and lower quantity. This pattern is less significant in table 13 but still exist at some extent.

Table 9: Quality Levels: Whole Kernel Rate

	Mean	Min	25%	Med	75%	Max	SD	N of obs
Paddy Purchases								
Quality Level 1								
Whole Kernel Rate	87.54	22.00	85.00	90.00	95.00	100.00	9.55	395
Purchasing Prices	153.08	0.00	110.00	120.00	185.19	1739.13	113.80	394
Quality Level 2								
Whole Kernel Rate	75.30	0.00	70.00	75.00	80.00	100.00	10.81	220
Purchasing Prices	138.48	80.77	104.00	116.00	175.93	390.00	46.06	220
Quality Level 3								
Whole Kernel Rate	64.80	40.00	60.00	65.00	70.00	100.00	10.48	124
Purchasing Prices	132.39	80.00	100.00	114.00	166.67	350.00	41.16	123
Rice Sales								
	Mean	Min	25%	Med	75%	Max	SD	N of obs
Quality Level 1								
Whole Kernel Rate	87.35	0.00	85.00	90.00	95.00	100.00	9.95	543
Sales Prices	217.06	138.89	185.19	203.70	217.59	824.07	65.91	538
Quality Level 2								
Whole Kernel Rate	78.89	0.00	75.00	80.00	85.00	95.00	10.38	325
Sales Prices	202.82	134.26	175.93	185.19	203.70	435.19	53.73	325
Quality Level 3								
Whole Kernel Rate	70.10	0.00	65.00	70.00	75.00	90.00	10.02	234
Sales Prices	188.37	129.63	162.04	174.07	185.19	416.67	50.91	232

Notes: This table shows that for each quality level, the Whole Kernel Rate thresholds set by millers. The price is unit price, which is MMK per lb. Whole Kernel Rate is among 0-100 percentages.

Table 10: Purchasing Prices

Dependent Var: Purchasing Prices				
	Moisture Rate		Whole Kernel Rate	
Quality	-1.38***	-1.19***	0.84***	0.96***
Dimension	(0.29)	(0.36)	(0.26)	(0.36)
Observations	1045	834	721	551
Variety FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Trader FE	No	Yes	No	Yes

The observations are at trader-quality level.

Table 11: Sales Prices

Dependent Var: Purchasing Prices				
	Moisture Rate		Whole Kernel Rate	
Quality	-2.95***	-3.65***	1.19***	1.60***
Dimension	(0.97)	(1.16)	(0.093)	(0.061)
Observations	400	218	1092	880
Variety FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Trader FE	No	Yes	No	Yes

The observations are at trader-quality level.

Table 12: Differences in sales from purchases versus whether conducting one processing step

Dep.Var	Difs in Prices		Difs in Quantities	
	(1)	(2)	(3)	(4)
Sun-drying	3.19	2.11	0.19	0.25
	(2.47)	(2.56)	(0.15)	(0.15)
Machine-drying	0.67	1.73	-0.33**	-0.35**
	(2.57)	(2.61)	(0.16)	(0.16)
Wet/mist polishing	2.01	2.34	-0.43***	-0.43***
	(2.35)	(2.35)	(0.14)	(0.14)
Color sorting	7.57***	7.70***	-0.99***	-0.99***
	(2.49)	(2.49)	(0.15)	(0.15)
Observations	1462	1462	1462	1462
Variety FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes

Notes: The observations are at trader-variety level. As before, the differences in prices = sales prices - purchasing price; the same for differences in quantities. The independent variables are dummies representing whether the mill ever conducted this processing step or not.

Table 13: Differences in sales from purchases versus the times of each step

Dep.Var	Difs in Prices		Difs in Quantities	
	(1)	(2)	(3)	(4)
dehulling_times	-0.75	-0.66	0.14	0.15
	(1.83)	(1.83)	(0.11)	(0.11)
seiving_times	0.76	0.33	0.13**	0.16**
	(1.01)	(1.03)	(0.061)	(0.062)
separation_times	-0.31	-0.54	0.0043	0.014
	(0.74)	(0.75)	(0.045)	(0.045)
whitening_times	-0.46	-0.62	0.019	0.026
	(1.21)	(1.21)	(0.073)	(0.073)
sorting_times	1.61	1.66	-0.32**	-0.33**
	(2.49)	(2.49)	(0.15)	(0.15)
Observations	1459	1459	1459	1459
Variety FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes

Notes: The observations are at trader-variety level. As before, the differences in prices = sales prices - purchasing price; the same for differences in quantities. The independent variables are the number of times the mill conducted each processing step.

4 Recommendation

4.1 Observations of Rice Industry

In Myanmar, rice industry has been existing for centuries and have established its own way of operation. However, facing the rapid change and fierce international competition these years, the rice industry is under the pressure to make changes and adapt itself for both modern growing and processing method.

This report mainly focuses on the milling step. We can see that some millers have already been using new technologies and machines to try to achieve quality upgrading. For example, small mills are being used to measure the whole kernel rate when purchasing paddies instead of just checking the quality visually as before. During processing, color sorting machines are also adopted by some millers to get higher quality rice.

However, as the customs data shows, the rice exported by Myanmar in recent years were still relatively low quality rice, where the whole broken rice and 25% broken rice were the two biggest rice varieties for exporting. Multiple reasons may account for this phenomenon. Many challenges faced by millers included lack of stable electricity, lack of capital to invest in high-quality machines, lack of excess to international market and so on.

4.2 Recommendation # 1 - Stable Supply of Electricity

Both during the in-depth interviews and the mill survey, one of the most commonly mentioned challenges faced by millers was the lack of stable electricity. Without enough electricity, many milling machines may be used inefficiently, which would then decrease millers' incentives in investment and milling capacity. Especially, if millers cannot use drying machines because of this, paddies that are not dried enough cannot be stored for long, which may make the problem worse. However, millers may not be able to solve this problem on their own. As shown in table 3, though some millers were trying to generate electricity using their own machines, this would be costly and would still not be enough, especially during peak seasons. Therefore, for this challenge, the government may need to step in to help with this.

4.3 Recommendation # 2 - Access to Capital for Investment

As shown above, while milling machines are key determinants of final rice quality levels, and most milling machines are expensive, few millers were renting machines. This may be because millers would need these machines almost at the same time. Given this situation, millers may be in need of enough capital to invest in and buying these machines themselves. Similarly, to expand the access to capital for millers, governments can also design policies around this.

4.4 Recommendation # 3 - Better Processing Scheme

For millers, it is necessary to design one's own optimal processing scheme, instead of simply following other millers, or adding more steps as much as possible. As previous results show, adding one more step or conducting one step for more times may both increase the quality and decrease the volume produced. To achieve quality upgrading, it is not to simply add more steps, but given the price structure, millers shall optimize its processing chain with higher quality being one of the goals. This, on the other hand, means that the market or the government shall step in to help design the best price structure for both paddy and rice, so that millers will have the correct incentives for achieving higher quality.

4.5 Recommendation # 4 - Improving the Whole Value Chain

Though milling is one of the most important parts along the whole value chain, higher quality cannot be achieved without the supports from other players. For example, while millers can check the quality of paddies when purchasing, if all paddies were mixed with other varieties or foreign matters in the beginning, it would be costly and hard to separate them later on. In addition, mentioned by most millers, the seed quality is the part that millers cannot control by themselves but would significantly affect the final rice quality. In this case, the whole value chain should be considered to achieve quality upgrading, for example, from the beginning where farmers shall have the access to good-quality seeds and other agricultural inputs.

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