Rice Science FOR DECISION-MAKERS

VOL. 7 • DECEMBER 2016 • ISSN 2094-8409

MECHANIZING POSTHARVEST WORK ENHANCES FARMERS' COMPETITIVENESS

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The Philippines (PH) currently adopts tariff and quantitative restriction (QR) as trade protection for rice. Tariffs are taxes imposed on traded products; QRs limit the volume of imported rice allowed into the country. Trade protection regulates the influx of cheaper imported rice in the local market, and shields local farmers and traders from superior competition. If government would remove QR, local rice prices would drop (Litonjua and Bordey, 2014; Bordey et al., 2016) in favor of consumers but to the detriment of farmers.

Our trade agreements with the Association of Southeast Asian Nations and World Trade Organization will require us to remove QR very soon. In the meantime, our government prepares rice farmers and traders for the new situation by helping them to become more competitive. This policy brief tackles one plausible way to induce competitiveness—mechanizing postharvest operations. It sheds light on the connection between competitiveness and rice mechanization, its effects on income, and the factors that would motivate farmers to use machines.

Price competitiveness and mechanization

Competitiveness refers to a firm's ability to produce and sell the same or better quality of product at a lower price than competitor. Raising the competitiveness of a seller, therefore, involves improving product quality without increase in price, or offering the same product quality at less price to match those of the other sellers' and still gain some income.

KEY POINTS

- Improving price competitiveness is necessary to help farmers survive under an open economy. This can be done by reducing the unit cost of rice.
- Labor is a significant cost component in rice production. Hence, labor has to be mechanized to reduce production cost.
- To hasten local mechanization, affordable machine services have to be made available through the rental market. Likewise, land reconfiguration can be initiated.

Relaxed rice trade opens the market to international competitors, which will likely reduce farmgate and wholesale prices. To ensure farmers' survival in this open market, they need to be competitive and efficient. They may either increase their yields at the same production cost, or reduce cost while maintaining the same yields so they can offer a lower selling price.

Table 1 shows that hired labor cost, particularly for manual harvesting and crop establishment,

accounts for the largest share (30%) in cost of production (Launio et al., 2015). Farmers are then advised to mechanize these activities because it could significantly reduce cost.

Table 1. Cost of hired labor in specific farm activities, Nueva Ecija, 2013.

Activities	Cost (P/ha)	
	Jan-Jun 2013	Jul-Dec 2013
Land preparation	862	1,159
Crop establishment	4,047	4,196
Crop care and maintenance	189	162
Harvesting	7,595	5,967
Threshing	1,644	1,446
Postharvest	1,031	488

From 2013 database of "Benchmarking Philippine rice economy relative to major rice-producing countries in Asia" project of PhilRice and IRRI.

Net effects of mechanizing harvesting operations on farmers' yield, cost, and income

Focus is on harvesting because it eats up the largest share in hired labor cost. Only the effects of combine harvesters are analyzed here because they are becoming more popular than the mechanical reapers.

Table 2 shows how the adoption of the combine harvester would reduce farmers' costs and increase returns. The usual practices of manual harvesting and mechanical threshing using axial-flow threshers both incur grain losses. Replacing the usual practices with the use of the combine harvester will reduce grain loss to only 2.11% (Regalado and Ramos, 2016). This will save 116.76 kg/ha of total harvest or about 2.1% increase from baseline yield of 5,434 kg/ha. It is equivalent to an additional income of P1,795/ha, holding other factors constant.

Using the combine harvester can reduce the costs on harvesting and threshing, and eliminate sacks and twine costs. It can also reduce permanent hired labor (PHL) cost, which is paid based on a harvest-sharing scheme: more yield necessitates higher PHL cost. The rental for the combine harvester that includes operator fee and fuel, is accounted as an additional cost to farmer. These factors reduce the total cost by 8% or P4,641/ha (Table 2), holding other factors constant.

Ultimately, the larger gross income and reduced cost result in an increased net income by 28% or P6,436/ha. These results imply that the net effect of the combine harvester is more substantial on cost reduction than on saved harvest due to less postharvest losses.

Table 2. Net effects of using the combine harvester on farmers' costs and returns.

Income-increasing Items		Income-reducing items		Net change	
Items	Value (P/ha)	Items	Value (P/ha)	Items	Value (P/ha)
Added gross income (A)	3,527	Reduction in gross income (C)	1,732	Net change in gross income (A-C)	1,795
Savings due to reduced postharvest losses from manual harvesting, axial-flow threshing, and piling (231.33 kg/ha)[a]		*Reduced income due to crop loss from combine harvester (114.57 kg/ha)*[a]		*Net savings on harvest due to a shift from usual harvesting and threshing methods to combine harvester*	
Reduction in production cost (B)	13,037	Added production cost (D)	8,396	Net change in production cost (B-D)	4,641
Manual labor cost on harvesting	5,482	Rental of combine harvester (includes operator fee and fuel)	8,222		
Threshing cost (includes operator, machine, and fuel)	5,482	Permanent hired laborer (PHL)[c]	173		
Sacks and twine[b]	1,721				
Permanent hired laborer	353				
Total added income and reduced cost (A+B)	16,564	**Total reduced income and added cost (C+D)**	10,128	**Net change in income (A-C) + (B-D)**	6,436

[a]Assumptions:
Grain/postharvest losses (source: PHilMech, and Regalado and Ramos, 2016)
Manual harvesting (2.03%), Mechanical threshing (2.18%)
Piling (0.08%), Combine harvesters (2.11%)
[b]Sacks and twine are free if farmer would avail of custom-hired combine harvester.
[c]PHL- payment is based on harvest-sharing arrangement: More yield necessitates higher PHL cost
Sharing arrangement (source: key informant interviews)
Manual harvesting (1:15)
Mechanical threshing (1:15)
Combine harvesters (10% of gross harvest)
Permanent hired laborer (10% of gross harvest)

Despite these benefits, the level of mechanization in harvesting is still low (Bingabing et al., 2015). Table 3 shows that very few farmers have adopted mechanical harvesters.

Table 3. Level of mechanized farming in the Philippines using efficient technologies, 2013.

Operations	Percent of area mechanized with efficient facilities (%)
Plowing	37.80
Harrowing	39.96
Planting	*
Weeding	*
Spraying	*
Harvesting	2.16
Threshing	49.68

*nil
Note: adopted from Bingabing et al., 2015.

The government is hereby challenged to hasten the adoption of combine harvesters. To create appropriate interventions, the government has to first understand the factors that could influence farmers' decision to mechanize.

What makes farmers mechanize harvesting?

Land size and labor cost per man-day are the significant factors that push farmers into mechanizing harvesting (Table 4). Farmers who cultivate bigger lands are more likely to mechanize harvesting than those with smaller lands. This is because manual harvesting becomes more laborious and costly as area increases. As labor becomes more expensive, farmers would resort to mechanized harvesting. High labor price also implies scarcity of labor in the area.

Table 4. Factors affecting farmers' decision to mechanize harvesting, Philippines, 2011-2012.

Variables	Odds ratio	Std. Error
Land size	1.235*	0.108
Age	1.007	0.014
Gender	2.650	1.440
Farming experience	1.015	0.012
Membership in farm organizations	0.967	0.218
Land ownership	0.931	0.213
Labor cost per man-day	1.002**	0.000
Constant	0.001	0.001

*,** - Indicates that odds ratio is significant at 5% and 1% alpha, respectively. An odds ratio of at least 1 means the farmer would more likely mechanize harvesting as the given variable increases or changes.
LR chi2: 41.19 with p-value of 0.0.
Source of raw data: 2011-2012 RBFHS of the Socioeconomics Division, PhilRice.

Other studies (PhilRice, 2015 and Lantin, 2001) have reported that irregularly shaped fields and small plot sizes, which are common in the Philippines, make machine operation inefficient, hence low adoption. Machines can hardly maneuver in such fields.

Also, lack of field access is a constraint in machine adoption because of difficulty in reaching inner parcels. Right-of-way is limited to outer parcels along access roads. Irrigation water is also not distributed equally among land parcels because of uneven field landscape. Land reconfiguration, which involves modification of field layout and shape, could address these issues.

Arida et al. (2016) also report that, based on farmers' perceptions, non-adoption of combine harvesters is due to labor displacement and non-applicability of the machine to area, which could

refer to field layout, shape, and plot size. Other reasons mentioned are "combine harvester could damage the field resulting in low quality of paddy and postharvest losses, and unaffordable machine custom fee."

CONCLUSION

Mechanizing harvesting can reduce farmers' cost and contribute to their competitiveness. One approach to increasing the current level of mechanization is to help farmers access affordable machines through the rental market. For farmers with limited financial resource, a fair and reasonable custom hiring arrangement would be best. To strengthen the rental market, a sound credit scheme can be provided for those who would like to engage in machine rental business. This could entice more investors, hence increase the availability of machines for farmers. With more custom-hired machines, farmers will enjoy more affordable rental rates.

For areas where machines are already available, intervention could focus on reconfiguration of lands to make fields more suitable for the adoption and efficient operation of high-capacity machines.

CALL FOR ACTION

- Prioritize projects and programs on mechanization in areas with large farms and high labor price (implying labor scarcity). Farmers in these areas will be more receptive.
- Introduce a sound credit program to farmers or farmers' organizations interested to avail of machines.
- Make machines for rent more available. As most farmers operate on a limited budget, the rental market is their best chance to avail of machine services. Such market must be strengthened.
- Carry out land reconfiguration that modifies field layout for more efficient machine operations and easier field access.

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ABOUT THE MATERIAL

Rice Science for Decision-Makers is published by the DA-Philippine Rice Research Institute (PhilRice) as a policy advocacy material. It synthesizes findings in rice science to help craft decisions relating to rice production and technology adoption and adaptation. It also provides recommendations that may offer policy triggers to relevant rice stakeholders in search of opportunities to share their knowledge on rice-related products.

The theme for this issue highlights the significance of mechanizing postharvest operations to improve farmers' competitiveness. To be competitive is to be able to reduce cost while maintaining the same yields so they can offer a lower selling price.

This issue pushes for the prioritization of programs on mechanization in areas with large farms and high labor price, introduction of a sound credit program to farmers to avail of machines, availability of machines for rent, and reconfiguration of lands. These recommendations when formulated into policies can help Filipino farmers become more competitive.

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Rice Science for Decision-Makers, December 2016
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