How effective are our postharvest facilities?

Nerlita M. Manalili, Kevin F. Yaptenco, and Alessandro A. Manilay

Losses from postharvest operations are one of the most common problems in agriculture. The United Nations Food and Agriculture Organization Global Initiative on Food Loss and Waste Reduction reports 40–45 percent postharvest losses for cereals, seafood, fruit and vegetables, roots, and tubers (FAO 2015). In the Philippines, Serrano et al. (2009) estimate losses of 15 percent for rice and 13–29 percent for major fruits and vegetables.

The Philippine government has implemented programs to address the problem of postharvest losses. These programs cover various stages of the food supply chain such as on-farm postharvest activities, processing, logistics, marketing, and trading. Given the significant amount of public investment given to these programs, their effectiveness needs to be determined.

This Policy Note summarizes the key findings of an evaluation of postharvest facilities (PHFs) in the country. The study looked into the effectiveness of PHFs to generate the needed evidence if these are worthy of further investments and to have a basis in upgrading value chains and improving the economic outcomes for small farmers. The results are useful for determining the direction of agricultural research, development, and extension in the country, formulating government policies, and planning agricultural projects and programs.

1 Facilities that fall under PHF include equipment and facilities that are required immediately after harvest (e.g., threshers, mechanical dryers), processing and storage facilities (e.g., milling equipment, ice plants, cold storage, warehouses), and market infrastructure and transport facilities (e.g., food terminals, tramlines, farm roads).
In 2009, the Korean International Cooperation Agency (KOICA) gave a grant worth PHP 649 million to establish four rice processing centers (RPCs) equipped with modern milling and drying equipment. These facilities are located in the provinces of Pangasinan, Iloilo, Bohol, and Davao del Sur. This six-month study (October 2014–March 2015) covered the four RPCs supported by KOICA. From these sites, other facilities funded by other programs/projects of the Department of Agriculture (DA) that were within reasonable distance of an RPC such as food terminals, flatbed dryers, and rice threshers were included in the study. Site visits to three municipal food terminals (MFTs), seven barangay food terminals (BFTs), three flatbed dryers (FBDs), and threshers were conducted.

The evaluation started with an initial assessment of the operational status of the various PHFs, followed by an in-depth assessment of a final list of PHFs. In-depth assessment was carried out through site visits and interviews with farmer-respondents and key informants (Table 1). Key informants included representatives of institutions involved in the planning/operation of a PHF, such as local government officials, heads of local units of the DA, facility managers, and members of the Board of Directors of RPCs. Background information and current status of PHFs were also obtained from relevant government agencies such as the Philippine Center for Postharvest Development and Mechanization (PHILMECH), the DA, and provincial and municipal local government units (LGUs).

Results

Rice processing centers

The RPCs were assessed on the basis of their capacity utilization and effect on postharvest losses. Based on procurement records, these facilities were found to be underused mainly because of lack of capital to procure paddy.

Table 1. Number and type of respondents and postharvest facility covered by the study per province

<table>
<thead>
<tr>
<th>Province/Institution</th>
<th>Rice Processing Center</th>
<th>Municipal Food Terminal</th>
<th>Barangay Food Terminal</th>
<th>Flatbed Dryer</th>
<th>Thresher</th>
<th>Key Informant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A B C D E C</td>
<td>A B C D E C</td>
<td>A B C D E C</td>
<td>A B C D E C</td>
<td>A B C D E C</td>
<td>A B C D E C</td>
</tr>
<tr>
<td>Pangasinan</td>
<td>35 35 1 0 0 0</td>
<td>0 5 1 4 4 27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Davao del Sur</td>
<td>31 32 1 0 0 0</td>
<td>30 33 3 4 4 34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iloilo</td>
<td>32 30 1 21 13 2</td>
<td>4 8 1 6 10 23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bohol</td>
<td>31 30 1 11 11 1</td>
<td>20 20 2 6 5 22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHILMECH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>129 127 4 32 24 3</td>
<td>54 66 7 20 25 117</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A = User of facility; B = non-user; C = manager; D = supplier of food terminal; E = customer of food terminal

Source: Impact Evaluation Terminal Report
As required by the agreement with KOICA, the DA and the RPC beneficiary (farmers’ organization) must contribute PHP 20 million and PHP 2 million, respectively, as working capital of the RPC. However, this is inadequate relative to the design capacities of the RPCs. Since each RPC can service 1,000 hectares of production area, about PHP 80 million is needed as capital to operate at full capacity. Moreover, the Bohol and Pangasinan RPCs have been operating at a loss. Only the Iloilo and Davao del Sur RPCs reported a positive income from 2011 to 2014.

In addition to lack of operating capital, other problems were evident in the operational aspect such as the nonpreparedness of recipient farmer organizations. Also, some of the RPCs are not profitable due to management issues, lack of proper oversight, and local politics like delays in operational turnover to recipient farmer organization arising from the desire of LGUs to have a greater role in RPC operations that conflicts with the original project concept. Specifically, in the case of the RPC Matanao, the LGU refuses to sign the Memorandum of Agreement (MOA) unless they are given direct oversight in the financial management of the RPC as they plan to inject funds to its operation.

Regardless of these limitations, the RPCs were still able to reduce quality and physical postharvest losses in rice. Paddy must be dried in less than 24 hours after harvest to prevent quality deterioration (i.e., grain yellowing) that reduces the value of paddy and milled rice. This study noted that drying of paddy can be delayed for one to three days when sun dried (the popular drying method). Paddy procured by the RPCs can be dried immediately since each facility is equipped with five batch-recirculating dryers (total drying capacity of 6 tons per day). The avoided value loss, assuming a one- and three-day delay in drying, was computed using the actual paddy procurement (7,238,178 kg) of the RPCs for the months of July–October in 2013 and 2014. In addition, the price (PHP 20.50/kg) paid by the RPCs for good-quality paddy was used to compute for the monetary value. This was compared to the value of paddy that was not subjected to any delay in drying. Zero delay in drying represents 100-percent paddy value (no quality loss due to yellowing) while percent deductions from the 100-percent value correspond to one and three days’ drying delay. A one-day delay in drying results in a value loss equivalent to PHP 30.4 million. A larger value loss (PHP 44.67 million) can be experienced if drying is delayed by three days. An average value was also computed based on one and three days’ drying delays. This study used this average (PHP 37.53 million) as the value loss avoided due to the presence of the RPCs (Table 2).

In addition to preventing value losses, the RPCs also reduced quantitative losses during the drying and milling processes. The

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2 Quality deterioration due to delays in drying becomes significant during the wet season months of July–October.
the facility. The average RPC buying price for wet paddy is higher than the buying price offered by private traders and millers, especially during the wet season with rice farmers benefiting from price margins of PHP 0.79-1.11 per kilogram. The total gain in farmers’ income due to higher buying prices reached PHP 13.9 million. The RPCs also provided a safety net for farmers during periods of oversupply (wet season harvest), when private traders do not accept wet paddy or offer very low buying prices. The hindrances were found to be related mainly to project implementation in addition to the lack of working capital.

A benefit-cost analysis using the capital recovery approach revealed that the presence of the RPCs resulted in a capital recovery ratio of 1.37 indicating that the annualized value of aggregate benefits was able to cover one year of the annuity value of the project cost (PHP 865 million) plus 37 percent of the annuity for the succeeding year. This implies that the investment on the RPCs is viable and sustainable.

**Flatbed dryers and threshers**
Flatbed dryers reduce grain deterioration during the rainy season at the farm level. However, the aggregate capacity of drying facilities is not enough to accommodate all

### Table 2. Estimated reductions in value and quantitative losses in paddy using RPC drying and milling facilities

<table>
<thead>
<tr>
<th>Reduction in quality deterioration (value loss) by using RPC dryers</th>
<th>Value of paddy with zero delay in drying (RPC dryers)</th>
<th>Value of paddy with 1–3 days’ delay in drying (sun drying)</th>
<th>Value of avoided quality loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full value: PHP 148,382,649*</td>
<td>75% of full value: PHP 110,851,569*</td>
<td>PHP 37,531,080*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduction in physical losses by using RPC dryers</th>
<th>Recirculating batch dryers</th>
<th>Sun drying (5.8% losses)</th>
<th>Value of avoided quantity losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>No significant quantity losses</td>
<td>PHP 82,876,528</td>
<td>PHP 82,876,528</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduction in physical losses using RPC rice mill</th>
<th>RPC rice mill</th>
<th>Single-pass rice mill (60% MR**)</th>
<th>Value of avoided quantity losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in physical losses using RPC multipass rice mill (67.5% MR**)</td>
<td>PHP 1,499,109,158</td>
<td>PHP 1,332,541,478</td>
<td>PHP 166,567,680</td>
</tr>
</tbody>
</table>

Total value of avoided losses

| | PHP 286,975,288 |

*PHP 20.50 per kilogram of wet paddy; **Milling recovery
Source: PHILMECH and IRRI

Philippine Center for Postharvest Development and Mechanization (PHILMECH) estimated that 5.8 percent of the total paddy volume can be lost due to sun drying. By using the RPC drying facilities, physical losses due to drying could be averted. The value of the avoided losses was estimated to be PHP 82,876,528.00 when converted to milled rice. This was based on 5.8 percent of the total paddy procurement of the RPCs for 2013 and 2014 for the dry and wet season harvests (57,850,436 kg). Lastly, losses reduced due to improved milling recovery (from 60% to 67.5%) amounted to PHP 166,567,680.00 representing the increase in quantity of milled rice as a result of using the RPCs’ modern milling facilities.

The RPCs also helped increase farmers’ income by offering higher buying prices, thereby serving as an incentive to farmers to patronize
farmers. During the dry season, the impact of FBDs is less pronounced because farmers prefer selling wet paddy or practice sun drying. A common problem experienced with the FBDs is the corrosion of the perforated steel flooring. A cheap and effective solution is to use bamboo slats covered by nylon nets.

Threshing immediately after harvest is urgent because farmers need ready cash to pay off debts and meet household needs. Delays in threshing also lead to yellowing of grain that reduces its value (Mendoza and Quitco 1985). The volume of paddy threshed by the DA thresher, based on 20 key informants, was 141,320 kilograms (Table 3). The computed cash value of the quality loss eliminated by timely threshing was PHP 190,000 or PHP 9,500 per farmer.

**Food terminals**

BFTs and MFTs function as food depots and distribution hubs. Located around farming or fishing areas, these facilities can provide direct links between suppliers and consumers. Farmers and other local residents can also easily purchase groceries for household needs. Reduced transport cost was identified as a significant benefit from BFTs. Savings ranged from PHP 7.50 to PHP 275.00 per trip depending on the type of commodity being transported.

MFTs serve as trading centers where growers can bring produce in large volumes for direct trading with wholesalers and “viajeros”. The involvement of middlemen is reduced, which means better income for growers.

**Conclusion and recommendations**

Overall, the PHFs assessed were found to have a positive impact in addressing postharvest losses and improving the marketing system for rice and high-value crops.

The main objective of the RPCs is to increase farmers’ income through the production of good-quality milled rice and the reduction of postharvest losses. The RPCs achieved these expectations. More benefits can be realized if capital for paddy procurement can be increased.

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**Table 3. Volume of paddy (kg) threshed by 20 key informants in study sites**

<table>
<thead>
<tr>
<th>Study Sites</th>
<th>Bohol</th>
<th>Davao</th>
<th>Iloilo</th>
<th>Pangasinan</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>4,400</td>
<td>760</td>
<td>4,000</td>
<td></td>
<td>19,160</td>
</tr>
<tr>
<td>20,000</td>
<td>4,800</td>
<td>4,240</td>
<td>4,800</td>
<td></td>
<td>33,840</td>
</tr>
<tr>
<td>3,160</td>
<td>4,960</td>
<td>600</td>
<td>20,000</td>
<td></td>
<td>28,720</td>
</tr>
<tr>
<td>8,800</td>
<td>8,320</td>
<td>24,000</td>
<td>1,320</td>
<td></td>
<td>41,120</td>
</tr>
<tr>
<td>10,000</td>
<td>960</td>
<td>3,000</td>
<td>3,200</td>
<td></td>
<td>10,960</td>
</tr>
<tr>
<td>1,320</td>
<td>1,320</td>
<td>3,000</td>
<td>3,200</td>
<td></td>
<td>1,320</td>
</tr>
<tr>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,200</td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>3,200</td>
<td>3,200</td>
<td>3,200</td>
<td>3,200</td>
<td></td>
<td>3,200</td>
</tr>
</tbody>
</table>

Source: Impact Evaluation Terminal Report
The distribution of FBDs and threshers is part of the Rice Mechanization Program for the period 2001–2016. The program was able to preserve grain quality and reduce the volume of postharvest losses by augmenting existing thresher and dryer capacities.

The food terminals are meant to provide agrisuppliers with access to markets, improve the availability of commodities and basic goods, create employment, enable operators to become entrepreneurs, and strengthen partnership between LGUs and the private sector. The evaluated food terminals were found to be well-managed and have achieved their objectives. Products sold at comparable prices (relative to the nearest market) as well as the entrepreneurial skill of beneficiaries were found to be important factors for the successful operation of a food terminal.

But as reported, these PHFs are beset with issues that are mainly related to their management and operation, viability, and sustainability. Below are some recommendations to address those issues.

**Project planning and implementation**

- Give sufficient time and attention to packaging of project proposals as flawed concepts, designs, and plans cannot be offset by a good implementation strategy.
- Involve beneficiaries and project stakeholders as early as possible for greater understanding and appreciation of the PHF to be established. Identifying potential individuals who will champion the cause of the project and are acceptable to all beneficiaries and stakeholders is recommended.
- Implement strict adherence to project guidelines (MOA, terms of reference, etc.) to improve project implementation. Political interference and personal interests that affect implementation should be avoided or minimized.
- Monitor compliance of RPC products with National Food Authority standards for milled rice by mandated government agencies (PHILMECH, Bureau of Agriculture and Fisheries Product Standards, or Department of Trade and Industry). Impose sanctions or penalties for violations.

**Rice processing centers**

Utilization, reduction of postharvest losses, plant operation, and management are all pressing concerns that affect the viability and sustainability of RPCs. The following recommendations should be considered:

- Increase the operating capital to PHP 40–80 million to allow RPCs to scale up procurement. To be able to accommodate the increased volume, additional cargo trucks of mixed sizes must be provided to each RPC for timely pickup of harvested paddy and delivery of milled rice. This can be considered as a second phase of the KOICA project to ensure the sustainability of each RPC. However, the release of additional funds and inputs by the DA should be subject to performance evaluation of each facility (e.g., good quality of milled rice products, healthy financial standing of the RPC, and positive impact of the RPC on rice farmers).
• Strengthen information and education campaign on existing government programs and review the limitation of current financing and credit issuance schemes given that despite years of program existence, not many farmers are being reached by the program or are availing of its services. Financing and crop insurance services attuned to farmers’ needs help reduce farmers’ dependence on private traders who are charging high interest rates on loans while procuring paddy at very low prices.

• Identify and/or train a reputable and capable Philippine distributor of Korean spare parts and equipment for RPC facilities and equipment. Distributors should be able to comply with guidelines on after-sales service as specified by the Philippine Agricultural Engineering Standards 138:2004.

• Provide specific guidelines as to:
  a. The limit of management’s prerogative to sustain plant operation at whatever cost (e.g., procure paddy beyond the design service area of 1,000 hectares).
  b. The treatment of cost and revenue of the PHF.

• Set aside sufficient funds to cover repair and maintenance of equipment and facilities. For facilities provided by donor agencies, after-sales service by equipment suppliers should be negotiated under acceptable terms.

• Enhance the role of RPCs as a coordinator of the rice value chain by:
  a. Providing farmers with information that can help them make informed decisions (buying and selling prices, volume requirements and availability, cultivar requirement, among others).
  b. Formulating a schedule of planting and harvesting in identified areas to rationalize paddy deliveries to RPCs. The production schedule can be coordinated by the management team of the RPC since they are in contact with the buyers of milled rice who have specific requirements with respect to variety, volume, quality, and time of delivery.
  c. Providing credit within the value chain to ensure sustainable supply of paddy to the RPC by farmer-beneficiaries.

**Food terminals**

The success and failure of MFT and BFT projects need to be documented and their results should be disseminated for learning insights. For existing food terminals, technical improvements are recommended such as better lighting and mechanized handling to help reduce physical damage to fragile produce, reduce labor requirements, and lessen workers’ injury. Hygienic handling should be promoted to improve food safety.

To ensure maximum utilization of an MFT, a survey of existing food terminals and wet markets is suggested during the planning stage of a new project. The current status of existing food terminals can provide clues on whether an additional facility is needed, how large should it be, and where it should be established.

**Flatbed dryers**

With the implementation of the DA Rice Mechanization Program until 2016, further improvement in the design, fabrication, and
use of flatbed dryers nationwide should be done. To recover public investment through reduced postharvest losses and improved product quality, the following measures are recommended:

- Closely monitor accredited fabricators to ensure quality of disseminated units, compliance with specifications, and proper and timely servicing if defects are present.
- Conduct thorough evaluation of project beneficiaries and proper site selection to maximize the use of dryers.
- Incorporate design improvements for safety and durability.
- Perform regular monitoring and testing (by government agencies concerned, such as PHILMECH, DA regional and provincial field units, and Agricultural Machinery Testing Center) to ensure proper operation and maintenance of FBDs.

All of the PHFs evaluated are still ongoing government programs and some of them may be expanded. While the study found the PHFs as worthy government investments, a regular and thorough review should still be carried out to determine their further impact. Selection of sites and beneficiaries should be based on a set of suitable criteria, rather than using a “divide-by-N” approach that disregards the possibility of duplication of functions and overlapping coverage of a growing or trading area (HDN 2013). Facilities established and maintained with scarce government funds and without properly trained personnel result from poor and short-sighted planning.

References


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1 The “divide-by-N” approach refers to the practice of, for example, having 10 state universities for 10 provinces that are clustered together, even if two universities would have been able to service these provinces.