From Rice Fields to Rice Mills: Updating the Palay Milling Recovery Rate in the Philippines using Multi-Disciplinary Approach

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Abstract

Amid growing concerns over the supply and demand of key agriculture and fishery commodities in the Philippines, a comprehensive study was conducted to evaluate the milling recovery rate (MRR) from palay to rice. As rice is a prime staple food and critical commodity in the Philippines, statistics related to it has to be reliable and up-to-date. To this end, the Philippine Statistics Authority reassessed the MRR to ensure alignment with current industry conditions.

This study employed a multidisciplinary approach which include field visits, focus group discussion, consultation meetings, and desk research to produce an updated MRR, adjusting it from 65.4% to 63.0%. This approach enabled the researchers to analyze, explore, and actively engage with key stakeholders, recognizing their vital role in the validation process and in the broader agricultural industry of the country.

The recalibration, in effect, has significant implications, as these statistics serve as key references for policy and decision-making, particularly in ensuring food security, managing supply and demand, and advancing agricultural policy development.

Keywords: milling recovery rate, palay/paddy, food security, supply and demand

1. Introduction

Official statistics rely on comprehensive and accurate data to support informed decision-making. The Handbook on Management and Organization of National Statistical Systems (2022) mentioned that data for official statistics are primarily obtained through three key methods: (a) by direct inquiries – surveys – among individuals, households, business and institutions; (b) by the acquisition of administrative data from government and other administrative sources; (c) by utilization of other data sources, such as commercial data streams from businesses, geospatial data, data from sensors, and social media data.

As data sources continue to evolve, "new methods may have to be considered to deal with the unstructured nature of the data and to make the most of the emerging opportunities to produce more timely and more detailed information, or even new types of information (Broe et al., 2021)." Furthermore, the integration of new data sources with traditional survey and administrative data is often necessary for comprehensive statistical analysis.

Accordingly, the Philippine Statistics Authority (PSA)[1] incorporates data sources and methods, extending beyond surveys and administrative records. To refine methodologies, concepts, and statistical definitions, including updating of parameters, the PSA employs a multidisciplinary approach that incorporates stakeholder consultations, focus group discussion, field visits, and desk research. The study aims to improve the precision and applicability of the economic indicator MRR by adopting these comprehensive methodologies to validate and enrich data collection, ultimately contributing to high-quality statistical products that remains relevant and responsive to data users' needs.

[1] The PSA, as the government's central agency, is responsible for all national censuses and surveys, sectoral statistics, community-based statistics, consolidation of selected administrative recording systems and compilation of national accounts.

The validation process undertaken in this study cannot be replaced by purely innovative data collection methods which may require higher costs, as the type of data required in this study demands rigorous scrutiny through an in-depth understanding of on-the-ground conditions. A thorough examination of the real-world context, facilitated by physical field visits, remains essential for ensuring the reliability and accuracy of statistical findings.

This study addresses this need by identifying and validating the updated MRR from *palay* (paddy) to rice through a multidisciplinary approach. It seeks to evaluate whether the existing conversion ratio accurately reflects the current realities of the rice industry, ensuring its continued relevance and reliability in agricultural statistics and planning.

2. Background on the Milling Recovery Rate

The Milling Recovery Rate (MRR) is a critical conversion rate in the estimation of rice stocks and in the preparation of the Supply Utilization Accounts and Food Balance Sheets (SUA-FBS). These statistical accounts are identified as designated statistics under the System of Designated Statistics (SDS)[2] of the PSA.

The SUA-FBS presents a comprehensive picture of the pattern of a country's food supply during a specified reference period. In the compilation of the SUA-FBS, definite conversion ratios and parameters are utilized. Some of these conversion ratios and parameters were offshoots of statistical and research studies done by agencies involved in the generation of statistics on production and usage of agricultural products through an Interagency Committee which developed the manual in 1995. Since then, these conversion ratios and parameters have been used constantly. With the changing technology and accessible data collection methods, the PSA recognized the need to come up with up-to-date conversion ratios and parameters reflective of the current situation of the agriculture and fishery sector.

In 2023, the PSA engaged in the process of reviewing, validating, and updating the conversion ratios by conducting a joint project with Food and Agriculture Organization (FAO) of the United Nations on strengthening agricultural statistics. This initiative highlighted the need for an in-depth review of the SUA-FBS framework, its parameters, and the technical conversion ratios, including the MRR.

The MRR is the ratio of the weight of milled rice to the total weight of *palay* (paddy), expressed in percent (%), and is used as a conversion factor from *palay* (paddy) to rice equivalent. Accurate MRR values are essential in ensuring reliable estimates of the beginning and ending rice stock inventories and in the estimation of derived rice production in the SUA-FBS framework.

[2] The SDS is a mechanism that identifies and designates the most critical and essential statistics required for social and economic planning/analysis based on approved criteria per Executive Order (EO) No. 352 "Designation of Statistical Activities that will Generate Critical Data for Decision-Making of the Government and the Private Sector" issued on 01 July 1996.

Definition of Terms

Milling Capacity - quantity of *palay* (paddy) that the rice mill can process to a specified quality per total milling time, expressed in kilogram per hour (kg/hr).

Milling Recovery - ratio of the weight of milled rice to the total weight of *palay* (paddy), expressed in percent (%).

Moisture Content - water content of *palay* (paddy) and milled rice expressed in percent (%).

Multi-pass rice mill - this type of rice mill has a capacity that ranges from one ton per hour to as high as 10 ton per hour input capacity. It has two kinds, the improved cono type and the other one is the modern rice mill. The milling process combines several operations run by different machine components that produce higher quality and higher yields of white rice from paddy or rough rice.

Single-pass rice mill – this type of rice mill processes the removing of hulls and bran layer done in one passing inside milling machines with separate huller and whitener in one cylinder with steel fluted huller/whitener and screens; and in a rice mill machine with huller paddy separator and single whitener.

Premium Grade Rice - any rice variety which meets the highest-grade requirements for rice that contains a maximum 5% broken kernels and well milled.

Regular Milled Rice - rice kernel from which the hull, the germ, the outer bran layers and the greater part of the inner bran layers have been removed but parts of the lengthwise streaks of the bran layers shall be within the range of 15-40 percent of the kernels.

Well Milled Rice - less than 15 percent presence of bran streaks in sample grains.

Rice Bran (darak) - outer layer of the brown rice consisting of the aleurone cells covering the endosperm of the rice grain.

Rice Brewer (binlid) - milled rice chips, small pieces or particles of rice that pass through a sieve having round perforations 1.4 millimeters in diameter.

Rice Broken - grains that break in the process of milling which have a size of less than eight-tenth (8/10) of the average length of whole grain.

Rice Husk/Hull (ipa) - the most visible part of a rough rice or paddy grain.

3. Methodology

Data Collection Methods

A. Field Visits to Selected Rice Milling Establishments

i. *Key Informant Interview (KII)*
Data and relevant information were collected for updating the SUA-FBS conversion ratios and parameters through interviews with the owners, operators, or other knowledgeable individuals familiar with the operations of rice milling establishments. These key informant interviews provided detailed insights into the processes, challenges, and practices of the rice milling industry.

ii. *Actual Observation (AO)*
Data was collected through actual observation, which involved measuring the actual weight of *palay* (paddy) and by-products at each stage of the milling process. This step-by-step approach was conducted directly within the milling establishments, using the available palay being processed during the visit.

a. MRR Computation

During the data gathering process, the weight of milled rice was recorded for each *palay* (paddy) sample and MRR was computed as:

$$Milling\ Recovery\ Rate\ (\%) = \frac{Weight\ of\ Milled\ Rice\ (kg)}{Weight\ of\ Paddy\ Sample\ (kg)}\ x\ 100$$

Weighted MRR based on the Volume Capacity of the Machinery

Using the MRRs gathered at the establishment/sample's level, the weighted average MRR was calculated based on the volume capacity of the machinery using the formula:

$$w_{bw} = \frac{\Sigma V_i}{\Sigma V_{ijkl}}$$

where:

V_i	is the volume of production of each establishment
ΣV_{ijkl}	is the total volume capacity of the machinery, type of observation, and milling degree of sample establishments in the province

b. Sample Selection

The study focused on key palay-producing provinces contributing 50% of the country's total palay production, prioritizing areas with active rice milling establishments. A total of 18 provinces with 154 respondents were surveyed, namely Ilocos Norte, Ilocos Sur, Pangasinan, Cagayan, Isabela, Bulacan, Nueva Ecija, Pampanga, Tarlac, Occidental Mindoro, Oriental Mindoro, Capiz, Iloilo, Negros Occidental, Bohol, Negros Oriental, Bukidnon, and Misamis Oriental.

The 2021 List of Establishments (LE)[3], which was the latest LE available during the conduct of the study, guided the selection of rice milling establishments, prioritizing those with a total employment (TE) of 10 or more. For prominent rice-producing provinces such as Bulacan, Nueva Ecija, and Isabela, milling establishments with a TE of 20 or more were included.

Informal and village-type milling establishments, which were not included in the LE were also strategically included during field visits. However, remote areas and establishments which were unresponsive to the request letter to visit were excluded due to time and budgetary constraints.

[3] The 2021 List of Establishments (LE) serves as the source of sampling frame for all establishment-based surveys and censuses conducted by the PSA. It provides information on the distribution of establishments and employment across areas and industries.

c. Data Collection Instrument

A structured questionnaire was used to guide the interviews, facilitating the systematic collection of data on the following:

- MRR and by-products, including rice bran, broken rice, brewer's rice, and rice husk/hull;
- market dynamics, such as pricing of milled rice, target markets, moisture content of palay, and the volume of palay milled; and
- detailed stages of the milling process, from initial handling to the final product output.

B. Desk Research

Secondary data were obtained from local and international studies, to analyze existing research and records to support the statistical validation. These were obtained from previous surveys conducted by the PSA, as well as research from key organizations namely the Department of Agriculture – Philippine Rice Research Institute (DA-PhilRice), Department of Science and Technology - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD), and International Rice Research Institute (IRRI). Comparative benchmarks were also derived from international sources such as the Rice Knowledge Bank of IRRI and ASEAN Food Security Information System (AFSIS).

C. Consultation Meetings

In collaboration with experts and relevant national agencies, additional information on the MRR was gathered through consultation meetings with private organizations and companies engaged in rice production and milling. This study was also shared during the 3rd Quarter Meeting of the Philippine Council for Agriculture and Fisheries (PCAF) National Sectoral Council (NSC) on Rice and Other Food Staples.

D. Focus Group Discussion (FGD)

A focus group discussion was further conducted to solicit inputs from government agencies and private sector entities. This provided a comprehensive review of the rice milling industry, and it ensured that the study was informed by experts engaged in rice production and across the milling value chain.

The FGD was attended by the following stakeholders:

- Government Agencies: Agricultural Machinery Testing and Evaluation Center (AMTEC), Bureau of Plant Industry (BPI), Department of Agriculture (DA), National Irrigation Administration (NIA), National Food Authority (NFA), and DA-PhilRice.

- Private Sector Entities: IRRI and Philippine Statistical Association, Inc. (PSAI).

4. Results and Discussion

Table 1. Field Visit Results to Selected Rice Milling Establishments: 2024
(Weighted based on the milling capacity)

Parameter	MRR (%)	Field Visit Results	
		MRR from Key Informant Interview	MRR from Actual Observation
Milling Recovery Rate	62.86	62.74	63.48
Rice Bran (darak)	11.79	11.24	14.59
Rice Broken	0.49	0.33	1.29
Rice Brewer	1.09	1.14	0.81
Rice Hull (Ipa)	23.78	24.55	19.84

Table 1 shows that based on the results of field visits in 2024, the MRR at 14% moisture content was 62.86% or approximately 63.0%. This means that for every 100 kilograms of *palay*, the rice equivalent is 63 kilograms.

Table 2. Desk Research

Desk Research	MRR (%)
Local Studies	62.47
International Studies	67.00

Table 2 presents the desk research based on local and international studies. The average MRR for local studies cited in this study was 62.47%, while international studies reported an MRR of 67.0%.

Table 3. Previous PSA Surveys/Field Visits

PSA Surveys/Field Visits	Year/s conducted	MRR (%)
Survey of Rice Mills	2008 and 2011	64.13
Field Visits to Rice Milling Establishments in Leyte and Iloilo	2022	61.33
Survey on Costs and Returns of Palay Production	2022	58.57

In 2008 and 2011, the PSA conducted the Survey of Rice Mills to determine a parameter for converting the total weight of *palay* (paddy) milled into rice for consumption, resulting in a MRR of 64.13%. In 2022, the field visits to rice mills in Leyte and Iloilo yielded a MRR of 61.33%. Additionally, the 2022 Survey on Costs and Returns of Palay Production, based on *palay* farmers' perspective, reported an MRR of 58.57% (Table 3).

Table 4. Consultation with Government and Private Institutions

Government and Private Institutions	MRR (%)
Private Organization 1	65.00
Private Organization 2	
Premium Rice	65.00
Regular Milled Rice	70.00
Private Organization 3	
Regular Milled Rice	63.00
Well Milled Rice	60.00
Private Organization 4	61.00
Government Agencies (FGD)	63.00 to 65.00

Consultation meetings and responses from the private sector institutions revealed that MRR ranges from 60.00% to 70.00%. Meanwhile, inputs from the concerned government agencies during the FGD indicated that the MRR ranges from 63.00% to 65.00% (Table 4).

Multiple Regression Analysis

A multiple regression analysis was conducted as supplemental to determine the relationship of MRR with several possible factors. The findings showed that the predictors volume capacity of the machinery and the age of machinery, jointly have a significant effect on the MRR with p-value of 0.03 at 5% level of significance. The estimated value of the volume capacity of the machinery at 0.04 implies that for every additional metric ton of volume milled, the MRR is predicted to increase by 0.04, holding other variables constant. Meanwhile, the estimated value of the age of equipment at -0.05 suggests that for each year added to the age of the machinery, the MRR is predicted to decrease by 0.05, holding other variables constant.

General Observations

Overall, this study highlights several observations from the different approaches that may contribute to the variations in the MRR, particularly on the factors that may critically influence the MRR. These include the variety of *palay* (paddy), maturity of grain, moisture content, drying process, harvesting practices, and the color rice when milled.

The variety of *palay* (paddy), such as RC160, RC168, and Longpin, exhibit distinct characteristics affecting milling efficiency and output. The maturity of the grain may also be a factor affecting MRR, golden colored palay grain tends to provide rice with higher quality. The moisture content of *palay* (paddy) is also a major factor to be examined. Rice millers use the optimal range of moisture content from 13% to 14%. Additionally, the drying process practices impacts the outcome, as mechanical drying and sun drying produce varying effects on the grain.

Further, the harvesting process determines the quality and recovery rate of the crop while the color of the milled rice is a key indicator that could affect the MRR, depending on the buyer's preference. Operators of mills normally adjust the rice huller knobs to suit the customer's

preference on the color and milling degree (well milled or regular milled). This adjustment results to the changes in the MRR as well. Moreover, it was revealed by rice millers in Bulacan which caters predominantly to the Metro Manila market, - most populated metropolitan in the Philippines, that rice buyers have a strict demand for rice quality. Apparently, the more particular a buyer is in the color of *palay* (paddy), the more it yields a lower MRR.

It was also discovered by actual observations on rice milling practices that most establishments process mixed varieties of *palay* (paddy), locally referred to as "Rambol" which may impact milling consistency and rice quality. In addition, single-pass milling machines are usually used to cater milling of rice intended for home consumption.

Institutional Coordination

The PSA presented the results of the study to the Technical Working Group on Crops Statistics (TWGCS) which then reviewed and recommended the updated MRR from 65.4% to 63.0% for the approval of the Interagency Committee on Agriculture and Fishery Statistics (IACAFS)[4]. The recommendation was based on the results of the field visits to selected rice milling establishments. The value of 63.0% MRR represents the modal value across the various methods conducted. Also, the TWGCS recommended to present the results of the study to the concerned units of the DA [i.e., PhilRice, Philippine Center for Postharvest Development and Mechanization (PhilMech), NFA, and Department of Agriculture - National Rice Program (DA-NRP)], to solicit comments and solidify the proposal of the TWGCS.

The IACAFS during its 4th Quarter 2024 meeting recommended and endorsed for approval of the PSA Board[5] the updated MRR of 63.0% subject to the concurrence of DA. The DA interposed no objection to the updated MRR of 63.0% and acknowledged that the MRR should be more precise to support better data collection, analysis, and policy-making in the sector. As such, the recommendations by the TWGCS and IACAFS supporting the validation process which reflects the current situation of the rice milling industry, was elevated to the PSA Board.

The results of the study and recommendations were presented to the PSA Board during its 37th Meeting where the recommendations were approved through PSA Board Resolution No. 17 Series of 2024 entitled “Approving and Adopting the Updated Milling Recovery Rate of 63 Percent (63.0%) from Palay to Rice”.

As a result, the PSA institutionalized the adoption of the updated MRR from *palay* (paddy) to rice starting January 2025, for the generation of rice stocks and compilation of SUA, which is as well a component in the compilation of the FBS as designated statistics.

[4] The IACAFS is a coordination mechanism which serves as a forum for discussion of the issues raised by concerned producers, users and other stakeholders of statistics before it is elevated to the PSA Board.

[5] In the Philippine Statistical System, the PSA Board serves as the highest policy-making body on all matters relating to government statistical operations, standards and classifications. It is composed of the different government agencies in the Philippines.

Policy Implications

The updated MRR of 63% clearly has an impact on the changes of Food Available for Consumption[6] under the SUA of Rice. A lower MRR leads to reduced rice equivalent available in the market, potentially affecting food security. Hence, the quantity of imports on rice would increase to meet the local demand and maintain rice supply stability.

This study also observed that multi-pass rice milling establishments with advanced technology are likely to produce more volume and higher quality of milled rice than those of the single-pass or village-type rice mills. This highlights the need to align the policies toward improving the equipment of farmers and millers through assistance, subsidies, and programs aimed to promote technology advancement.

5. Conclusions

The change in the MRR can be further attributed to multiple factors which cannot be solely imputed to a single cause. This adjustment is grounded in a comprehensive validation process, reflecting the current situation of the rice industry in the Philippines.

The multidisciplinary approach employed in this study underscores the importance of aligning data collection and analysis, maintaining reliable and up-to-date statistics. It also highlights the importance of strengthening linkages with agricultural sector stakeholders involved in the improvement and advancement of the Philippine rice industry, as it does not only contribute to the resilience and competitiveness of the rice industry both in the local and global contexts.

Ultimately, this study emphasizes that the need for the updating of the conversion ratios should be viewed in the context of promoting an integrated approach to economic statistics which requires, to the extent possible, the active involvement of government agencies and private sector stakeholders in the agricultural industry in identifying and addressing community challenges. The methodology—comprising field visits to rice milling establishments, desk research, consultation meetings, and focus group discussions—proved to be a cost-effective and reliable means of updating statistical parameters. Through these validation practices, this study enabled researchers to analyze, explore, and actively engage with key stakeholders, recognizing their vital role in the validation process and the broader agricultural industry.

Over time, it is crucial to recognize that the conversion ratios and parameters currently used in producing statistics, along with the methodologies, may require essential update in response to technological advancements and evolving industry conditions.

[6] Food Available for Consumption refers to the volume of food commodity available for human consumption. It is the remaining balance after all the "use" parameters in SUA are taken into account.

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