Breakthrough of rice quality and market share in rice to rice processing business (A case study in rural rice milling business in Karawang, West Java)

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Abstract Small Rice Mill (SRM) has an important role in rice business. Nevertheless however, low quality of milled rice and changing in consumers preferences cause SRM faces difficulty to maintain the role. Development of a business called Rice to Rice Processing (R2P) presents as a breakthrough rice business that will support their existence. This study aimed at analysing the feasibility of R2P business integrates SRM and market share in a business partnership pattern. The study was conducted in Karawang as a rice production centre. The qualitative method employed for analysis includes technical and partnership pattern with medium and big scale rice miller. The financial aspect used the quantitative method of Net Present Value, Net Benefit Cost Ratio and Switching Value to check their sensitivity. The results showed R2P business is a feasible for technological and financial aspects. Technology has evolved to produce various qualities (premium or medium). The switching value analysis showed that a decrease in product prices is sensitively influencing the financial feasibility. To strengthen cooperation that enhancing mutually beneficial relationship, R2P assists equipment investment in and buy raw material from SRM in the shape of brown rice in a rational agreed price.

1. Introduction
One of the problems on the rice milling industry is the high of grain water content [1]. In addition, the number of rice mills exceeded the production. This excess lead to seizure and raise the price of rice grain. The Indonesia Union of Rice Millers Association (PERPADI) [2] proposed equalization of the ideal number of rice mills in Indonesia. The first alternative was 45,452 units (SRM 94 %, medium rice mill (MRM)4 % and Big rice mill (BRM)2 %, second alternative of the number of rice mill was 42,979 units (SRM 85 %, MRM 10 % and BRM 5 %) and third alternative of the number of milling 40,035 units (SRM 75 %, MRM 15 % and BRM 10 %) [3]. All these alternatives still leave SRM production obtain quality problems that did not meet market demand.

Indonesia has 180 thousand rice milling units which are dominated by Small Rice Milling (SRM) of 169 thousand units or 92.8 %, followed by Medium Rice Milling (MRM) by 4.7 %, other was 1.3 %, and Big Rice Milling (BRM) of 1.1 % (Table 1) [4]. The evaluation results that one-pass type rice milling produces a yield of milled rice of 58 %. The rice recovery of this is significantly different from the yield of two-pass type rice milling, which is 62 % head rice. In 2017, the Ministry of
Agriculture issued Regulation of the Minister of Agriculture Number: 31/Permentan/PP.130/8/2017 concerning Rice Quality Class [5] as a follow up to the Minister of Trade Regulation Number: 57/M-DAG/PER/8/2017 regarding Determination of the Highest Retail Price (HRT) of rice [6]. In 2015, West Java Province has 1.9 million ha of rice fields with productivity of 6.1 tons/ha. Indramayu, Subang, and Cirebon were the largest rice production centres in West Java. The total land area of Indramayu in 2014 was 117,792 ha followed by Subang with 84,750 ha and Cirebon of 53,368 ha [7]. Rice production increased around 3% in Indramayu in 2015 due to improvements in agricultural infrastructure from 2015.

| Description | Type of milling | Total |
|-------------|----------------|-------|
| Mills (unit) | 171,495 | 8,628 | 2,076 | 182,199 |
| age (%)      | 94     | 4,7   | 1,1   | 100    |
| Recovery (%) | 55,71  | 59,69 | 61,48 |
| Rice quality (%) | 74,25  | 75,73 | 82,45 |

Decreasing of number of rice mills only reduced grain competition between mills but did not solve problems of quality and post-harvest losses. SRM played an important role in the post-harvest loss which was remain at 10-12% [9]. The highest loss occurred in drying and rice milling and SRM uses sun drying with drying floors so it will be physically scattered and low in quality, those were unevenly drying causing the rice to break in milling process easily [10]. The high loss was due to engine configuration which was generally a one pass or two passes (two times husking and two times polishing), without being followed by cleaning that made the grain was dirty. The configuration of mills with twice the breaking of grain skin caused a lot of rice cracked, so the percentage of rice broken was high [11].

1.1. Problems of the Study
SRM was expected to gradually extinct as demand for rice quality changed, the gradual competition of grain between both SRM and BRM [12]. The synergy between the two milling business could be developed to maintain SRM as a rural enterprise [13]. The development of cooperation schemes between SRM and BRM should be economic-based on sustainable growth [14]. Therefore, feasibility studies should be conducted as a basis for developing partnerships between SRM and BRM. The attention of rice business practitioners in general is market preference, also it oriented to the matching of the physical quality of rice market against the requirements of ministry reg. Num: 31:2017. (Table 2) [15]. The attention of the mill owners is still limited to satisfaction if they are able to get and buy the best condition of grain (such as low moisture content, high yield variety and good appearance of grain) to produce high miled rice yields, bran production, and less mill repairs and setting as necessary. The Standard Operation Procedure of rice postharvest handling were less be the reference. Based on these problems, the objective of the study were to search and identify the effort of millers in increasing rice quality; and to identify the proper configuration of rice mills in relation to increase whiteness, transparency and milling degree; as well as to organize a harmony in rice chain business among scales of RMU network to achieve sustainable rice market share.
Table 2. Rice quality standard. (Ministry of Agric. Reg.Num.: 31/ 2017)[5]

| No | Component of quality                                      | Unit   | Medium | Premium |
|----|-----------------------------------------------------------|--------|--------|---------|
| 1  | Milling degree                                           | %      | 95     | 95      |
| 2  | Moisture Content (max)                                    | %      | 14     | 14      |
| 3  | Head rice (max)                                           | %      | 75     | 85      |
| 4  | Broken kernel (max)                                       | %      | 25     | 15      |
| 5  | Total other rice grain (max): brewery, red kernel, yellow/damage kernel, and chalky | %      | 5      | 0       |
| 6  | Rough rice grain (max)                                    | (grain/100 g) | 1    | 0       |
| 7  | Other material (max)                                      | %      | 0.05   | 0       |

2. Method of research

The research was conducted by means of field survey to identify the status and condition of small, medium and big rice milling units included the configuration of the rice process. Arranging the network for probable variation of rice transaction and revitalization of the existed RMU configuration.

3. Results and Discussion

Model I: Rice milling configuration processed wet harvested grain as input into premium rice

The configuration of rice milling comprised of harvested grain as input processed into premium rice quality as the output. In this model, the small scale rice mills (SRM) and medium scale (MRM), generally mill the rice after dried the grain by sun drying. The quality of rice produced vary greatly but most produce medium rice quality. To produce the premium rice quality needs to be more capital on the addition of a shining machine, grader and color sorter. The process of making premium rice quality from the harvest dried grain through the process of mist polisher to get shining rice as well as machine separation such as rice grader and color separation, dirt and others rice kernels.

Model II: Rice milling configuration processed dried grain as input into premium rice

The configuration of rice milling comprised of harvested grain as input processed into premium rice quality as the output. In this model, the Big scale rice mills (BRM), generally, mill the rice after they dried their harvested grain integrated with the line process of milling machines to produce high milled rice recovery and premium quality. Most of big type rice milling, however, implemented by rice grader and color sorter, the milled rice still contain more than 5% of broken kernel, thus the produce still in medium rice quality. To produce premium rice, the BRM configuration needs to be implemented by color sorter and rice grader. Model of rice to rice mill process is more simpler milling system rather than usual milling process from rough rice. The key points of rice to rice milling process were (a) the system should had an excess among each others such as the supply of raw materials was continuous, (b) the uniformity of the quality of rice, (c) the available investment for equipment and (d) good cooperation among BRM and MRM and SRM, so the union gave advantages for each type as well as a steady operating. The raw materials come from a new rice harvested.
Model III: Rice milling configuration processed from brown rice as input for premium rice
The configuration of rice milling is processing the material from brown rice for producing premium rice. The SRMs would be interested to produce brown rice only with definitive market under contract or collaboration, otherwise they would not do that. Generally, the rice quality produced by SRM is fair, then to upgrade the quality of rice to be a premium need to apply proper machines such as at least rice grader, mist polisher and rice color sorter.

Model IV: Rice milling configuration processed medium rice as input for premium rice
The configuration of rice milling comprised of processing medium rice quality for producing premium rice. The existed configuration is only complemented by mist polisher as the shining rice maker, rice grader and color sorter to separate grain discoloration and foreign matter. To produce premium rice from medium rice. To produce rice premium, The BRM configuration needs to be upgraded by color sorter and rice grader. Model of rice to rice mill process having an excess among others,

Reliable economic analyses the manufacture of premium rice
To produce medium rice as well as premium rice qualities, depend up on preference consumers and demands as well as market preferences. The majority of consumers' demand was medium rice instead premium rice due to (a) the price of medium rice is reasonable for middle to low income's people, (b) the rice millers point of view, that medium rice was more profitable than premium rice due to higher recovery. The analysis on economical feasibility of rice price for medium as well as premium qualities resulted in the proper selection for SRM to produce regular rice quality or lower than medium quality from wet harvested grain. Then the MRM as well as LRM will purchase the milled rice produce by SRM at reasonable price, so the benefit price can be earned by SRM consistently as well as the MRM and BRM due to obtaining the guarantee of regular milled rice as the raw material for reprocessing (Figure 1). The analysis on economical feasibility of rice price of each models are mentioned in Table 3, Table 4 and Table 5.
Figure 1. Model link of SRM with LRM In developing the sustainability rice business

Table 3. Economic feasibility analyses the manufacture of medium rice from Wet Harvested paddy

| Components of activities                                      | Amount  |
|----------------------------------------------------------------|---------|
| 1. Procurement/Operational cost:                               |         |
| - Wet Harvested paddy (WHP) (Rp/kg)                           | 4,000   |
| - Wage                                                        |         |
| - Handling cost (packing, weighing, unload, transportation) (Rp/kg) | 50      |
| - Sundrying (Rp/kg)                                           | 50      |
| - Milling (Rp/kg)                                             | 250     |
| - Transportation fee (Rp/kg)                                  | 50      |
| - Overhead cost (Rp/kg)                                       | 200     |
| Sub total amount                                              | 4,600   |
| 2. Rice yield recovery (55% of WHG)                           |         |
| 3. Break Event Point of milled rice                           | 8,364   |
| 4. Market price of Medium rice per kg                         | 9,000   |
| 5. B/C Ratio                                                  | 1.96    |
Table 4. Economic feasibility analyses the manufacture of premium rice from wet harvested paddy

| Component of activities                                      | amount  |
|--------------------------------------------------------------|---------|
| 1. Procurement/Operational cost:                             |         |
| - Wet Harvested paddy (WHP) (Rp/kg)                         | 4,200   |
| Wage                                                          |         |
| - Handling cost (packing, weighing, unload, transportation) (Rp/kg) | 50      |
| - Sundrying (Rp/kg)                                         | 150     |
| - Milling (Rp/kg)                                           | 250     |
| - Transportation fee (Rp/kg)                                 | 50      |
| - Milled Rice Grading fee (Rp/kg)                            | 50      |
| - Milled Rice Color sorting fee (Rp/kg)                      | 350     |
| - Overhead cost (Rp/kg)                                     | 200     |
| Sub total amount                                             | 5,300   |
| 2. Rice yield recovery (55% of WHG)                         |         |
| 3. Break Event Point of milled rice                          | 11,521.73 |
| 4. Market sale for Premium rice (Rp/kg)                      | 12,521  |
| 5. Broken rice (15%) 0.15 x Rp.6000/kg                       | 900     |
| 6. Brewery (2%) 0.02 x Rp.2000,-/kg                          | 40      |
| Sub total amount (4+5+6)                                     | 13,461  |
| 7. B/C Ratio                                                 | 1.168   |

Table 5. Economic feasibility analyses the manufacture of premium rice from medium rice

| Component of activities                                      | amount  |
|--------------------------------------------------------------|---------|
| 1. Procurement/operational cost:                             |         |
| - Medium rice(Rp/kg)                                        | 9,000   |
| Wage                                                          |         |
| - Handling cost (packing, weighing, unload, transportation) (Rp/kg) | 50      |
| - Milling (Rp/kg)                                           | 250     |
| - Transportation fee (Rp/kg)                                 | 50      |
| - Milled rice grading fee (Rp/kg)                            | 50      |
| - Milled rice Color sorting fee (Rp/kg)                      | 350     |
| - Overhead cost (Rp/kg)                                     | 200     |
| Sub total amount                                             | 9,950   |
| 2. Rice yield recovery (83%)                                 |         |
| 3. Break Event Point of milled rice                          | 11,987  |
| 4. Market sale for Premium rice (Rp/kg)                      | 12,987  |
| 5. Broken rice (15%) 0.15 x Rp.6000/kg                       | 900     |
| 6. Brewery (2%) 0.02 x Rp.2000,-/kg                          | 40      |
| Sub total amount (4+5+6)                                     | 13,927  |
| 7. B/C Ratio                                                 | 1.161   |
4. Conclusion

The type of rice to be milled must be based on market demand/supply and the existing conditions of the most favourable rice prices. The rice mills configuration determined the capability of rice milling units in producing the quality level of milled rice and moreover supporting by processing equipment and capital investment. The rice milling business system in rice to rice is one solution to sustain the availability of alternative raw material such as brown rice and regular rice as well as newly harvested rice and this is a breakthrough of rice quality and market share in rice to rice processing business.

5. References

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