Hayami method application: A value-added analysis of rice crackers industry in ex-residency of Madiun

M T Sundari, Setyowati and R K Adi
Study Program of Agribusiness, Faculty of Agriculture University of Sebelas Maret Surakarta, Jalan Ir. Sutami No. 36 A, Surakarta 57126, Indonesia

Abstract. This study aimed to determine the value-added of rice processing into rice crackers in the Ex-Residency of Madiun, East Java. Three areas (Ponorogo Regency, Magetan Regency, and Madiun City) well-known as rice crackers producers were chosen as the locations. The sample in this study was selected purposively. The result shows that the average value-added per raw material was Rp 2,210.57/kg with an average of 946.67 kg/month for raw material used. Using the Hayami method, the average value-added was Rp 14,206.33 per working hour. Rice crackers SMEs are advised to continue to improve efficiency, especially in terms of cost and the use of raw materials to further increase the value-added.

1. Introduction
Ministry of Agriculture [1] stated that the agricultural sector has a significant role in the national economy, among others in the form of contributions in the formation of GDRP, provision of food, supply of foreign exchange resources, supply of industrial raw materials, provision of employment, poverty alleviation, increase of people’s income, and bio-energy sources. In developing the agricultural sector, one of the obstacles that is often faced is the relatively low competitiveness of agricultural products. As the market competition is increasingly fierce, strategic efforts are needed to increase the competitiveness of agricultural commodities by increasing the value-added of superior commodities. Through increasing competitiveness, it is hoped that leading agricultural commodities will be able to provide maximum contribution in improving farmers’ welfare and regional economic income.

According to Soekartawi [2], agro-industry is an industrial activity that processes agricultural raw materials into other forms that are more attractive, provide value-added, and create jobs for the community. Agro-industry is important to increase value-added, especially when production is abundant from low product prices, also for damaged or low product quality. Agro-industry development with sufficient available raw materials and time is a sufficient requirement for sustainable production. Optimization of value-added is generally achieved in an industrial pattern that is directly integrated with family farming and agricultural companies.

One of the leading industries in the Ex-Residency of Madiun that supports the development of agro-industry is the rice crackers industry. This industry enables rice commodities to have a value-added. As the staple food for Indonesian, rice is also one of the important raw materials for the food industries. The development of the rice crackers business as a home industry is supported by the availability of
sufficient raw materials, considering the production of rice in East Java Province is relatively high. This industry also creates a distinctive advantage in the Ex-Residency of Madiun.

Rice crackers or puli crackers are crackers made of rice that have been processed into rice and added with salt and a number of other seasonings. The dough is then thinly sliced, dried, and packed. Crackers are usually sold in raw form. Rice crackers have a savoury taste and a medium-hard texture. The processing is simple enough so that it is likely to be adopted as a home industry by rural communities, especially female farmers.

The development of rice cracker agroindustry in the Ex-Residency of Madiun is still faced with several obstacles such as limited capital, high production costs, limited marketing, and the obsolete technology so that the benefits are not optimal. By looking at this fact, it is necessary to conduct research to assess how much the value-added from processing rice into rice crackers by utilizing data from the MSMEs of rice crackers in the Ex-Residency of Madiun.

2. Research methods

2.1. Basic method

The basic method used in this research is descriptive-analytic. According to Surakhmad [3], this research method focuses on problems that exist in the present (actual) by collecting data which is then compiled, explained, and then analyzed. This research was conducted in the Ex-Residency of Madiun, East Java Province which included Ngawi Regency, Magetan Regency, Pacitan Regency, Ponorogo Regency, Madiun City, and Madiun Regency. This research was conducted in February - May 2018. The location was chosen because rice crackers are superior product from three regencies/cities in the Ex-Residency of Madiun, namely Ponorogo Regency, Magetan Regency and Madiun City.

The sample in this study was determined purposively. The sample used in this study was MSMEs that processed rice into rice crackers in the Ex-Residency of Madiun, which had been operating for at least one year. Respondents in this study were the owners or managers of UMKM rice crackers.

2.2. Data analysis method

The data analysis method used in value-added study is the Hayami method. According to Sulistyowati, et.al [4]; Baihaqi, et.al [5]; Karyani, et.al [6]; and Matakena, et.al [7], the Hayami method is useful to analyze the value-added obtained from processing rice into rice crackers. According to Hayami and Kawagoe [8], the procedure for calculating value-added using the Hayami method uses a calculation component consisting of output, input, price, revenue and profit.

3. Results and discussion

3.1. Research location review

The Ex-Residency of Madiun is one of the administrative division areas in East Java Province. The Ex-Residency of Madiun consists of Madiun Regency, Magetan Regency, Ponorogo Regency, Ngawi Regency, Pacitan Regency, and Madiun City. The geographical location and area of the regency that are members of the Ex-Residency of Madiun can be seen in Table 1.

Those data on Table 1 are from Central Statistics Agency of Madiun Regency 2017 [9]; Central Statistics Agency of Magetan Regency 2017 [10]; Central Statistics Agency of Ngawi Regency 2017 [11]; Central Statistics Agency of Pacitan Regency 2017 [12]; Central Statistics Agency of Ponorogo Regency 2017 [13]; Central Statistics Agency of Madiun City 2017 [14].

The Ex-Residency of Madiun is geographically located directly adjacent to Grobogan, Blora and Bojonegoro Regencies in the north. Meanwhile, it borders Tulungagung, Trenggalek and Nganjuk Regencies from the east. In the south, it borders the Indian Ocean and in the west, it borders Karanganyar Regency.
Table 1. Geographical conditions and total area of regency and city in the Ex-Residency of Madiun in 2016.

| Regency   | Coordinate Point                        | Total Area (km²) |
|-----------|-----------------------------------------|-----------------|
| Pacitan   | 110°90' - 111°43' EL and 7°92' - 8°29' SL | 1,389.87        |
| Ponorogo  | 111°07' - 111°52' EL and 7°49' - 8°20' SL | 1,371.78        |
| Madiun    | 111°25' - 111°51' EL and 7°12' - 7°48' SL | 1,010.86        |
| Magetan   | 111°10' - 111°30' EL and 7°30' - 7°47' SL | 668.85          |
| Ngawi     | 110°10' - 111°40' EL and 7°21' - 7°31' SL | 1,295.98        |
| Madiun City | 111° - 112° EL and 7° - 8° SL           | 33.23           |
| **Total** |                                         | **5,770.57**    |

3.2. Characteristics of respondents of MSMEs rice crackers in the ex-residency of Madiun, East Java

Characteristics of respondents are a general description of the background and condition of rice crackers MSMEs in the Ex-Residency of Madiun, East Java. Characteristics of respondents in this study can be seen in Table 2.

Table 2. The characteristics of respondents in the Ex-Residency of Madiun in 2018

| Description                                         | Total   |
|-----------------------------------------------------|---------|
| Number of respondent (people)                       | 18      |
| Average age of respondent (years)                   | 46      |
| Average respondent education (years)                | 9       |
| Average number of respondent family members (people)| 4       |
| Average length of effort (years)                    | 20      |
| Average building area (m²)                          | 214.33  |
| Average operating time (hours/day)                  | 7       |
| Average raw material (kg)                           | 540.13  |

Based on Table 2, the average age of respondents is 46 years and the average education of respondents is 9 years or graduating junior high. Of all respondents, the average number of respondent family members is 4 people. On average, the cracker industries have been running for 20 years, meaning that the cracker business owners can be said to have experience and have an established customer. The average building area owned by respondents is 214.33 m². This building area greatly affects the sustainability of the rice cracker industry. This is because the cracker industry requires a large place of business for the drying process. The average length of operation is 7 hours/day, which depends on weather and sunlight conditions since the drying process is very dependent on sunlight. The average raw material used is 540.13 kg. Most respondents obtain raw materials by buying directly to the market.

3.3. Analysis of production cost

Production costs are generally defined as the total costs incurred from the preparation of production to the marketing of rice crackers. The total production costs are the sum of fixed costs and variable costs.

3.3.1. Fixed cost. Based on Table 3, the fixed cost components of rice cracker business operators in the Ex-Residency of Madiun are the costs of depreciation of tools and machinery, electricity and water costs, labor costs, and land and building tax costs. The average amount of fixed costs for each month of rice cracker business in the Ex-Residency of Madiun was Rp 3,301,402.
Table 3. The average fixed cost per month of crackers business in the Ex-Residency of Madiun in 2018.

| Cost Component                  | Average per Month (Rp) |
|---------------------------------|------------------------|
| Depreciation of tools and machinery | 607,943               |
| Electricity and water           | 94,315                 |
| Labor                           | 2,434,667              |
| Land and building tax           | 164,477                |
| Total Fixed Cost                | 3,301,402              |

3.3.2. Variable cost. Based on Table 4, the total average cost of the rice cracker business in the Ex-Residency of Madiun was Rp. 24,757,081. The fee consisted of the cost of raw materials amounting to Rp 8,573,734 which was used to buy 946.67 kg of rice. The cost of supporting materials such as onions, salt, etc. was Rp 8,723,492. The cost of fuel used was Rp 6,836,037, the cost of packaging using plastic packaging was Rp 593,818 and the transportation cost was Rp 30,000. The greater the quantity of production, the greater the variable costs incurred.

Table 4. The average of variable cost per month of crackers business in Ex-Residency of Madiun in 2018

| Cost Component     | Average per Month (Rp) |
|--------------------|------------------------|
| Raw materials      | 8,573,734              |
| Supporting material| 8,723,492              |
| Fuel               | 6,836,037              |
| Packaging          | 593,818                |
| Transportation     | 30,000                 |
| Total Variable Cost| 24,757,081             |

3.3.3. Total cost. Based on Table 5, the average of total cost that must be incurred in running a rice cracker business in the Ex-Residency of Madiun was Rp 28,058,483. The results were obtained from the sum of fixed costs of Rp 3,301,402 and variable costs of Rp 24,757,081. The amount of costs incurred is influenced by the price level of other components such as rice prices, fuel prices, and others.

Table 5. The average of total cost per month of rice crackers business in Ex-Residency of Madiun in 2018

| Cost Component | Average per Month (Rp) |
|----------------|------------------------|
| Fixed Cost     | 3,301,402              |
| Variable Cost  | 24,757,081             |
| Total Cost     | 28,058,483             |

3.3.4. Revenue. Based on Table 6, the average monthly revenue of the rice cracker business in the Ex-Residency of Madiun is Rp 40,001,868. The amount was obtained from the average sales of raw crackers per month in various packages with a total production of 946.89 kg. The average price of rice crackers

Table 6. The average revenue per rice crackers business in Ex-Residency of Madiun in 2018

| Description       | Average per Month (Rp) |
|-------------------|------------------------|
| Price/kg (Rp)     | Number of bags (kg)    | Revenue (Rp) |
| Raw Crackers      | 37,574                 | 946.89        | 40,001,868   |
| Total             | 37,574                 | 946.89        | 40,001,868   |
per kilo is Rp. 37,574. The cheaper the price of rice as raw material and the higher the price of crackers sold will increase business acceptance of rice crackers, and vice versa.

### 3.3.5. Value added.

Based on Table 7, the final product value was Rp. 40,001,868 obtained from the average sale of raw rice crackers in various packages totaling 946.89 kg and the average price per kilo was Rp. 37,574. The intermediate costs incurred in the amount of Rp. 24,757,115 came from the cost of raw materials for rice in the amount of Rp. 8,573,734 with a total of 946.67 kg of rice. The cost of supporting materials such as onions, salt and others was Rp 8,723,492. Fuel costs were Rp 6,836,037, plastic packaging costs were Rp 593,818 and transportation costs were IDR 30,000.

Based on Table 6, the value-added consists of gross value-added, net value-added, value-added per raw material and value-added per labor.

#### Table 7. Analysis of value-added per month of rice crackers business in Ex-Residency of Madiun in 2018

| Description                           | Total     |
|---------------------------------------|-----------|
| Final Product Value (Rp)              | 40,001,868|
| Input or Intermediate Cost (Rp)       | 24,757,115|
| Gross Value Product (Rp) (1-3)        | 15,244,753|
| Depreciation Value (Rp)               | 607,493   |
| Net Value Added (Rp) (3-4)            | 14,636,810|
| Amount of Raw Material (Kg)           | 946.67    |
| Value Added per Raw Material (Rp) (3/6)| 2,210.57  |
| Total Working Hours (hours)           | 9,461.33  |
| Value Added per Labor (Rp) (3/8)      | 14,206.33 |

#### 3.3.5.1. Gross value-added in rice crackers industry.

Gross value-added is obtained by calculating the difference between the final product value and the intermediate cost. The final product value in this business is the value given by consumers to cracker products sold by producers. Intermediate costs are costs used in the production process for one month, including services therein. The intermediate costs used in the cracker industry are the cost of raw materials for rice, the cost of supporting materials for salt and other seasonings, fuel costs, packaging costs and transportation costs. The greater the intermediate costs, the smaller the Gross Value Added earned or vice versa. Gross added value on the rice crackers was Rp 2,210.57. This means that the rice cracker business in the Ex-Residency of Madiun was able to provide value-added of Rp 2,210.57 to rice. The final product value of rice crackers in the Ex-Residency of Madiun was Rp. 40,001,868 and the cost was Rp. 24,757,115.

#### 3.3.5.2. Net value added in rice crackers industry.

Net value-added is the difference between gross value-added and equipment depreciation. Net value-added for rice cracker products in the Ex-Residency of Madiun is Rp. 14,636,810 with depreciation value of equipment and machinery is Rp. 607,943.

#### 3.3.5.3. Value added per raw material in rice crackers industry.

Value added per raw material is value-added or remuneration given for each kilogram of raw material. In this study, the value-added was given to every one kilogram of rice. The average value-added per raw material in the rice cracker industry is Rp.2,210.57. The amount of raw material used was 946.67 kg. This can be interpreted that one kilogram of rice provides added value of Rp 2,210.57 / kg.

#### 3.3.5.4. Value added per labor in rice crackers industry.

The Value added per labor is the remuneration given to every 1 working hour of labor in the production process. From Table 6, the value-added per labor of rice crackers in the Ex-Residency of Madiun was Rp 14,206.33 with an average number of
working hours per month of the rice cracker industry was 9,461.33 hours. This means that everyone hour of work can provide value-added of Rp. 14,206.33/hour

4. Conclusions and recommendations

4.1. Conclusions
The average value-added per raw material in the Rice Crackers business in the Ex-Residency of Madiun was Rp2,210.57/kg with an average amount of raw material used for one month was 946.67 kg. The average value-added calculation per working hours of the Rice Crackers business in the Ex-Residency of Madiun was Rp 14,206.33/hour.

4.2. Recommendations
The rice crackers MSMEs need to continue to attain a sufficient level of efficiency, especially in terms of cost and the use of raw materials to further increase the value-added. The quality control must be improved to produce a quality product in accordance with consumer wills.

References
[1] Ministry of Agriculture of the Republic of Indonesia 2009 The Role of the Agriculture Sector in Indonesia’s Economy Accessed on 1 March 2019 at 12.57 WIB
[2] Soekartawi 1996 Pembangunan Agroindustri yang Berkelanjutan (Malang: Universitas Brawijaya Press)
[3] Surakhmad W 1994 Penelitian Ilmiah, Dasar, Metode dan Teknik (Bandung: Tarsito)
[4] Sulistyowati L 2018 IOP Conf. Ser.: Earth Environ. Sci. 142 012042
[5] Baihaqi A, Hamid A H, Susanti E, Paga P E, Wardhana M Y and Marsudi E 2020 IOP Conf. Ser.: Earth Environ. Sci. 425 012076
[6] Karyani T, Djuwendah E and Supriyadi E 2018 IOP Conf. Ser.: Earth Environ. Sci. 166 012047
[7] Matakena S, Sairdama S S and Karyawanti 2021 Turkish Journal of Computer and Mathematics Education 12 3477–84
[8] Hayami Y and Kawagoe T 1993 The Agrarian Origins of Commerce and Industry: A Study of Peasant Marketing in Indonesia (New York: St. Martin’s Press)
[9] Central Statistics Agency of Madiun Regency 2017 Madiun Regency in Figures 2017 (Madiun: BPS Kabupaten Madiun)
[10] Central Statistics Agency of Magetan Regency 2017 Magetan Regency in Figures 2017 (Magetan: BPS Kabupaten Magetan)
[11] Central Statistics Agency of Ngawi Regency 2017 Ngawi Regency in Figures 2017 (Ngawi: BPS Kabupaten Ngawi)
[12] Central Statistics Agency of Pacitan Regency 2017 Pacitan Regency in Figures 2017 (Pacitan: BPS Kabupaten Pacitan)
[13] Central Statistics Agency of Ponorogo Regency 2017 Ponorogo Regency in Figures 2017 (Ponorogo: BPS Kabupaten Ponorogo)
[14] Central Statistics Agency of Madiun City 2017 Madiun City in Figures 2017 (Madiun: BPS Kota Madiun)