# ECONOMIC EFFICIENCY OF THE USE OF PRODUCTION FACTORS IN THE HOUSEHOLD INDUSTRY OF TEMPEH CHIPS IN WONOGIRI REGENCY

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## ABSTRACT

This research aims to determine the cost, revenue, influence of production factors, and economic efficiency of tempeh chips in Wonogiri Regency. The primary method of analysis is descriptive and analytical. The proportional random sampling method determined the process of determining the location by purposive sampling and 30 samples. Data analysis methods include (1) Cost, Revenue, and Profit Analysis; (2) Analysis of Multiple Linear Regression in the Cobb-Douglass Production Function; (3) Economic Efficiency Analysis. The results showed an average total cost of Rp. 22,550,435.53 per month, a revenue of Rp. 27,828,488.57 per month, and a profit of Rp. 5,278,053.04 per month. Soybean and flour production factors partially have a significant effect on the production of tempeh chips. The results of the economic efficiency analysis showed that the use of soybeans had not achieved economic efficiency while the use of flour was inefficient. Economic efficiency in the tempeh chips industry business can be improved by increasing the factor of soybean and reducing the use of flour.

## BACKGROUND

The food processing industry is a business innovation from agricultural products into a product with higher value. The food and beverage industry can be run on a large or small scale. The food and beverage industry can be run on a large or small scale. Drive can be done in a small scope, such as a household. The household industry consists of a workforce of 1-4 people (Statistics Indonesia, 2017). The most significant number of household industries in Wonogiri Regency is the food and beverage industry. Based on data from Department of KUKM and PERINDAG Wonogiri Regency (2019), the number of sectors reached 2,347 businesses out of 3,746 businesses. One of the growing food industry businesses is the tempeh chips industry. Tempeh chips are a popular snack that Indonesians well like (Wijaya et al., 2019).

Soybean is the raw material used to make tempeh which is then processed into tempeh chips. Soybeans are very influential in the production of tempeh produced (Sopuwan et al., 2016). Soybeans are very important as a source of vegetable protein and improve people's nutrition because they are safe for consumption (Wahyudin et al., 2017). Wonogiri Regency is ranked 5th in soybean production in Central Java and was able to produce as many as 8,431 quintal soybeans with a harvest area of 5,453 ha (BPS Central Java Province, 2018).

Based on data from Department of KUKM and PERINDAG Wonogiri Regency (2019), the tempeh chips industry at Wonogiri Regency decreased from 158 industries to 143 industries. The number of industries has decreased because entrepreneurs do not understand production factors efficiently due to a lack of understanding of entrepreneurs' use of production factors. In the tempe

chips industry, various factors affect the production of tempeh chips. Factors affecting the production of tempeh chips in Blora Regency are raw materials, labor, capital, and the chip technology (Pradana, 2013). This research aims (1) to analyze the amount of cost, revenue, and profit, (2) to analyze the influence of production factors, and (3) to analyze the economic efficiency in combining the use of production factors in the tempeh chips industry in Wonogiri Regency.

## RESEARCH METHODS

**Research Location Determination Method**

Determining the research location using the purposive sampling method is a determination technique with specific considerations (Syamsuni, 2019). Location selection is located in Giriwoyo district and Girimarto district. The underlying location determination is because Giriwoyo and Girimarto districts have the highest number of tempeh chips in the Wonogiri Regency.

**Sample Determination Method**

According to (Singarimbun, 1989), a study used a sample size large enough to follow a normal distribution. A large sample that follows normal distribution is a sample whose size is 30, so the sample to be used is as many as 30 samples taken from 2 districts, namely Giriwoyo district and Girimarto district. Each district is taken by two villages that have the most tempeh chips. A method to determine the number of samples of the tempe chips industry uses a proportional random sampling technique. This technique is a sample consisting of sub-sub-samples whose balance follows the sub-population study using randomization (Riyanto & Hatmawan, 2020). Here is a table on the calculation of sample size in each district.

**Table 1.** Sample Size in Tempeh Chips Industry in Wonogiri Regency 2020.

| No | Sub-district | Village | Number of Industries | Sample |
|----|-------------|---------|----------------------|--------|
| 1. | Girimarto | Jendi | 24 | 19 |
| | | Selorejo | 2 | 2 |
| 2. | Giriwoyo | Sirnoboyo | 6 | 5 |
| | | Pidekso | 6 | 4 |
| | **Amount** | | **38** | **30** |

Sources: Department of KUKM and PERINDAG Wonogiri Regency 2019.

**Cost, Revenue, and Profits Data Analysis Methods**

The total cost of the tempeh chips household industry consists of explicit and implicit costs. Direct costs are actual expenses incurred by the company to purchase or rent the necessary inputs. Implicit cost is the value of the input that is owned and used by a company in its production process (Salvatore, 2007). The cost can be written in the form of the following formula:

$$TC = EC + IC$$

Where TC is the total cost (Rp/month), EC is the explicit cost (Rp/month), and IC is the implicit cost (Rp/month). From Purwaningsih (2017) told that farm revenue is the value of the production. Revenue is the result of multiplying the amount of production and selling price. Systematically formulated as follows:

$$TR = P.Q$$

Where TR is total revenue or total receipt (IDR/month), P is the output price (IDR/month), and Q is the number of products produced (pieces/month). Also from Purwaningsih (2017), the profits of farming are the difference between revenue (TR) and all costs, both explicit and implicit. Written with the following formula:

$$\Pi = TR\text{-}TC$$
$$TC = \text{Explicit TC} + \text{Implicit TC}$$

## Double Linear Regression Analysis with Cobb- Douglass Production Function

Analysis of the effect of the use of production factors on production in the tempeh chips industry is carried out using the cobb-Douglass production function with the formula as follows:

$$Y = A \, K^a \, L^b \text{ (Todaro \& Smith, 2006)}.$$

From the Cobb-Douglas function, the production function model for tempe chips is compiled as follows:

$$Y = aX1^{b1} \ X2^{b2} \ X3^{b3} \ X4^{b4} \ e^u$$

| | | |
|---|---|---|
| $Y$ | : | Production of Tempeh Chips |
| $X^1$ | : | Soybeans (Kg) |
| $X^2$ | : | Flour (Rice, Kanji, and Gaplek) (Kg) |
| $X^3$ | : | Packaged Cooking Oil (Liter) |
| $X^4$ | : | Labor (unit of workday) |
| a | : | Contanta |
| b1-b4 | : | Regression coefficient |
| e | : | Natural logarithm |
| u | : | Error |

For the short-term Cobb-Douglas production function to be applied to analyze the existing production system, the original form of the Cobb Douglass function must be transformed into a linear structure in logarithmic, as follows:

$$\text{LnY= Ln and} + \beta1 \text{ Ln X1} + \beta2 \text{ Ln X2} + \beta3 \text{ Ln X3} + \beta4 \text{ Ln X4} + u$$

Simultaneous tests (F) are used to see if independent variables have a significant effect on dependent variables (Kurniawan, 2016). Partial significance tests are used to see how each independent variable partially affects its dependent variables (Kurniawan, 2016).

## Analysis of Efficiency of Use of Production Factors

The value of economic efficiency is calculated by looking for the ratio of the marginal product value of each production factor (MPVi) equal to the input price (Pxi) (Wahyuningsih et al., 2018).

$$MPVi = \bar{P} \, xi$$
$$\beta \, xi \, . \bar{Y}/\bar{X}, \bar{P}y = \bar{P} \, xi$$

Where Pxi is the average price of input price factor I, $\beta$ xi is the regression coefficient of the I production factor, $\bar{Y}$ is average output (production), Xi is the average input, and $P_y$ is the average output (sell) price. According to Soekartawi (2003), the actual reality of the value equation is not equal to 1 (one); what often happens is : (MPV / Pxi) > 1; this means that the use of the x production factor is not yet efficient, to achieve efficiently, then the use of production factor x needs to be added

or (MPV/ Pxi) < 1 this means the use of x production factor is inefficient, so it is necessary to reduce the x production factor to achieve efficiency.

## RESULT AND DISCUSSION

### General Condition of Research Sites

The area of Wonogiri Regency is located at 7º 32 '- 8º 15' latitude south and Longitude 110º 41 '- 111º 18' East Longitude. Wonogiri Regency is located in the southeastern part of Central Java Province. The area of Wonogiri Regency is 182,236,02 Ha, or 5.59% of the area of Central Java Province. Most of Wonogiri Regency's area is rocky and hilly due to its location on the Sewu highlands. Wonogiri Regency consists of 25 districts and 251 villages. Girimarto District and Giriwoyo District are part of Wonogiri Regency, which produces the most Tempe Chips, according to data from the Department of KUKM and Disperindag Wonogiri Regency 2019.

### Identity of Tempeh Chips Industry Owner

The respondent's identity includes the number of respondents, age, education, number of family members, family members who are active in the business, the number of workers outside the family, and long work. Respondents of tempeh chips were sampled by 30 with an average age of 49. This age is still considered productive age (15-64 years). The productive age of the respondents can maximize the tempe chips industry. Most of the education level of the tempe chips industry owner is only elementary school. The education level of the respondents is low due to constraints on school fees.

Two family members help in the process of making tempe chips. Most of those who work are housewives and their husbands or children. In addition, there is also labor from outside to help the production process. The tempe chips industry has been around for 11 years. The average respondent has long established the industry because there is an industry from his parent's legacy, and entrepreneurs can be said to be experienced. Tempe chips industry is the main occupation of the respondents. In establishing the tempeh chips industry, several reasons are behind it, including legacy business, experience as a laborer, and following his training and initiatives.

### Characteristics of Tempe Chips Industry

The tempeh chips industry is a food industry that uses soybean as raw material and is processed into tempeh. Respondents chose to use imported soybeans due to the better quality of soybeans. In line with (Mh et al., 2015) that imported soybeans are more in demand by Surakarta Regency people, including Wonogiri Regency, where it is mentioned that the soybeans desired by tempeh producers are clean, expand, big size, shiny yellow color, and uniform. The equipment used to help the production process of tempeh chips is very diverse. Such kit includes a soybean grinding machine, stove, frying pan, shelf, plywood board, wood ruler, plastic tub, strapless, perch, etc.

## Costs, Revenue, and Profits Tempe Chips Industry

Here's a table of calculations of costs, revenue, and profits.

**Table 2.** Average Production, Revenue, Cost, and Profit in Tempeh Chips Industry in Wonogiri Regency 2020

| Description | Per Month |
|---|---|
| Production (Pieces/Month) | 65,749.53 |
| Price (IDR/piece) | 423.25 |
| Revenue (IDR/month) | 27,828,488.57 |
| Explicit Cost (IDR/month) | 19,363.423.35 |
| Implicit Cost (IDR/month) | 3,187,012.18 |
| Profit (IDR/month) | 5,278,053.04 |

Source: Processed Data, 2020.

The average explicit cost is IDR 19,363,423.35 per month. The explicit costs include the cost of raw materials, the cost of supporting materials, the cost of packaging, the cost of fuel, the cost of transportation, and the cost of outside labor. The average implicit cost is IDR 3,187,012.18 per month. The implicit costs in the tempe chip industry in Wonogiri Regency include depreciation costs, own capital costs, and domestic or family labor costs. The average total cost of IDR is 21,692,769.20 per month. Revenue is obtained from the multiplication of the price and the amount of production of tempeh chips. The average income in the tempeh chips industry business is IDR 27,828,488.57 per month. The average profit is IDR 5,278,053.04 per month.

## Factors Influence the Production of Tempeh Chips.

Factors that influence the production of tempe chips, among others soybeans, flour, cooking oil, and labor. The equation model used for analysis is the Cobb-Douglas production function model. Here is the equation after in the natural logarithm.

$$LnY = Ln\ 6,354 + 0,960Ln\ X^1 - 0,251Ln\ X^2 + 0,228LnX^3 - 0,090LnX^4$$

Where:

Y        : Production of Tempeh Chips (pieces)
$X^1$     : Soybeans (Kg)
$X^2$     : Flour (Rice, Kanji, and Gaplek) (Kg)
$X^3$     : Packaged Cooking Oil (Liter)
$X^4$     : Labor (unit of workday)

## Classic Assumption Testing

The normality test shows if the distributed residual value is average (Ansofino et al., 2016). Based on the normality test results using histogram charts and P-Plot tests, it can be known that the curve of the histogram chart is bell-shaped, and the data peaks at point 0. The P-Plot test shows that the data were close to a straight line, with the results being proven to be normally distributed data. Suliyanto (2011) stated that if the tolerance value is more than 0.1 and the VIF value is no more than 10, then there are no multicolinear symptoms. Based on the multicollinearity test results on SPSS, tolerance values on each variable > 0.1 and VIF < 10 values can be known. This indicates that there are no deviation multikolinearitas in the regression model. Based on the results of scatterplot diagram

research, some dots spread and do not form a certain pattern so that the data can be inferred that there is no heteroskedasticity (Santoso, 2010)

**The Influence of Production Factors on Tempe Chips Production**

Based on the results of the analysis can be known that an adjusted value of $R^2$ is 0.963. This means that the production of 96.3% of tempeh chips is influenced by production factors such as soybeans, flour, cooking oil, and labor. The remaining value of 3.7% is influenced by other factors not studied.

Based on the results of the study, it can be seen from the sig two-tailed value of 0.000 and more petite than $\alpha = 1\%$, which means that the variables of soybean, wheat flour, cooking oil, and labor together have a significant effect on the production of tempeh chips. The influence of production factors on partial production results can be seen by using the significance test of the regression coefficient with the t-test (Kurniawan, 2016). The following are the results of the regress coefficient test.

**Table 3.** Analysis of Regression Coefficient of Regression Coefficient in Tempe Chips Industry in Wonogiri Regency Year 2020

| No | Variable | Regression Coefficient | t count | t table (1%) | Sig |
|----|----------|-----------------------|---------|--------------|-----|
| 1. | Soybean | 0.960 | 11.486 | 2.78744 | 0.000*** |
| 2. | Flour | -0.251 | -3.172 | 2.78744 | 0.004*** |
| 3. | Cooking Oil | 0.228 | 2.005 | 2.78744 | 0.056[ns] |
| 4. | Labor | -0.090 | -0.986 | 2.78744 | 0.334[ns] |

Source: Processed Data, 2020

Based on Table 3, the partial soybean and flour factors significantly affect the production of tempeh chips, where the significance value is less than the significance level tested (0.05), and the t table value is more than the t count. Soybean is an important production factor in tempe chips because soybeans are the raw material for making tempe chips. Flour is used as a dough mixture with spices to fry tempeh chips. The flour used in the tempeh chips business uses two types of flour, namely rice flour and tapioca flour. While the cooking oil and labor factors partially do not affect the production of tempeh chips. The standard test value of the partial regression coefficient is used to determine the production factors most influential to the production of tempeh chips from other production factors.

**Table 4.** Standard Value of Partial Regression Coefficient in Tempe Chips Industry in The District Wonogiri Year 2020.

| No | Production Factor | Standard Regression Coefficient |
|----|-------------------|--------------------------------|
| 1. | Soybeans | 0.942 |
| 2. | Flour | -0.153 |

Source: Processed Data, 2020.

Based on Table 4. it is known that the production factor whose most significant value is soybeans with a beta value of 0.942. Soybeans are the raw material in the manufacture of tempeh chips, so the production factor of soybeans is most influential in the production of tempeh chips.

**Tempe Chips Industrial Economic Efficiency Analysis**

Based on the study results, the number of regression coefficients obtained was 0.709. The value indicates the elasticity of production (Ep) where $0 < Ep < 1$, the elasticity value is in region II. In this area, there is a maximum profit. Maximum profit can be achieved if the marginal product value equals the input price (Sujarwo, 2019). Here's a table of economic efficiency calculations.

Table 5. Economic Efficiency Analysis on Tempeh Chips Industry in Wonogiri Regency 2020.

| No | Factors of production | β xi | Ȳ/Xi | Py | MPVxi | Pxi | MPVxi/Pxi |
|----|----|----|----|----|----|----|----|
| 1. | Soybeans | 0.960 | 173.075 | 423.25 | 70,323.90 | 7,248.00 | 9.702 |
| 2. | Flours | 0.251 | 103.272 | 423.25 | -11,126.96 | 13,021.35 | -0.842 |

Source: Processed Data, 2020.

The calculation of the economic efficiency of the MPVxi / Pxi value of soybean production factors is 9.702, where the value of MPVxi/Pxi > 1 means that soybeans have not achieved economic efficiency, so it is necessary to add the use of soybeans to attain maximum profit. In line with the research from (Anggraini et al., 2016) on The Economic Efficiency and Income Analysis of Tempeh Craftsmen in Klaten Regency, it is explained that soybean and yeast factors have not been economically efficient judging by the MPVx/Px ratio of more than one so that soy and yeast inputs must be added to maximize profits. The value of MPVxi/Pxi of flour production factor is -0.842. The value of MPVxi/Pxi < 1 means that flour is not economically efficient, so it is necessary to reduce the use of flour to achieve efficiency. Excessive use of flour will only result in crumbs.

## CONCLUSION AND SUGGESTION

Based on the study results, the average explicit cost is IDR 19,363,423.35 per month, and the average implicit cost is IDR 3,187. 012.18 per month, so the average total cost is IDR 21,692,769.20 per month. Average revenue in the tempeh chips industry business amounted to IDR 27,828,488.57 per month and an average profit of IDR 5,278,053.04 per month; factors of production in the form of soybeans, flour, labor, and cooking oil together are also real influence on the production of tempeh chips in Wonogiri Regency. The partial production factors of soybeans and flour have a significant effect n the production of tempeh chips, while the cooking oil and labor factors partially do not affect the production of tempeh chips; The combination of the use of soybean production factors in the tempeh chips business has not achieved the highest economic efficiency. The combination of the use factor of flour production in the business of tempeh chips is inefficient.

Based on the conclusion obtained, recommendations to increase the tempeh chips industry in Wonogiri Regency are as follows; Industry owners should pay more attention to combining production factors to achieve efficiency economically as soy use needs to be increased while flour needs to be reduced.

# REFERENCES

Anggraini, P. D., Prasetyo, E., & Setiawan, B. M. 2016. Economic Efficiency Analysis And Income of Tempeh Producer in Klaten Regency. Journal of Social Welfare 3(2), 155–171.

Ansofino, Jolianis, Yolamalinda, & Arfilindo, H. 2016. Buku Ajar Ekonometrika. In Ilmu Ekonomi. Yogyakarta : Deepublish Publisher.

Department of KUKM dan PERINDAG Kabupaten Wonogiri. 2019. Data Industri Rumah Tangga 2019.

Kurniawan, R. 2016. Analisis Regresi Dasar dan Penerapan dengan R. Jakarta : Kencana.

Pradana, A. D. 2013. Analisis Faktor-Faktor yang Mempengaruhi Efisiensi Industri Rumah Tangga Keripik Tempe di Kabupaten Blora. Economics Development Analysis Journal, 2(2), 120–127.https://doi.org/https://dx.doi.org/10.15294/edaj.v2i2.139

Purwaningsih, Y. 2017. Ekonomi Pertanian Pendekatan Teori, Kebijakan, dan Penerapan. Surakarta : UNS Press.

Riyanto, S., & Hatmawan, A. A. 2020. Metode Riset Penelitian Kuantitatif Penelitian di Bidang Manajemen, Teknik, Pendidikan dan Eksperimen. Yogyakarta : Deepublish Publisher.

Salvatore, D. 2007. Mikroekonomi Edisi Keempat. Jakarta : Erlangga.

Santoso, S. 2010. Statistik Parametik Konsep dan Aplikasi dengan SPSS. Jakarta : Elex Komputindo.

Singarimbun, M. 1989. Metode Penelitian Survai. Jakarta : LP3ES.

Soekartawi. 2003. Teori Ekonomi Produksi Dengan Pokok Analisis Fungsi Cobb Douglas. Jakarta : PT. Raja Grafindo Persada.

Sopuwan, M., Napitupulu, D., & Elwamendri. 2016. Analisis Faktor Faktor yang Mempengaruhi Produksi Tempe di Kelurahan Rajawali, Kota Jambi. Sosio Ekonomika Bisnis, 19(2), 1–13. https://doi.org/http://doi.org/10.22437/jiseb.v19i2.5027

Statistics Indonesia. 2017. Industri Rumah Tangga. Jakarta. https://www.bps.go.id/istilah/index.html?Istilah_sort=deskripsi_ind.desc&Istilah_page=53#:~:text=Industri rumah tangga adalah usaha,pekerja antara 1-4 orang.&text=Industri Pengolahan digolongkan menjadi empat,yang dimiliki oleh industri tertentu.

Sugiharti, M. H., Endang, S. R., Adi, R. K., & Sundari, T. 2015. Kajian Preferensi Produsen Tahu Tempe Terhadap Bahan Baku Menyongsong Swasembada Kedelai 2014 di Karesidenan Surakarta. Agrin: Jurnal Penelitian Pertanian 19(1), 66–80.

Sujarwo. 2019. Ekonomi Produksi Teori dan Aplikasi. Malang : UB Press.

Suliyanto. 2011. Ekonometrika Terapan : Teori & Aplikasi dengan SPSS. Yogyakarta : CV. Andioffset.

Syamsuni, H. 2019. Statistik dan Metodologi Penelitian Dengan Implementasi Pembelajaran Android. Jawa Timur : CV. Karya Bakti Makmur.

The Central Statistics Agency (BPS) Central Java Province. 2018. Luas Panen, Produksi, dan Produktivitas Kedelai Menurut Kabupaten/Kota di Provinsi Jawa Tengah, 2018. Jawa Tengah.https://jateng.bps.go.id/statictabl/2019/10/15/1737/luas-panen-produksi-dan-produktivitaskedelai-menurut kabupaten-kota-di provinsi-jawa-tengah-2018.html

Todaro, M. P., & Smith, S. C. 2006. Pembangunan Ekonomi (Edisi Kesembilan). Jakarta : Erlangga.

Wahyudin, A., Wicaksono, F. Y., Irwan, A. W., Ruminta, R., & Fitriani, R. 2017. Respons Tanaman Kedelai (Glycine max) Varietas Wilis Akibat Pemberian Berbagai Dosis Pupuk N, P, K, dan Pupuk Guano Pada Tanah Inceptisol Jatinangor. Kultivasi, 16(2), 333–339. https://doi.org/10.24198/kltv.v16i2.13223

Wahyuningsih, A., Setiawan, B. M., & Kristanto, B. A. 2018. Efisiensi Ekonomi Penggunaan Faktor-Faktor Produksi Pendapatan Usahatani Jagung Hibrida dan Jagung Lokal di Kecamatan Kemusu, Kabupaten Boyolali. Agrisocionomics Jurnal Sosial Ekonomi Pertanian, 2(1), 1–13. https://doi.org/https://doi.org/10.14710/agrisocionomics.v2i1.2672

Wijaya, I. G. N. S., Ciptahadi, K. G. O., & Yasa, I. P. E. P. 2019. Pengembangan Usaha Industri Rumah Tangga Keripik Tempe di Tabanan 1. Jurnal Ilmiah Populer, 1(2), 47–51.