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TECHNICAL EFFICIENCY OF TRADITIONAL MEDICINE RAW MATERIAL INDUSTRY IN INDONESIA

Indri Ivana, **Suhel Suhel**, **Mukhlis Mukhlis**
Faculty of Economics, University of Sriwijaya, Palembang, Indonesia
*E-mail: ivanainds@gmail.com

ABSTRACT
Indonesia has a variety of plants that function as medicines potentially improving the economy through the part of the herbal plantation sector which is used as an industrial traditional medicine. In this study, researchers calculate the level of efficiency of the traditional medicine raw material industry in Indonesia (ISIC 21021) in the period 2000-2019. The stochastic frontier approach (SFA) model is based on the Cobb-Douglas production theory including production, capital, raw materials, and labor to see industrial efficiency. This research shows that the average of efficiency is 0.994731809 from the frontier or maximum production. The capital variable has a negative and significant effect on the output produced by producers in the industry, while the labor variable has a positive and significant effect on the output produced. Raw materials also have a significant effect on the output for this Industry in Indonesia.

KEY WORDS
Stochastic Frontier Approach (SFA), Cobb-Douglas, production theory, technical efficiency, industrialization.

Industrialization has played an important role in improving the economic conditions of various countries, including Indonesia. Many types of industries that exist, the traditional medicine industry has an important part and it is a potential asset for the people of Indonesia due to its biological wealth in the form of herbal plants evidenced by the existence of Jamu which is local wisdom and a reflection of the nation's culture which is a high-value heritage. Traditional medicine is a value-added transformation of herbal spices which can increase economic growth and on the other hand provide benefits for its consumers (Nuzuliyah, 2018). For the Indonesian people, traditional medicines whose raw materials are taken from natural plants and traditionally prepared from generation to generation by their ancestors so that they can provide benefits to this day (Isnawati & Sumarno, 2021). From 2017 to 2020 the growth of the chemical, pharmaceutical and traditional medicine industries, which are included in the processing industry sub-sector, continues to increase by 8.48 percent.These factors made Indonesia still has to import to fulfill the demand for medicinal raw materials that comply with standards (Ministry of Trade, 2019). In addition to natural factors and farmers' knowledge regarding management and market structure, another reason for the scarcity of traditional medicinal raw materials is the business activity of exporting traditional medicinal raw materials abroad, causing Indonesia still has to import to fulfill the demand for medicinal raw materials in accordance with standards and consequences. There is a difference in prices that are better than the selling price in the domestic market; farmers sell their commodity more in foreign markets than in the country because the margins obtained are more profitable. Other problems that reduce the value of industrial productivity in medicinal plants caused by weather factor and market uncertainty due to low productivity and affect the level of efficiency of the raw material industry for traditional medicines. According to Hasibuan (1993) that inefficient conditions are related to high cost economic factors. The high cost economy includes unstable inputs, weak inter-industry linkages, relatively narrow markets and low innovation. Production costs will affect the level of efficiency. Therefore, this research is specifically different from previous. Analyzing the efficiency of the traditional medicine raw material industry in Indonesia by using the Stochastic Frontier Analysis approach to capital, raw materials and labor variable.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Structure, performance and behavior, Schmalensee (1988) defines it as the application of microeconomic theory to the analysis of firms, markets and industries, with the SCP model or paradigm developed in 1933 by JS. Bain, where the SCP model examines the interaction between the three main components of an industrial organization which are structure, behavior and performance. There are three elements or market variables that are considered important because they affect the market behavior shown by buyers and sellers. These elements are structure, behavior and performance. In industrial organization theory, there is a theory called SCP (structure, behavior, performance), which this theory explains that the performance of an industry is strongly influenced by market structure. The market structure will affect the behavior and strategies of companies in trading, and practices will affect performance. First, deepen the relationship between structure and also performance, and then the second is to continue analyzing structure in behavior and then performance.

Meanwhile, Farrell (1957) with Efficiency Theory, where in his pioneering work on efficiency argues that the problem of measuring economic efficiency is not only important for economic theory but also useful in policy-making and implementation processes. Efficiency is a condition when people get a lot of goods and or services with limited resources (Mankiw, 2014). According to Farrell, (1957) maximum production is defined by frontier production. Measuring efficiency involves measuring the distance between the observed data points and the frontier. The efficiency of a manufacturing company has two components: technical efficiency and allocation efficiency. Technical efficiency (TE) measures a firm's ability to generate maximum potential output from a given input. Allocative efficiency (AE) measures a company's ability to utilize an input cost-minimizing ratio or an output ratio that maximizes revenue. A company must be technically efficient to be allocative efficient, and achieving both levels of efficiency requires economic efficiency (Coelli et al., 2005). The study of efficiency measurement decomposes technical efficiency further into technical efficiency and pure scale. Scale efficiency measures the optimality of firm size where the mean and marginal product is the same (Forsund & Hjalmarsson, 1979). Pindyck & Rubinfeld, (2014) developed the Theory of Production Theory and Function, in which a firm's production decisions are analogous to consumer purchasing decisions, and can also be understood in three steps: 1) Production Technology: a practical way to describe how inputs (such as labor, capital, and raw materials) can be turned into output. 2) Cost Constraints: The Company has to factor in the prices of labor, capital and other inputs. Just as consumers are constrained by a limited budget, companies will pay attention to their production costs. 3) Choice of Inputs: Given the technology of production and the prices of labor, capital, and other inputs, a firm must choose how much of each input to use in producing its output.

Companies must take into account the prices of different inputs when deciding which input to use. Production results or output produced by producers is influenced by the number of production factors or inputs used. The physical relationship between input and output is called the input-output relationship or (input-output relation) or also the factor relationship (FR). Approach to The Cobb-Douglas function is a functional form of the production function widely used to represent the relationship of output to input. Aigner & Lovell, (1977) and Meeusen & van Den Broeck, (1977) explain the stochastic frontier production function model. The optimal production level known as the Production Possibility Curve (PPC) is the goal of each unit of economic activity. The higher the PPC, the more efficient the production unit is. Production efficiency is inseparable from the efficiency of the use of input factors. When input factors are used efficiently, the results obtained are higher. (Garamond, 12, Justify, 12 pt after).

MATERIALS AND METHODS OF RESEARCH

In this study, researcher examines the level of efficiency of the traditional medicine raw material industry in Indonesia (ISIC 21021) in the period 2000-2019. The stochastic frontier approach (SFA) model is based on the Cobb-Douglas theory of production including

production, capital, raw materials and labor to see the efficiency. The general form of the Stochastic Frontier Approach (SFA) model:

$$\text{Ln } Y_i = \beta_0 + \sum \beta_1 ln\, X_{ij} + exp^{ei} \quad (1)$$

Based on this equation, the Stochastic Frontier Approach (SFA) model is applied to the technical efficiency of the Indonesian traditional medicine raw material industry mathematically:

$$\text{Ln } P_t = \beta_0 + \beta_1 ln\, K_t + \beta_2 ln\, L_t + \beta_3 ln\, BB_t + v_t - u_t \quad (2)$$

Results Estimation of technical efficiency is carried out by calculating the Stochastic Frontier Approach regression using the Frontier 4.1 application. able to provide efficiency estimation results. If the estimation results are close to 0 to 1, the more efficient the raw material industry for traditional medicines is in using input factors and producing optimal output. In this research, data is transformed into a natural logarithm (Ln). The variables used in this study are output (Q), capital (K), labor (L) and raw materials (BB).

Table 1 – Frontier Production Function Estimation Results

Variable	MLE (Maximum Likelihood Estimation)		
	Coefficient	Standard-Error	t-ratio
Konstanta	35.936743	4.7593040	7.5508401
LnK	-1.5263658	0.1249951	-12.211397
LnL	0.1888649	0.1593265	2.1853951
LnBB	0.3129139	0.0873154	3.5837200
Sigma-squared (s)	0.2771800	0.1349159	2.0544650
Gamma (γ)	0.0007258	0.5129055	0.0014150
Log likehood function = -13.987227			
Mean eff. in year = 0.99473181			
Level significant = 5 %			
t_tabel (5%, 16)= 1.7458			
t_tabel (1%, 16)= 2.583			

Source: Data processed by researcher (2022).

$$lnYit = ln\,35.936743 - 1.5263658 lnK_1 + 0.1888649 lnL_2 + 0.3129139 lnBB_3$$

The coefficient results are interpreted as follows:

1. The capital variable (K) has a coefficient of -1.5263658. This means that if the use of the capital variable increases by one percent; it will reduce output by 1.5263658 percent. The capital in question is fixed capital depreciation.
2. The labor variable (L) has a coefficient of 0.1888649. This means that if the use of the labor variable increases by one percent; it will increase output by 0.1888649 percent.
3. Raw material variable (BB) has a coefficient of 0.3129139. This means that if the use of the labor variable increases by one percent; it will increase output by 0.3129139 percent.

The Sigma test aims to see the cause of the deviation in the sigma square where the t-table value of sigma squared in the traditional medicine raw material industry in Indonesia, the sigma squared value is 2.0544 percent, sigma squared which is greater than zero indicates that there is an influence of standard deviation because it maximizes which means that there is an effect of technical efficiency in the model. Meanwhile, the Gamma Test shows that the error variations are caused by the technical efficiency component. Based on the estimation results, the variation in the value of the error caused by the low technical inefficiency component is 0.000725 percent. That is, there is a small difference between actual production and maximum production which is caused by technical inefficiency effects, not by other factors not included in the model. Then in the Model Constancy Test by looking at the value of the gamma ratio. At = 5 percent and N = 16 the table value is 1.7458 and the t-ratio gamma is 0.0014150 different or not equal to zero, so H0 is rejected. The right test

model or the appropriate model is the maximum likelihood estimation (MLE) model or in other words, Ha is accepted.

Statistical Test (t-test) where the t-count value with t-table is at = 5 percent and the degree of freedom (df) 16 is 1.7530. Results obtained; (1) The capital variable has no significant effect on output because the value of t-ratio < t-table, -12.2113 <1.7530, meaning that capital t has a negative effect on the resulting output. (2) The labor variable has a significant effect on the output of the Indonesian traditional medicine raw material industry. This can be seen through the value of t-ratio > t-table 2.1853951 > 1.7530, which means that labor has a positive relationship with output. The greater the labor expended, the greater ability of the traditional medicine raw material industry to produce output. (3) Raw material variables also have a significant effect on the output of the raw material industry for traditional medicine in Indonesia. We can see this from the comparison of the t-ratio > t-table value, namely 3.5837200 > 1.7530, so raw materials have a positive relationship with output. This means that the greater the raw material used, the greater the output produced. This is in line with the research conducted.

The test Effect of Inefficiency in the Model (Z Test) To see the test for the effect of efficiency in this study, you can divide the gamma coefficient by the standard error of the gamma $z = \frac{Gamma}{se.gamma}$ calculated z value is $\frac{0.0007258}{0.5129055}$= 0.0014150755 calculated z value is 0.0014150755 percent of output produced. In this case, the hypothesis is accepted, production output is not fully efficient (not fully efficient), this is following the theory where Ho = z = 0, production output is fully efficient (fully efficient) and Ha = z > 0, production output is not fully efficient (not fully efficient).

Table 2 – Stochastic Frontier Approach Analysis

Years	Efficiency
2001	0,99464427
2003	0,99466891
2004	0,99467695
2005	0,99470109
2006	0,99470928
2007	0,99475948
2008	0,99476445
2009	0,99472917
2010	0,99472955
2011	0,99472998
2012	0,99473725
2013	0,99473942
2014	0,99475004
2015	0,99471384
2016	0,99471396
2017	0,99479607
2018	0,99479858
2019	0,99481027
Average	0,994731809

Source: Data processed by the researcher, SFA (2022).

Analysis of efficiency, based on the results of calculating technical efficiency, it is known that the use of inputs which include capital, labor and raw materials from the traditional medicine raw material industry is efficient but not optimal, besides that the efficiency of the traditional medicine raw material industry tends to increase and the highest efficiency occurs in in 2019 of 0.99481027. Meanwhile, the lowest efficiency occurred in 2014 of 0.99475004.

CONCLUSION

The average of efficiency traditional medicine raw material industry is 0.994731809 from the frontier or maximum production. This shows that the use of production factors in this industry is efficient. This research refers to the opinion of Coelli (2005) if the value of the efficiency index ≥ 0.7 is efficient. The capital variable has a negative and significant effect on

the output produced by producers in the industry, while the labor variable has a positive and significant effect on the output produced. Raw materials also have a significant effect on the output for this Industry in Indonesia.

To increase the optimal value of technical efficiency, it is necessary to add some of the input factors of production. In addition, it is necessary to conduct a further review of capital inputs because the results show that capital does not have a significant effect on production results. In addition, the government needs to support and develop raw materials by increasing innovation, research and technology so that the raw materials potential can fulfill domestic demand standards and reduce imports of raw materials to create efficiency. It is hoped that further research on efficiency can be carried out using other methods such as calculating allocative efficiency and economies of scale as measured by DEA (Data Envelopment Analysis) in the Traditional Medicine Raw Materials industry.

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