p-ISSN: ....., e-ISSN: .....

THE GOVERNMENT EXPENDITURE EFFICIENCY TOWARDS HUMAN DEVELOPMENT INDEX: EVIDENCE FROM SUMATRA

ABSTRACT

This study aims to evaluate and analyze the local government expenditure efficiency of 10 provinces in Sumatra between 2017 to 2020, towards the achievement of the Human Development Index (HDI). The variables used in this study are the realization of government expenditure per capita as input variables and I-HDI indicators as the output. In addition, the efficiency determinant was further analyzed to find some factors that can be optimized to enhance the efficiency level. Data Envelopment Analysis (DEA) and Tobit Regression were employed as the research methods. The DEA result shows that North Sumatra and South Sumatra are the most efficient province, while Aceh considers the lowest efficiency level. This study also found that the HDI achievement is the main source of inefficiency, where Life expectancy contributed the most. Furthermore, the Tobit regression result shows that population density, GDP per capita, and unemployment affect the efficiency level significantly.

Keywords: Efficiency, Government Expenditure, DEA, Tobit Regression, Sumatra

I. INTRODUCTION

By the end of the 1980s, almost all the developing countries were dealing with serious financial issues such as declining export levels, rising energy and import prices, and decreasing amounts of foreign aid. In response to these problems, governments become interested finding ways to use the limited resources more effectively. Then, the concept of decentralization appeared to become at least a partial solution to the problems (Rondinelli et al., 1983). It is hoped that decentralization will enhance the government's capacity to respond to the people's needs and raise the number and grade of the services it offers. In the last few decades, decentralization has become one of the most important reforms to improve the quality of a government. Since then, further reforms have been announced in several developing countries, one of which is Indonesia.

After President Suharto, who had ruled Indonesia for 32 (1966 to 1998), was fall in February 1998, Indonesia undertook a broad variety of social reforms. One of the most crucial reforms

is a "big bang" approach to wide-ranging decentralization, by giving local governments more political power and financial resources. All Indonesian subnational governments function in accordance with this standardized system. The old-centralized government planning system was replaced by this democratic and independent one. (Nasution, 2016). The implementation of regional autonomy policy in Indonesia begins with the ratification of Law number 22 of 1999 about regional government and Law number 25 of 1999 about regional and central financial balance. The central government gives full authority to each region, both at the provincial level and at the regency or city level to regulate and manage the regional households with little intervention from the central government. This policy is known as regional autonomy. With this regulation, Indonesian economic growth is expected to be more accelerate and improve the achievement of the Human Development Index (HDI). It is also expected that with the decentralization, more growth centers will be created at least at the provincial levels. During a centralized government, the growth that has been created tends to be centralized. This is evidenced by the continued increase in HDI achievements nationally but economic inequality between provinces still occurs.

One of the crucial aspects of decentralization is the issue of fiscal decentralization. Fiscal decentralization requires that any power granted by the regional government must be accompanied by funding the amount of which must be commensurate with the burden on the respective local authorities. By this policy. With decentralization, regional growth and development are expected to be evenly distributed among all regions in Indonesia (Kadir & Ismail, 2020). Basically, there are three main objectives of implementing fiscal decentralization, which are increasing the quality and quantity of public services to the community, creating efficiency and effectiveness in the management of regional resources, and empowering and creating space for the community to participate in development.

The goal of development, especially in terms of human development, has reached a consensus among countries as the main objective of all economic and social policies implemented by governments across the world. (Anand et al., 2009; Lind, 1992; Ranis & Stewart, 2000). Indonesia has adopted the concept of Human Development as measured by the Human Development Index (HDI), which is included in the National Medium-Term Development Plan (RPJMN). This is in accordance with Law No. 25 of 2004, which regulates the national development planning system. According to UNDP (United Nations Development Program), The Human Development Index (HDI) is a composite index that measures a country's average performance in the three basic aspects of human development. First, long life, measured by life expectancy; second, education, measured by the average length of schooling and the

literacy rate of the population aged 15 and over; third, the standard of living, measured by per capita income.

The decentralization policy in Indonesia is expected to be able to improve the efficiency of public expenditure as well as Human Development Achievement. However, (Faisol, 2017) in his study stated that the regional economic growth after the decentralization is still the same, even lower than that of before the regional autonomic policy was implemented. This fact then raises the question of whether public spending is efficient after decentralization or if there is no positive impact of this policy on economic achievement. Evaluating the efficiency of public spending is still a subject of academic and policy debate in the public sector.

Comparing and measuring the performance of different levels of government remains an important topic on the current sustainable development agenda. Performance evaluation is still seen as the most important key for policy makers' decisions, and the efficiency of government spending is one of the most important issues in public finance (Hauner, 2008). By 2022, Indonesia consists of 37 local governments at the provincial level, 10 of them in Sumatra. Sumatra has various provinces with different natural potentials and uses of technology. These differences are among them in the characteristics of natural, social, economic, and natural resources, which are distributed differently in each region. These differences can be an obstacle to equitable development due to the concentration of economic activities in several provinces that have abundant natural resources. This natural wealth should be an added value to economic development. In this current era of regional autonomy, each region is required to properly manage its own regional potential to encourage a development process with a good level of equity and good economic growth as well

The study that measures government expenditure efficiency has been carried out by several researchers with various scopes and methods (Afonso et al., 2020; Ahec Sonje et al., 2018; Esanov, 2009; Gavurova et al., 2017; Gupta & Verhoeven, 2001; Iskandar & Saragih, 2019; Masca, 2014; Mohanty & Bhanumurthy, 2021a; Ouertani et al, 2018; Rapiuddin & Rusydi, 2017; Sekiguchi, 2019; Tu et al., 2018a). However, there is still no literature that specifically examines the efficiency of Sumatra. There is also found that most of the previous work only evaluates the efficiency level without discussing intensively the determinants that affect the efficiency level. The objective of this study is to evaluate the efficient performance of local government expenditure in 10 provinces in Sumatra, towards the achievement of the Human Development Index. Data Envelopment Analysis (DEA) was employed as the research method to compare multiple input and output variables. Furthermore, the efficiency determinant was further analyzed to find some factors that can be optimized to enhance the efficiency level.

II. LITERATURE REVIEW

The fundamental question of economics is concerned with the limited resources that are available to fulfill a relatively unlimited desire. One of the focuses in the economics literature is to provide efficient allocation of resources. The concept of efficiency comes from one microeconomic theory, namely the producer theory. This theory tries to minimize the cost or maximize the profit from the firm's views. In the producer theory, there is something called a production frontier line. This line is supposed to describe the relationship between the production process's inputs and outputs (Bauer et al., 1998). This line on the production frontier depicts the maximum output that can be obtained by utilizing each input. Technical efficiency refers to the process of transforming inputs into outputs. This concept applies solely to the technical relationship between inputs and outputs. The production frontier line is shown in Figure I:

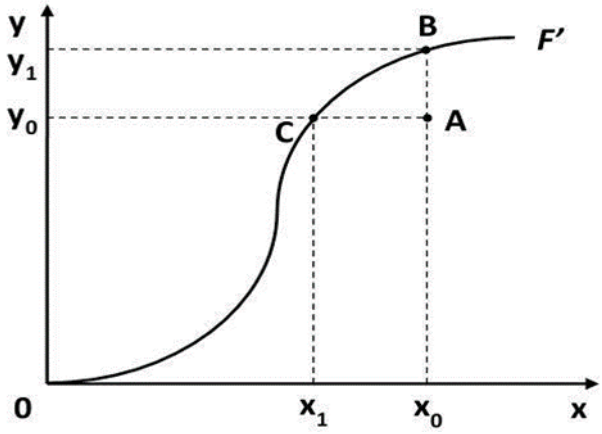

Figure 1. Production Frontier Curve

Farrel (1957) distinguishes two types of efficiency: technical efficiency and economic efficiency. In the macroeconomic context, technical efficiency is typically limited to technical and operational relations in the process of converting inputs into outputs. Because prices change in response to macroeconomic policies, economic efficiency favors the viewpoint of microeconomics, where prices are not considered unspecified (Ascarya & Yumanita, 2008). In the context of government expenditure, efficiency is defined as the ability of a government to maximize its economic activity given a given level of spending, or the ability of a government to minimize its spending given a given level of economic activity (Iskandar & Saragih, 2019). Hence, local government expenditure efficiency could be used as an indicator to assess the effectiveness of government policy implementation.

A province considers as efficient when it is no longer possible to reallocate resources that can improve the welfare of the community, in this context Human Development Index (HDI) achievement. In other words, the efficiency of local government expenditure is a condition when every rupiah spent by the government produces the most optimal level of Islamic welfare. This research is conducted to evaluate how the provincial government in Indonesia distributes the budget. There might be some provinces that have a large budget, but only perform lower than other provinces with a smaller budget. According to Esanov (2009), The efficiency of public expenditure can be measured as the difference between actual spending and the theoretically possible minimum spending sufficient to produce the same level of actual output.

In recent years there are increasing interest in the study that analyzes the government expenditure efficiency in various cases. Some of those studies analyze the government spending efficiency with across-country cases, such as the research conducted by Gupta et al (1997) which evaluated the government expenditure efficiency among 38 countries in Africa. Then, Prasetyo & Zuhdi (2013) measured the efficiency of 81 selected countries, and some research compare the efficiency of OECD Countries (Afonso et al., 2020; Dutu & Sicari, 2016; Gavurova et al., 2017; Wang & Alvi, 2011). In addition, efficiency measurements were also carried out by researchers with the case of one country, including Masca (2014) which measure the public expenditure efficiency in Rumania. Ouertani et al (2018) in Saudi Arabia, Tu et al (2018) in China, and Sonje et al (2018) in the case of Croatia.

Previous studies with an almost similar case to this study by comparing the efficiency of local government expenditure have been carried out by several types of research with the case of different countries. Mohanty & Bhanumurthy (2021) evaluated the public expenditure efficiency at the subnational level in India and Sekiguchi (2019) measured the local government expenditure in Vietnam. In the case of Indonesia, there is still limited literature evaluating the government expenditure efficiency, among them (Faisol, 2017; Iskandar & Saragih, 2019; Rapiuddin & Rusydi, 2017)

Faiso's (2018) studies aim to evaluate the public expenditure of cities or regencies in Central Java and East Java which consist of 29 regencies-6 cities and 29 regencies-9 cities respectively. This study implied Stochastic Frontier Analysis (SFA) as a research method and use the data from 2011 to 2016. The result of this study shows that in Central Java and East Java, the public expenditure efficiency scores have a positive and significant correlation with economic growth. Hence, the greater the score of regional expenditure efficiency, the higher the economic growth in the region. Then, Rapiuddin & Rusydi (2017) analyze the health and

education sectors in 24 regencies or cities in South Sulawesi using Data Envelopment Analysis (DEA). They found that most of the districts/cities in South Sulawesi Province are still not efficient in terms of technology costs and technical systems. Last, Iskandar & Saragih, (2019) in their paper evaluated the local government spending of 33 provinces in Indonesia on the health and education sector using DEA. The result showed that Bali, Babel, Yogyakarta, Central Java, and Riau Island had a relatively better efficiency value both in the education and health sectors.

III. RESEARCH METHODOLOGY

This study aims to evaluate and analyze the efficiency level of local government expenditure in 10 Provinces in Sumatra between 2017 and 2020. The input variable used in this study is local government expenditure per capita based. Data related to the regional expenditure was derived from the realization of local government expenditure per function obtained from the website of the Directorate General of Regional Fiscal Balance, Ministry of Finance. While output variable used is the indicators of the Human Development Index, which is obtained from the Central Bureau of Statistics. The detail of input and output variables used in this study are.

Table 1. Input and Output Variable

Input variables	
realization of local government expenditure per capita based on health functions	
realization of local government expenditure per capita based on education functions	
realization of local government expenditure per capita based on economic functions	
Output Variables	
Life Expectancy (LE)	Means Years of Schooling (MYS)
Per capita Expenditure (PE)	Expected Years of Schooling (EYS)

3.1. Data Envelopment Analysis

Data Envelopment Analysis (DEA) was originally developed by Charnes, Chopper, and Rhodes in 1978 (Charnes et al., 1978) and then expanded by Banker, Charnes, and Chopper in 1984 (Banker et al., 1984). This method is used to measure the relative efficiency of the Decision-Making Unit (DMU), in this case, 10 Provinces in Sumatra, between 2017 to 2020. DEA uses a non-parametric programming technique to calculate a relative efficiency score for each DMUs by comparing its outputs to inputs. DEA also provides the potential improvement

analysis to know the variables that cause the inefficiency and generate information about the variables that need to be adjusted to achieve efficiency. Currently, this method is the most commonly used in measuring the relative efficiency of DMUs. Although DEA was mostly used in microeconomic research on firm efficiency, later research extended its application to various macroeconomic topics including the efficiency of public spending.

The first step to using DEA is choosing the appropriate input and output variables used. Once the variables are identified for a set of DMUs, we begin to construct the production possibility set, within which the DMUs operate. The production possibility set contains all the correspondences of input and output vectors that are feasible. In this study, the input variable used is the realization of government expenditure per capita based on its function, and the output variable is Human Development Index (HDI). To simplify, let denote the set as Ω, government expenditure as x, and HDI as y, so that:

$$\Omega = \{(x, y) \in \Re_+^{m+s} \text{ I } x \; can \; produce \; y\} \quad (1)$$

Then, an input set$L(y)$ is the subset of all input vectors $x \in \Re_+^{m+s}$, and a production set $P(x)$ is the subset of all output vectors $y \in \Re_+^{m+s}$, which are obtained from x. The input and output sets are therefore defined respectively as:

$$L(y) = \{x \; I \; (x, y) \in \Omega\} \text{ or } L(y) = \{x \; I \; y \in P(x)\} \quad (2)$$

$$P(x) = \{x \; I \; (x, y) \in \Omega\} \text{ or } P(x) = \{x \; I \; y \in P(y)\} \quad (3)$$

In this case, the 10 provinces producing 4 outputs $(Y_i, i = 1, \dots, 4)$ with 3 inputs $(X_i, i = 1, .., 9)$. The shadow output and input prices are $(\mu_r, r = 1,2, .., 4)$ and $(v_i, i = 1,2, .., 9)$. So, for the province K, they use the input bundle $Xk = \left(Xk_{1,} Xk_2, \dots, Xk_{9,}\right)$ to produce $Yk = \left(Yk_{1,} Yk_2, \dots, Yk_{4,}\right)$. The linear "fractional" programming problems are set up as:

$$\max AP_k = \frac{\mu Y_k}{v Y_k} = \frac{\sum_{i=1}^{s} \mu_{rk} Y_{rk}}{\sum_{i=1}^{m} v_{ik} x_{ik}} \quad (4)$$

There are two DEA models which are frequently employed, namely Charnes, Cooper, and Rhodes (CCR) model and the Banker, Charnes, and Cooper (BCC) model. The primary distinction between the CCR model and the BCC model is the treatment over a return to scale.

The CCR model assumes a constant return to scale (CRS), where the production function is considered to be fixed. However, the BCC model assumes a variable return to scale (VRS), where the production function (the ratio between input and output) increment is different. It also means that in the VRS, the addition of input *x* times will not cause the output to increase by *x* times, it can be smaller or larger.

Farrell (1957) as one of the efficiency measurements pioneers separated efficiency into technical efficiency and allocative efficiency. Technical efficiency is based on the radial expansion of the factors of production (inputs and output), which can be achieved through either the maximization of outputs with a given number of inputs or input minimization to produce a given number of outputs. While allocative efficiency is the result of choosing the combination of inputs subject to their prices to maximize outputs. DEA term refers more to the definition of technical efficiency.

In the context of DEA, technical efficiency is defined as the relative ability of each DMU (in this case 10 local governments from 2017 to 2020), to produce outputs, where "relative" denotes the comparison of each unit to any other homogenous unit within the dataset. DEA allows the calculation of technical efficiency into either input or output oriented. An input-oriented seeks to determine the amount by which the input quantity can be proportionally decreased without changing the quantity of output while an output-oriented try to assess how much output can be proportionally increased without changing the quantity of input used.

This study adopted output orientation because it is assumed that the local governments want to maximize the level of human development given the size of the budget. The output orientation allows us to measure the proportional increase of the output at constant inputs. In addition, the VRS model was applied in this study because it is expected to remove the scale effect of the budget which is feared to affect outputs (Banker et al., 1984). VRS-Output DEA for the data set x, y for each province can be obtained by solving the linear programming equation below:

$$\widehat{\emptyset}_{vrsi} = max \begin{pmatrix} \emptyset > 0 | \emptyset_i Y_i \leq \sum_{i=1}^{n} y_i Y_i;\ X_i \geq \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} y_i = 1;\ Y_i > 0, i = 1,\ldots,n \end{pmatrix} \quad (5)$$

In the equation above, X and Y represent input and output variables respectively, and $\emptyset_i Y_i$ represents the efficient level of output. $\emptyset$ is a scalar while y_i is a non-negative optimal weight of input and output. $\widehat{\emptyset}$ is the technical efficiency term, where if $\widehat{\emptyset} = 1$ means that the province

is fully efficient. However, $\widehat{\emptyset}$ *<1* implies that the province is less efficient and needs to maximize its output given the level of inputs.

3.2.Tobit Regression

This method introduced by Tobin (1958) aims to evaluate the limited dependent and independent variable relationship, where the estimation is based on the result of Maximum Likelihood (ML). Tobit regression is also known as a censored regression (Gujarati & Porter, 2009). The variable is censored because the response cannot take values below (left-censored) or above (right-censored) a certain threshold value (McDonald & Moffitt, 1980). The Tobit regression is used in this research in order to evaluate the determinant of censored provinces' efficiency value (dependent variable), as the score lies between 0 and 1. Hoff (2007) argued that the Tobit approach as the second stage of DEA is sufficient in most cases. The Tobit model for panel data can be defined as follows:

$$y_{it}^{*} = X_{it}\beta + \varepsilon_{it} \tag{6}$$

$$y_{it} = \begin{cases} 0 \;\; if \; y_{it}^{*} \leq 0 \\ 1 \; if \;\; y_{it}^{*} \geq 1 \\ y_{it}^{*} \; if \; 0 < y_{it}^{*} < 1 \end{cases} \tag{7}$$

y_{it}^{*} is an unobservable latent variable, where *i* and *t* represent the provinces and year, respectively. X_{it} is a vector of the explanatory variables that are per capita GDP, population density, and unemployment. β is a vector of unknown coefficients, and ε_{it} is error terms that follow a normal distribution. Existing literature suggests that, in addition to public expenditures, human development outcomes also depend on the quality of governance (Bhanumurthy et al., 2016). It implies that government expenditure becomes more effective in increasing development outcomes depending on how the government manages its resources and considers appropriate policy. All the data related to the independent variables were obtained from the Central Bureau of Statistics. Following is the Tobit equation used in this study:

$$Eff_{it} = \upsilon_i + \beta_i Density_{it} + \beta_i GDP_{it} + \beta_i Unemployment_{it} + \varepsilon_{it} \tag{8}$$

Population density is the variable that is most commonly used by previous works to explain expenditure efficiency, measured by dividing the total population per square kilometer of land area (Lionel, 2015; Ou et al., 2020; Tu et al., 2018b). This variable is expected to capture the effect of the intensity of land use in the province. Then, per capita GDP is expected to capture monetary poverty and the degree of development, which variable was also used (Jacob, 2015; Lionel, 2015; Mohanty & Bhanumurthy, 2021b; Ou et al., 2020). Last, we use the unemployment variable to capture the human capital capacity of each province refers to (Ou et al., 2020).

IV. RESULT AND ANALYSIS

4.1. Statistical Descriptive

Table 2. Statistical Descriptive of Input Variables

Year	2017				2018			
Provinces	**Population**	**Education**	**Health**	**Economy**	**Population**	**Education**	**Health**	**Economy**
Aceh	5.189.500	3.559.083.832	1.718.796.971	1.400.137.514	5.243.400	3.780.310.006	1.902.151.831	1.451.531.046
North Sumatra	14.262.100	5.353.735.113	489.801.828	843.836.714	14.476.000	5.336.167.433	557.226.429	765.288.884
West Sumatra	5.321.500	1.922.225.470	609.820.720	433.371.632	5.411.800	2.182.818.461	669.677.595	495.599.380
Riau	6.657.900	3.157.985.465	865.019.954	451.636.166	6.717.600	2.973.018.195	759.568.127	421.360.380
Jambi	3.515.000	1.385.111.285	407.741.261	285.572.963	3.527.100	1.506.133.286	458.273.202	316.567.799
South Sumatra	8.627.000	1.597.164.563	372.596.762	281.944.894	8.391.500	1.757.782.760	433.162.596	296.405.282
Bengkulu	1.934.300	679.960.492	356.573.597	194.914.647	1.948.600	789.389.814	349.072.291	223.529.683
Lampung	8.289.600	2.530.950.212	586.894.233	362.923.845	8.377.700	2.712.583.880	558.079.907	330.770.290
Bangka Belitung	1.430.900	671.380.942	216.809.933	215.589.878	1.432.100	722.342.444	240.080.236	212.560.535
Riau Island	2.082.700	959.555.462	282.728.546	247.861.709	2.174.800	982.434.845	301.404.806	307.517.922
average	5.731.050	2.181.715.284	590.678.381	471.778.996	5.770.060	2.274.298.112	622.869.702	482.113.120
max	14.262.100	5.353.735.113	1.718.796.971	1.400.137.514	14.476.000	5.336.167.433	1.902.151.831	1.451.531.046
min	1.430.900	671.380.942	216.809.933	194.914.647	1.432.100	722.342.444	240.080.236	212.560.535
growth					0,68%	4,24%	5,45%	2,19%

Year	2019				2020			
Provinces	**Population**	**Education**	**Health**	**Economy**	**Population**	**Education**	**Health**	**Economy**
Aceh	5.316.300	4.387.079.891	2.369.494.957	1.633.985.771	5.388.100	3.909.952.437	2.019.099.252	1.018.010.275
North Sumatra	14.639.400	5.784.899.908	540.117.396	754.346.713	14.798.400	6.253.454.268	543.841.150	582.641.410
West Sumatra	5.479.500	3.185.362.546	711.589.678	485.821.488	5.545.700	3.029.424.275	653.547.260	322.867.908
Riau	6.835.100	3.071.277.917	919.415.812	449.757.717	6.951.200	3.345.644.848	935.082.062	325.517.524
Jambi	3.566.200	1.653.980.458	487.782.083	362.191.616	3.604.200	1.681.741.408	436.253.687	256.063.647
South Sumatra	8.497.200	3.024.481.333	349.042.362	304.909.546	8.600.800	3.293.576.427	378.897.259	270.207.121
Bengkulu	1.971.800	1.070.755.069	375.498.861	210.001.516	1.994.300	1.152.607.779	329.098.236	150.759.474

Lampung	8.457.600	2.757.056.389	550.208.465	319.789.167	8.534.800	3.003.290.488	730.904.385	291.903.101
Bangka Belitung	1.451.100	832.044.951	242.317.929	259.583.649	1.469.800	994.127.106	231.252.060	218.511.499
Riau Island	2.241.600	1.043.952.057	365.910.231	288.796.618	2.309.500	1.031.111.059	382.975.956	314.403.315
average	5.845.580	2.681.089.052	691.137.777	506.918.380	5.919.680	2.769.493.009	664.095.131	375.088.527
max	14.639.400	5.784.899.908	2.369.494.957	1.633.985.771	14.798.400	6.253.454.268	2.019.099.252	1.018.010.275
min	1.451.100	832.044.951	242.317.929	210.001.516	1.469.800	994.127.106	231.252.060	150.759.474
growth	1,31%	17,89%	10,96%	5,15%	1,27%	3,30%	-3,91%	-26,01%

Table 3. Statistical Descriptive of Output Variables

Year	**2017**				**2018**			
Province	**LE**	**MYS**	**EYS**	**PE**	**LE**	**MYS**	**EYS**	**PE**
Aceh	69,52	8,98	14,13	8.957	69,64	9,09	14,27	9.186
North Sumatra	68,37	9,25	13,1	10.036	68,61	9,34	13,14	10.391
West Sumatra	68,78	8,72	13,94	10.306	69,01	8,76	13,95	10.638
Riau	70,99	8,76	13,03	10.677	71,19	8,92	13,11	10.968
Jambi	70,76	8,15	12,87	9.880	70,89	8,23	12,9	10.357
South Sumatra	69,18	7,99	12,35	10.220	69,41	8	12,36	10.652
Bengkulu	68,59	8,47	13,57	9.778	68,84	8,61	13,58	10.162
Lampung	69,95	7,79	12,46	9.413	70,18	7,82	12,61	9.858
Bangka Belitung	69,95	7,78	11,83	12.066	70,18	7,84	11,87	12.666
Riau Island	69,48	9,79	12,81	13.566	69,64	9,81	12,82	13.976
average	69,56	8,568	13,01	10.490	69,76	8,642	13,06	10.885
max	70,99	9,79	14,13	13.566	71,19	9,81	14,27	13.976
min	68,37	7,78	11,83	8.957	68,61	7,82	11,87	9.186
growth					0,29%	0,86%	0,40%	3,77%
Year	**2019**				**2020**			
Province	**LE**	**MYS**	**EYS**	**PE**	**LE**	**MYS**	**EYS**	**PE**
Aceh	69,87	9,18	14,3	9.603	69,93	9,33	14,31	9.492
North Sumatra	68,95	9,45	13,15	10.649	69,1	9,54	13,23	10.420
West Sumatra	69,31	8,92	14,01	10.925	69,47	8,99	14,02	10.733
Riau	71,48	9,03	13,14	11.255	71,6	9,14	13,2	10.675
Jambi	71,06	8,45	12,93	10.592	71,16	8,55	12,98	10.392
South Sumatra	69,65	8,18	12,39	10.937	69,88	8,24	12,45	10.652
Bengkulu	69,21	8,73	13,59	10.409	69,35	8,84	13,61	10.380
Lampung	70,51	7,92	12,63	10.114	70,65	8,05	12,65	9.982
Bangka Belitung	70,5	7,98	11,94	12.959	70,64	8,06	12,05	12.794
Riau Island	69,8	9,99	12,83	14.466	69,69	10,12	12,87	14.209
average	70,03	8,783	13,09	11.191	70,15	8,886	13,14	10.973
max	71,48	9,99	14,3	14.466	71,6	10,12	14,31	14.209
min	68,95	7,92	11,94	9.603	69,1	8,05	12,05	9.492
growth	0,39%	1,63%	0,23%	2,81%	0,16%	1,17%	0,35%	-1,95%

Based on the statistical description in Table 2, North Sumatra is the province with the largest population in Sumatra, while Bangka Belitung is the lowest. The population growth of all provinces increases every year by an average of 1.08%. In addition, related to the local government expenditure, Aceh has the largest portion of government expenditure in all of the study periods, except for the education function where North Sumatra leads. Bangka Belitung and Bengkulu are the provinces with the least spending on the expenditure function

Furthermore, table 3 describes the statistical description of the output variables, which are the indicators of the Human Development Index. Some important issues can be drawn from the table above, firstly, there are identical results on the achievement of HDI in Sumatra where the highest score on each indicator in the research period is achieved by only one province. Riau leads the achievement of Life Expectancy, Aceh leads the Expected year of schooling indicators, and Riau Island lead on the Average Year of Schooling and Per capita Expenditure indicators.

Secondly, Overall HDI indicators show an increasing trend, except for the HDI achievement in 2020. All HDI indicators in 2020 experienced slower growth than the previous years, even though the population's per capita expenditure experienced a decline. The weakening of HDI in 2020 is estimated to be due to the effects of the crisis caused by the COVID-19 pandemic.

4.2. DEA Result

This paper aims to evaluate and compare the relative efficiency of Indonesia's local government expenditure towards the achievement of the Human Development Index using Data Envelopment Analysis. The DEA result displayed through the efficiency scores lies between 0-1. A score of 1 illustrated the ability of local government managing their funds optimally. The closer the efficiency score to 1 the higher the efficiency level while the closer the efficiency score to 0 the lower the efficiency level. The expenditure efficiency scores of 10 provinces in Sumatra can be seen in the following table.

Table 4. Efficiency Score of Local Government Expenditure in Sumatra

Province	2017	2018	2019	2020	Mean
Aceh	0,31	0,30	0,41	0,34	0,34
Bangka Belitung	0,47	0,45	0,38	0,47	0,44
Bengkulu	0,58	0,50	0,86	0,95	0,72
Jambi	0,49	0,45	0,26	0,30	0,38
Riau Island	0,53	0,56	0,42	0,49	0,50
Lampung	0,75	0,83	0,56	0,58	0,68
Riau Island	0,52	0,57	0,55	0,76	0,60
West Sumatra	0,58	0,52	0,42	0,62	0,53
South Sumatra	1,00	0,96	1,00	1,00	0,99
North Sumatra	1,00	0,98	1,00	1,00	0,99
Mean per Year	**0,62**	**0,61**	**0,59**	**0,65**	0,62

Based on the average efficiency scores throughout the study period, North Sumatra and South Sumatra are the most relatively efficient province in Sumatra with a score of 0.99. Aceh

considers the most inefficient province because it lowest scores compared to other provinces. In addition, the Average efficiency per year shows an interesting trend. The overall average efficiency shows a decreasing trend from 2017 to 2019, then an increasing trend in 2020.

2020 is the first year of the COVID-19 pandemic spread in Indonesia. This pandemic has resulted in a domino effect, which not only affects the health sector but also other sectors. The policies carried out by local governments in mitigating COVID-19 vary from one region to another depending on the number of cases in the area. Adjustments also need to be made by local governments from a fiscal perspective by prioritizing the spending to give stimulus to those whose affected.

This has an impact on budget adjustments, where the realization of government spending on economics, education, and health function in 2020 is lower than in previous years. (See descriptive statistical table). However, with the relatively stable HDI, the average efficiency of regional spending in Sumatra become increased. This illustrates the performance of local government spending, in terms of efficiency, is quite good because it was able to achieve stable output despite a reduction in inputs.

4.3. Potential Improvement

One of the advantages of the DEA method is that it brings recommendations on how to modify input and output variables to reach optimum efficiency levels, through potential improvement analysis. So, it can be a recommendation to the inefficient provinces by knowing which variables they need to optimize. Data of input and output variables in 2020 was used to conduct the analysis, the use of last year's research period is an effort to explain the real amount that needs to be achieved. The result of the potential improvement analysis can be seen in the following graph.

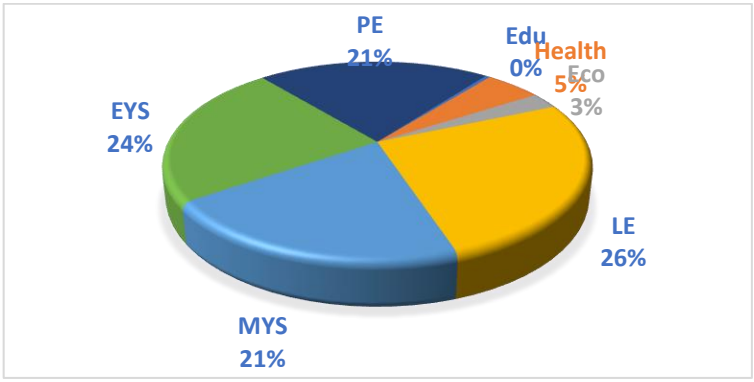

Figure 2. Potential Improvement Result

As can be seen in the diagram above, to achieve the optimum efficiency level, provinces that remain inefficient need to improve the variables above generally. Based on figure 2, it can conclude that the cause of inefficiency on average comes from the output variable, with the main source being the achievement of life expectancy. This variable contributes 26% to the inefficiency of local government expenditure. This means that local governments that have not yet reached maximum efficiency, should focus on increasing the life expectancy in their area by 26% so that the provinces achieve optimal efficiency values. This finding is quite interesting considering that the last year used as a reference in the analysis was 2020 when the COVID-19 outbreak began to spread in Indonesia and had a negative effect on the health and economic sectors, then affect the overall achievement of the Human Development Index.

4.4. Tobit Regression

In the previous section, it was noted that efficiency levels vary widely across the provinces. One of the reasons for these different results could be that government expenditure alone is not sufficient in affecting the efficiency level. There could be several other factors that influence it. The efficiency of government expenditure could be determined by various factors, in this case, we examined several indicators including GDP per capita (GDP), population density (DENSITY), and unemployment (UNEMPLOYMENT) using Tobit regression analysis. The Eviews 11 software program was used to analyze the Tobit model. The results are used to conclude the factors that influence the efficiency level. The following are the findings of the Tobit regression analysis:

Table 5. Tobit Regression Result

Variable	Coefficient	Prob.
C	0,755820	0,0000
Density	0,001538	0,0154
GDP	0,020689	0,0990
Unemployment	-0,067602	0,0383

The table depicts all the variables that significantly affect the efficiency level. The population density of a province proved to be an efficiency determinant that positively significant influence the efficiency level. This result is in line with several previous research such as (Hauner & Kyobe, 2010; Lionel, 2015; Ou et al., 2020; Tu et al., 2018) argued that reducing the administrative and monitoring costs of government expenditure and achieving economies of scale in the delivery of public services to the evolving population will lead to an increase in

spending efficiency. It is also strengthened by Lionel (2015) from the point of view of the economic scale, in which greater population density benefits the reduction of administrative and monitoring costs of government expenditure and helps to achieve the economy of scale in the provision of public services to the evolving size of the population, leading to growth in spending efficiency.

GDP per capita has also been proven as a significant factor to determine the efficiency level. The higher GDP per capita, the higher the standard of living, which would lead to an increase the human development. the higher level of HDI, the higher the efficiency level. This finding is supported by research conducted by Tu et al (2018) in the context of preschool education efficiency. They found that to a certain extent per capita GDP, it will enhance the management and funds efficiency. This finding is also in line with Lionel (2015) who measure the efficiency determinant across-country. He found that GDP per capita has a positive significant effect on expenditure efficiency, especially in low-income countries because of the highest marginal effect.

Lastly, the Unemployment variable was found negatively significant in affecting efficiency. The higher the unemployment rate in a province the lower the efficiency level. this is rational because the more jobless people in a province, the lower the consumption rate aggregate of that province, which then leads to lower human development achievement. Hence, for a province to become more efficient in its government expenditure toward the HDI achievement, reducing the unemployment rate is necessary.

V. CONCLUSION & RECOMMENDATION

1. DEA result shows that North Sumatra and South Sumatra are the most efficient province, whereas Aceh is the most inefficient province in Sumatra during the observation periods
2. Provinces that have attained their highest levels of efficiency must be able to maintain government performance by keeping a sizable share of inputs and continuing to work to raise output. in order to maintain or perhaps improve the level of community welfare the following year. However, the provinces that have not yet achieved the highest degree of efficiency should continue to maximize the use of their regional expenditures by selecting the best method for allocating their regional income and consulting other provinces that have already achieved this level of efficiency. Expenditure should be done with the public's interest in mind to avoid corruption, excessive spending, and budget misallocation to non-priority areas

3. Potential Improvement analysis found that the achievement of output variables are the main source of inefficiency. Hence, for the inefficient province, they should focus to find a strategy to increase their HDI level with the same level of inputs.
4. The Tobit result shows that GDP per capita and population density are positively significant variables influencing efficiency, while the unemployment rate affects the efficiency negatively significant. The local government should maintain macroeconomic stability and proper population structure because it affects the local government's expenditure efficiency.

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