Efficiency of zakat institutions in Indonesia: data envelopment analysis (DEA) vs free disposal hull (FDH) vs super-efficiency DEA

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Abstract

Purpose – Zakat is an important Islamic economic instrument that plays significant role in Sustainable Development Goals. Accordingly, Zakat Institutions must manage zakat in a proper and efficient manner. This study aims to examine the efficiency of Zakat Institutions based on their clusters which are government, business and social organizations.

Design/methodology/approach – This study uses three quantitative methods: data envelopment analysis (DEA), free disposal hull and super-efficiency DEA. The analytical method is based on production approach, variable return to scale assumption and output orientation. The sample consists of 14 Zakat Institutions from three clusters: Zakat Institutions managed by government, Zakat Institutions managed by corporation and Zakat Institution managed by social organizations.

Findings – The results revealed that all of three techniques culminate the same ranking order of efficiency. Zakat Institution managed by the government is the most efficient Zakat Institution, with the average value of 0.87 by using three approaches combined. Meanwhile, Zakat Institutions owned by company and social institutions cluster are in second and third position, with the average value of 0.65 and 0.4, respectively, based on the results of the three approaches. This study contends that the level of efficiency of Zakat Institutions may be supported by clusters (affiliations) in their management.

Research limitations/implications – This study's limitation is the inadequacy of the required data. Nonetheless, this study provides insights to improve the efficiency of Zakat Institutions based on their clusters. Zakat Institutions in each cluster can improve their efficiency by optimizing inputs to produce multiple outputs.

Originality/value – This study enhances research on the efficiency of Zakat Institutions using three methods to assess the consistency and strength of Zakat Institutions' efficiency values. In addition, this study examines the efficiency level of Zakat Institutions based on their clusters.

Keywords Efficiency, Zakat institutions, DEA, FDH, Super-efficiency DEA, Resource efficiency, Socioeconomic development

Paper type Research paper

1. Introduction

Indonesia is a country with the largest Muslim population in the world, and despite its potential for zakat collection, the realization still has a long way to go. Based on the latest data, the potential for zakat in Indonesia is US$22.8bn. However, the zakat collected through Zakat Institutions only reached 3.14% percent of the potential (BAZNAS, 2021). Meanwhile, many people also prefer to distribute their zakat directly to the poor. The survey proves that the total zakat collection apart from Zakat Institution collection is US$2m (BAZNAS, 2020). From this phenomenon, it can be concluded that there are problems faced by Zakat Institutions.

One of the reasons is because there are no rules that oblige Muslims to pay their zakat, specifically the obligation to pay through an official Zakat Institutions. Indonesia is one of the countries that implement the voluntary zakat system (Beik, 2020). Zakat is the third pillar of Islam which goes hand in hand with the instruction to pray (worship) (Muhammad and Saad, 2016). It is a form of social responsibility (Cokrohadisumarto et al., 2019) to achieve Islamic objective (Rahmat and Nurzaman, 2019), and primary purpose of zakat is anything that provides benefits for the entire community. Zakat raises awareness in helping the poor and enhances the quality of society (Alim, 2015). This is following the obligations of Zakat Institutions as mandated in Law 23 of 2011 concerning Management of Zakat Institutions and Zakat Core Principles, where zakat must be managed in a professional and efficient manner.

Efficiency refers to what is the maximum output that can be distributed using several resources. In the context of zakat, efficiency refers to the definition of the maximum amount of zakat funds that can be collected and distributed using several resources. The efficient management will ensure the optimization of zakat collections and distributions (Sari et al., 2013). Furthermore, efficiency would ensure that the distributed funds are right on the specific target. The inefficiency of Zakat Institutions and the lack of transparency in the distribution of zakat (Al-Mamun et al., 2019) have resulted in a loss of public trust in Zakat Institutions. Then it might hinder the behavior of zakat collection (Abioye et al., 2011). Therefore, an analysis of the efficiency of the Zakat Institution is needed to be examined deeper.

Zakat Institutions' efficiency can be distinguished based on their cluster to obtain a more comprehensive efficiency analysis. Islamic community organizations, Islamic-based foundations and Islamic-based communities have the right to propose the Decree of the Minister of Religion (2015) on establishing Zakat Institutions. Furthermore, this study distinguishes Zakat Institution clusters based on the primary source of the collection of Zakat collection and its affiliation. Each Zakat Institution has a unique management strategy based on the affiliate cluster to which it belongs. The management styles such as formed and operated by the government, nongovernmental organizations or individuals can be used to classify Zakat Institutions (Saad and Farouk, 2019). In Indonesia, Zakat Institutions can be classified according to their founding group: government, corporation or social organization. According to their respective clusters, these three classifications of Zakat Institutions differ in the uniqueness, opportunities, management methods and characteristics. Government-based Zakat Institutions are distinctive because they serve zakat management and supervisions (Ryandono et al., 2021). Meanwhile, Zakat Institution corporation cluster maximizes the collection of zakat funds from affiliated companies (Al-Ayubi et al., 2018). In addition, the corporation cluster can also collect large amounts of corporate social responsibility (CSR) funds. On the contrary, the third cluster is comprised by Zakat Institutions by social organizations category. This distinction will have an impact on the efficiency of zakat management.

The methods commonly used in zakat efficiency analysis are data envelopment analysis (DEA), free disposal hull (FDH) and super-efficiency DEA. Previous researches that analyze

the efficiency of Zakat Institutions using the DEA method were carried out by Al-Ayubi *et al.* (2018), Budiantoro *et al.* (2018); Hikmah and Shofawati (2020), Pratama and Cahyono (2019); Rustyani and Rosyidi (2018); and Rusydiana and Al Farisi (2016). Meanwhile, previous study that analyzed the efficiency of Zakat Institutions using the FDH and DEA method was carried out by Ryandono *et al.* (2021). Then, research that analyzed the efficiency of Zakat Institutions using the super-efficiency method was carried out by Atiya *et al.* (2020). On the contrary, research that uses these three methods to analyze the efficiency of zakat has never been done before.

Based on previous research, this study extends the former findings by analyzing the efficiency of Zakat Institutions based on their clusters using three methods: DEA, FDH and super-efficiency DEA. There are several novelties found from this research. First, the study uses three methodologies to provide an efficiency number close to its actual state with the input and output used. Second, three methodologies are being used to assess the consistency and robustness of the derived efficiency values because there is incompleteness data in this study. Third, this study analyzed efficiency of zakat and Zakat Institution clusters according to the Decree of the Minister of Religion No. 333 2015. The previous research that divided the groups of Zakat Institutions was carried out by Al-Ayubi *et al.* (2018), by analyzing the efficiency of Zakat Institutions using the DEA method by dividing Zakat Institutions into two groups: affiliated Zakat Institutions and unaffiliated Zakat Institutions.

According to the results of this study, efficiency measurements using DEA, FDH and super-efficiency DEA methods show the same conditions. The government cluster of Zakat Institutions' consistency and robustness has the highest efficiency value. Meanwhile, the corporate and social institutions clusters ranked in second and third, respectively. Each cluster of Zakat Institutions can support the level of efficiency.

The writing structure is as follows. Section 2 discusses the concept of Zakat Institutions and efficiency. Section 3 describes the efficiency method used. Section 4 presents the results of data processing. Section 5 discusses the analysis of the efficiency of Zakat Institutions from each cluster. Section 6 summarizes the results and discussion of the efficiency analysis of the Zakat Institution.

2. Literature review

2.1 The concept of zakat institution

Zakat is defined as the obligation of Muslims to donate a certain amount of their wealth to the beneficiaries, with the primary objective of achieving socioeconomic justice (Wahab and Rahman, 2011). Zakat's roots are extensive as evidenced by many Quran verses including chapter 2 verse 43 "*And perform the prayers, pay* zakat*, and reconcile with those who bow*." The function of zakat does not only cover spiritual aspects; it also includes elements of social and economic welfare (Andam and Osman, 2019). Sustainable form of zakat funds can help people in need to become economically productive (Djaghballou *et al.*, 2018), particularly to empower *mustahiq* by providing jobs, equipment for work, business needs and supporting spiritual needs (Bahri *et al.*, 2019). Zakat Institutions are social-based institutions, so all operational expenses are obtained from the collected zakat and *infaq* funds (Rusydiana and Al Farisi, 2016). Efficiency in managing zakat are crucial toward achieving the goals of zakat (Al-Ayubi *et al.*, 2018). Zakat Institution implements management activities that include planning, collecting, distributing and using the mandatory zakat, *infaq* and *shadaqah* funds. Zakat Institutions produces a socioeconomic impact, aims to alleviate poverty (Ahmad, 2019) and creates prosperity (Zauro *et al.*, 2020) making zakat a productive economic source and giving long-term effects to *mustahiq*.

Therefore, Zakat Institutions must be able to convince the public and provide evidence that zakat funds are managed professionally, efficient and in accordance with Islamic principles.

Previously, zakat in Indonesia was distributed directly from donors to the poor. Then the Zakat Institution was formed, which manages zakat, *infaq* and alms explicitly. Zakat Institutions in Indonesia are divided into two, namely, Zakat Institutions established by the government and nongovernment. The Zakat Institution established by the government is the National Zakat Agency (BAZNAS) that manages and oversees the management of zakat in Indonesia. Meanwhile, the nongovernmental Zakat Institution is called the National Zakat Institution. Nongovernmental Zakat Institutions can be further differentiated into Zakat Institutions formed by corporations and social communities. Zakat Institutions established by corporations include *Baitul Maal Muamalat*, *Bank Syariah Mandiri*, *Majlis Taklim Telkomsel* and *Yayasan Baitul Mal PLN*. On the contrary, Zakat Institutions established by social institutions include *Al-Azhar Indonesia, Dewah Da'wah, Dompet Dhuafa Republika, Global Zakat, Inisiatif Zakat Indonesia, Lembaga Amil Zakat Nahdlatul Ulama, Mizan Amanah, Rumah Zakat* and *Yayasan Kesejahteraan Madani*. The Zakat Institutions founded by various clusters are referring to the Decree of the Minister of Religion of the Republic of Indonesia Number 333 of 2015, which states that the establishment of Zakat Institution can be proposed by Islamic social organizations, Islamic-based foundations and Islamic-based associations. The establishment of Zakat Institutions from various clusters is intended to reach a wider area or community (Zakat Forum, 2015). Thus, the realization of zakat collection will increase, and the zakat distributed will provide to broader and more targeted beneficiaries.

2.2 Efficiency of zakat institution

Efficiency is defined as how well the system works to produce a particular output with a certain number of inputs (Chuweni and Eves, 2017). Efficient institutions is the institutions that can minimize costs in producing specific outputs (input-orientated) or maximize profits by using a combination of existing inputs (output-orientated) (Srivastava, 1999). Zakat is mentioned more than a hundred times in the Quran, thus, efficient management of zakat is crucial. *Amil* plays the core role of managing Zakat Institutions and they need to uphold the principles of professionalism, accountability and transparency, and to operate effectively and efficiently (Rusydiana and Al Farisi, 2016). Consequently, the objectives of zakat management in Indonesia are to increase the effectiveness and efficiency of services in managing zakat as well as the benefits of zakat to create social welfare and poverty alleviation (Rustyani and Rosyidi, 2018).

Studies that used DEA and super-efficiency DEA methods to examine the efficiency of Zakat Institutions have been conducted previously. Al-Ayubi *et al.* (2018), Budiantoro *et al.* (2018); Hikmah and Shofawati (2020), Pratama and Cahyono (2019); Rustyani and Rosyidi (2018); and Rusydiana and Al Farisi (2016) have conducted researches that focused on the efficiency of Zakat Institutions using the DEA approach. Recently, Atiya *et al.* (2020) conducted a study on Zakat Institutions using the super-efficiency DEA approach. Research that discusses the efficiency of zakat by comparing two methods, FDH and DEA, was conducted by Ryandono *et al.* (2021). There has not been a study examined the efficiency of Zakat Institutions using three methods: DEA, FDH and super-efficiency DEA based on government, company and social organization clusters. Al-Ayubi *et al* (2018) also contributed on Zakat Institutions studies. However, it is based on affiliated and nonaffiliated groups without specifying the sort of affiliation of each Zakat Institution. Furthermore, past studies only used one type of efficiency measurement method. This study expands on prior studies by using the DEA, FDH and super-efficiency DEA techniques and separate the

Zakat Institutions by group to provide a thorough efficiency analysis comparison. The efficiency of Zakat Institutions is analyzed based on groups: government, corporate and social organization, because there are different characteristics between groups of Zakat Institutions.

2.3 The concept of data envelopment analysis, free disposal hull and super-efficiency data envelopment analysis

The DEA, FDH and the super-efficiency DEA methods are integral parts in measuring the efficiency score. Three of them are nonparametric methods that use a linear programming model to calculate the ratio of output to input for all compared units (Naves *et al.*, 2020). The characteristics of DEA, FHD and super-efficiency DEA can be seen in Table 1. DEA was proposed by Charnes *et al.* (1978) to evaluate the efficiency score of the DMU that uses inputs to produce outputs. In the standard DEA model, it is not possible to differentiate between efficient and firm performance because all efficient units have an efficiency score of 1. By comparing the super-efficiency DEA model allows units to have values greater than 1, thus making it possible to differentiate their performance. The used common method to

Methods	Characteristic	References
Data envelopment analysis (DEA)	Previously used to analyze the public sector	(Sherman and Zhu, 2006)
	The efficiency value result is between 0 and 1	(Charnes *et al.*, 1978)
	Convexity of production possibilities	(Charnes *et al.*, 1978)
	Compares the most efficient DMU group to determine efficiency (benchmark)	(Sherman and Zhu, 2006)
	Recommends input and output targets to maximize efficiency (potential improvement)	(Sherman and Zhu, 2006)
	Measures efficiency with multiple inputs and outputs but does not require precise relationships between inputs and outputs	(Sherman and Zhu, 2006)
Free disposal hull (FDH)	Relevant for public sector efficiency analysis because it does not require many assumptions	(Borger *et al.*, 1994)
	The efficiency value result is between 0 and 1	(Tulkens, 1993)
	Nonconvexity of production possibilities	(Fall *et al.*, 2021)
	Efficiency analysis is generated by comparing the input and output of each DMU	(Tulkens, 1993)
	Recommends input and output targets to achieve efficiency (potential improvement)	(Cherchye *et al.*, 2000)
	Measures efficiency with several inputs and outputs but does not require precise relationships between inputs and outputs	(Tulkens, 1993)
Super-efficiency DEA	Relevant for analyzing the public sector	(Atiya *et al.*, 2020)
	The efficiency value result is more than 1 for DMU, which is considered efficient to determine the efficiency ranking of each DMU	(Andersen and Petersen, 1993)
	Convexity assumption	(Chen and Du, 2015)
	Compares the most efficient DMU group to determine efficiency (benchmark)	(Andersen and Petersen, 1993)
	Recommends input and output targets to achieve efficiency (potential improvement)	(Andersen and Petersen, 1993)
	Measures the efficiency with several inputs and outputs but does not require precise relationships between inputs and outputs	(Andersen and Petersen, 1993)
	Allows for infeasible result	(Lee and Zhu, 2012)

Table 1.
Characteristics of DEA, FDH and super-efficiency

measure efficiency is DEA. However, DEA method does not accommodate units that have efficient status (Rusydiana and Hasib, 2020).

FDH is a special case of the DEA method (Kovalev *et al.*, 2021) developed by Deprins and Simar (1984). FDH has similarities with DEA in terms of the result of efficiency value from the range 0–1. In contrast to the DEA method, FDH analyzes the efficiency of a DMU by comparing all DMUs to determine which DMUs are efficient and inefficient (Tulkens, 1993). In addition, the computational technique used to solve the FDH program considers more mixed programming than the DEA model with linear programming (Lim *et al.*, 2016). The FDH method is a nonconvex efficiency measurement method that does not require certain assumptions (Fall *et al.*, 2021). The FDH method can analyze special case data (Fall *et al.*, 2021).

The super-efficiency DEA concept developed by Andersen and Petersen (1993) is known for its ability in breaking the bonds between efficient DMUs (Yu and Hsu, 2020). Super-efficiency DEA is a measurement of the power of the efficient units used to rank the DMU units as the object of observation (Rusydiana and Hasib, 2020). Researches that apply the super-efficiency DEA model can be found in studies carried by Davidovic *et al.* (2019), Rahim (2015); Zimková (2014). This super-efficiency DEA model also has an essential role in various situations (Charnes *et al.*, 1978). Zhu (1996) used super-efficiency DEA model to analyze the sensitivity of DMU's efficiency, whereas Charnes *et al.* (1992) and Cooper *et al.* (2011) used the super-efficiency DEA model to rank the efficiency of DMUs.

Several assumptions, techniques and orientations are observed in assessing efficiency. The most frequent used methodologies in assessing efficiency are the production and intermediate approaches (Ayyubi and Saputri, 2018) This production strategy is related to production theory, which addresses how producers or businesses create optimal output at the lowest possible production cost (Ryandono *et al.*, 2021). The production approach is used in the analysis of Zakat Institutions to determine how much money can be collected and disbursed (Wahab and Rahman, 2012). At the same time, the intermediate method evaluates the effectiveness of Zakat Institutions on performing their intermediary tasks, which is delivering zakat cash to beneficiaries (Rustyani and Rosyidi, 2018).

Constant return to scale (CRS) and variable return to scale (VRS) are the assumptions to measure the efficiency (Djaghballou *et al.*, 2018). The CRS assumption is presented by adding one input results in proportional output, meanwhile, the VRS assumption is displayed by adding input of 1 may result in an output that can be considered large, small or greater than 1 (Ryandono *et al.*, 2021). Some previous studies based on the VRS assumption were carried out by Al-Ayubi *et al.* (2018), Atiya *et al.* (2020) and Djaghballou *et al.* (2018). The VRS assumption is more applicable to Zakat Institution analysis because the input used does not necessarily produce a constant output (Ryandono *et al.*, 2021).

Efficiency exists between two orientations: input orientation and output orientation. Input orientation shows how much input can be reduced for more efficient results, whereas output orientation shows how much output must be increased (Sherman and Zhu, 2006). Output orientation is thought to be more appropriate in the context of Zakat Institutions analysis because they are nonprofit or social institutions that focus on the amount of possible generated output (collection and distribution of zakat) (Al-Ayubi *et al.*, 2018).

3. Research methodology

3.1 Method

This study uses a quantitative approach by using DEA, FDH and super-efficiency DEA. Charnes *et al.* (1978) initially developed the DEA method to measure the efficiency of nonprofit institutions and public sector by calculating the use of inputs to produce several outputs. DEA accommodates various inputs and outputs to provide the potential on

efficiency enhancement and conditions of input use over output. The formula for the DEA method is as follows (Sherman and Zhu, 2006):

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{1}$$

where:

j = number of DMUs;
y_{rj} = amount of output r produced by firm k;
x_{rj} = amount of input consumed by firm k;
i = number of inputs used by the DMUs;
r = number of outputs generated by the DMUs;
u_r = weight assigned by the DEA to output r;
v_i = weight assigned by DEA to input I;
m = number of inputs; and
s = number of outputs.

The super-efficiency DEA method was developed by Andersen and Petersen (1993). The super-efficiency DEA method is an alternative for better distinguish between each DMU (Wanke *et al.*, 2020). A unit is considered to be relatively efficient if it has better efficiency value than the others (Rusydiana and Hasib, 2020). For this reason, the super-efficiency method compares the unit under observation until the efficiency rating of the units included in the sample is known. The formula for the super-efficiency DEA method is as follows (Andersen and Petersen, 1993):

$$\text{Min } E_1 - \eth e' s^- - \eth e' s^+ \tag{2}$$

Derived into the following formula:

$$\text{s.t } E_1 X_1 = \sum_{\substack{k=1 \\ k \neq 1}}^{n} z_k X_k + s^-, \tag{3}$$

derived into the following formula:

$$Y_1 = \sum_{\substack{k=1 \\ k \neq 1}}^{n} z_k X_k + s^+, \quad Z, s^+, s^- \geq 0 \tag{4}$$

where:

X_j = m-dimensional input vector;
Y_j = m-dimensional output vector;
E_j = scalar defining the share of DMUs input vector to produce the DMUs output within the reference technology;
Z = intensity vector;
Z_k = intensity of the kth unit;
$\eth$ = non-Archimedian infinitesimal; and
e' = the row vector.

Super-efficiency DEA produces an efficiency index of $0 \to 1$ and make a ranking of efficient observations possible. The non-Archimedian (δ) means that the index may be interpreted as the maximum possible proportional decrease in the input vector that is required to make the observation efficient.

The third method used is FDH, a special case of DEA. The FDH approach is another nonparametric method of measurement used to evaluate the technical efficiency of DMUs. This exploits the disposability of inputs and outputs without imposing convexity assumptions. The FDH method compares input and output with the obtained production limit to determine the dominant DMU in producing larger quantity of output using smaller inputs (Nicola *et al.*, 2020). In contrast with the DEA method, which forms the best set of units to be the basis for determining efficiency, the FDH method compares one-to-one basis of all DMUs that are observed (Ruiz-Torres and López, 2004). The mathematical equation of the FDH method is as follows:

$$\frac{\sum_{h=1}^{n} yh\, x_i^h}{x_i^k} \tag{5}$$

where, x^k is *I*-dimensional production of the quantities of inputs used, x^h is the vector of input and Y is output. x^k is a representation of x^0 to analyze observations that produce as much output as possible (y) without adding any input (x).

The use of these three methods aims to test the consistency and robustness of the efficiency value results. In addition, the use of the super-efficiency DEA method addresses to determine the efficiency value, which is not limited to a value of 1, as obtained from the DEA and FDH methods.

3.2 Data source

Secondary data is obtained from the Zakat Institutions' financial statements of the year 2014–2018. The financial data can be found on the official website of each Zakat Institution. The period of observation was chosen for two reasons. First, in 2014, the Ministry released Government Regulation No. 14 of 2014 concerning the Implementation of Law No. 23 of 2011 Concerning Zakat Management. Second, the period for medium-term efficiency analysis is restricted to five years. Therefore, the selected period of 2014–2018 intends to examine the medium-term performance (efficiency).

The population of the study consists of 28 Zakat Institutions on a nationwide scale in Indonesia. The sample comprises 14 Zakat Institutions in Indonesia which are organized by their respective founding groups: Zakat Institutions established by government, corporations and social institutions. Purposive sampling strategy with certain criteria is used to choose the samples. First is the Zakat Institution that releases financial reports from 2014 to 2018 on its website. Second is Zakat Institution that is included in the national scale.

The sample data collected consists of 14 Zakat Institutions which are then classified into three groups. The classification is described through Table 2. Based on Table 2, 56 DMUs are observed from 14 Zakat Institutions and five management periods from 2014 to 2018.

The Zakat Institutions in this study are presented using abbreviations. They are divided into three groups, namely, government group that consists of ZI Gov 1, corporation group that includes ZI Corp 1, ZI Corp 2, ZI Corp 3 and ZI Corp 4, and social institutions group that include ZI Social 1, ZI Social 2, ZI Social 3, ZI Social 4, ZI Social 5, ZI Social 6, ZI Social 7, ZI Social 8 and ZI Social 9. Overall, there are 56 measurement units from 14 samples and a

Group	Zakat institutions code
Corporation	ZI Corp 1
	ZI Corp 2
	ZI Corp 3
	ZI Corp 4
Government	ZI Gov 1
Social institutions	ZI Social 1
	ZI Social 2
	ZI Social 3
	ZI Social 4
	ZI Social 5
	ZI Social 6
	ZI Social 7
	ZI Social 8
	ZI Social 9

Source: Compiled by author (2020)

Table 2.
Zakat institutions in
Indonesia based on
the zakat institutions'
group

five-year period of observation. This outcome number is qualified to avoid biased results. The minimum number of measurement units that meet the requirements is calculated by the $3n$ formula, where n is the number of variables (Rustyani and Rosyidi, 2018).

The considerable input and output variables are used to achieve the research objectives (Table 3). The input variables include salary expense ($X1$), socialization expense ($X2$) and operational expense ($X3$). Meanwhile, the output variables are zakat funds ($Y1$) and zakat distribution ($Y2$).

3.3 Technique analysis
This study aims to measure the efficiency of Zakat Institutions in Indonesia by their cluster using three methods: DEA, FDH and super-efficiency DEA. The efficiency approach applied is

Variable	Definition	Source
Input		
Salary expense	The total cost received by zakat managers for their performance in managing zakat during the period is expressed in IDR	Al-Ayubi *et al.* (2018) Atiya *et al.* (2020)
Socialization expense	The total cost used to socialize zakat during the period is expressed in IDR	Al-Ayubi *et al.* (2018) Atiya *et al.* (2020)
Operational expense	The total cost incurred by Zakat Institution in managing zakat reduced by salaries expense and socialization expenses	Wahab *et al.* (2012) Al-Ayubi *et al.* (2018)
Output		
Zakat funds	The amount of zakat collected by Zakat Institution during the period is expressed in IDR	Wahab *et al.* (2012) Djaghballou *et al.* (2018) Atiya *et al.* (2020)
Zakat distribution	The amount of zakat distributed by Zakat Institution during the period is expressed in IDR	Wahab *et al.* (2012) Djaghballou *et al.* (2018) Atiya *et al.* (2020)

Table 3.
Variable operational
definition

the production approach, which assumes that the Zakat Institution collects and distributes zakat by issuing several costs. This study also uses output orientation and VRS assumptions along with the production approach. Output orientation is more considered because it can determine the maximum amount of funds collected and distributed by the Zakat Institutions (Al-Ayubi *et al.*, 2018; Rustyani and Rosyidi, 2018; Atiya *et al.*, 2020). DEA analysis is used using the MAXDEA software. At the same time, the super-efficiency data analysis is employed using the Banxia Frontier Analyst 4.0 software. Data processing steps include, first, data from the financial statements is sorted then tabulated into one data using Microsoft Excel. Second, data is imported into the software. Third, the data processing stage is operated using the software to ensure that the assumptions, orientations and methods chosen are appropriate. After all stages are completed, interpretation of the results can be carried out. The FDH and the standard DEA calculation model has an efficiency score equal to 1, whereas the super-efficiency DEA model reaches a value greater than 1 (Kundi and Sharma, 2017). Interpretation is created by analyzing the efficiency of Zakat Institutions based on their respective groups and comparing them with the existing researches and theories.

4. Results

This study produces several efficiency measures using DEA, FDH and super-efficiency DEA methods. The input variables used in this study are socialization expense, salary expense and operational expense. Meanwhile, zakat funds and zakat distribution are the output variables. This input and output variable selection is based on a review of the existing literature and theory (Table 4).

Based on the average number of input variables (Table 4), 17% represents the social expense, 34% represents the salaries expense and 48% represents the operational expense. Based on the average output variables, each variable between zakat funds and zakat distribution has the average of 50%. Overall, the measurement of efficiency in Zakat Institutions during the period of 2014–2018, which is shown in Table 5, displays the ranking according to the efficiency scores and benchmarks of Zakat Institutions. Based on the DEA and FDH methods, an institution is considered to be efficient if the efficiency value shows the number of 1 (Charnes *et al.*, 1978; Ruiz-Torres and López, 2004). Meanwhile, based on the super-efficiency DEA method, institutional efficiency is not limited to number 1 (Andersen and Petersen, 1993; Atiya *et al.*, 2020). Thus, the efficiency value that suggests a number less than 1 indicates inefficiency.

The results of the obtained efficiency score shows that ZI Corp 4 is the Zakat Institution with the highest level of efficiency, which can be seen from DEA, FDH and super-efficiency DEA methods. This study also measures efficiency based on classification of affiliation. Overall, by using the DEA, FDH and super-efficiency DEA methods, the highest average score is found in Zakat Institutions managed by the government. The second-highest score

Table 4.
Average input and output of zakat institutions in Indonesia, the study period 2014–2018

Input variable	
Socialization expense	US$262.123
Salaries expense	US$524.246
Operational expense	US$758.777
Output variable	
Zakat distribution	US$4.2m
Zakat fund	US$4.2m

Source: Output software MAXDEA and Banxia Frontier Analyst 4.0 compiled by author (2020)

of efficiency is corporation-based Zakat Institutions. The last rank of the average efficiency score is Zakat Institutions based on social institutions.

Based on the results above (Table 5), there are many inefficient Zakat Institutions. According to the calculations using DEA, FDH and super-efficiency DEA methods, potential improvement exists and aims to determine the source of inefficiency. Potential improvements are recommendations in the form of input and output targets to achieve efficiency. This information will become a valuable material for evaluation of Zakat Institutions.

Based on Table 6, the improvement to increase the efficiency based on DEA approach is implemented by reducing socialization expense to 29.47%, salaries expense 27.64% and operational expense 27.96%. Furthermore, on the output side, the amount of zakat distribution needs to be increased by 11.36%, and the zakat funds collected needs to be increased by 3.57%. Meanwhile, using the super-efficiency method, to increase the efficiency, the Zakat Institutions need to reduce socialization expense by 27.40%, salaries expense by 27.28% and operational expense by 28.08%. Then on the output side, the amount of zakat distribution needs to be increased by 12.66%, and the amount of zakat funds needs to be increased by 4.58%. Furthermore, there are also Zakat Institutions which are a benchmark for inefficient Zakat Institutions as follows:

Based on the Table 7, there are different Zakat Institutions act as the benchmark for inefficient Zakat Institutions among the DEA and super-efficiency DEA methods. Using the DEA and super-efficiency DEA approach, each of the six DMUs is inefficient Zakat Institutions.

Table 8 explains the conditions of return to scale for Zakat Institutions which are classified as increasing return to scale (IRS), that is, if a unit has additional input to produces more output; CRS if there is additional input will produce the same output; and decreasing return to scale (DRS), that is, if there is an additional input, it will produce less output.

Based on Table 8, the results of the return to scale show that Zakat Institutions that experience increasing conditions (IRS) each year occur in ZI Social 4, ZI Social 3, ZI Social 2 and ZI Social 7.

5. Discussion

The management of zakat must be estimated properly in the use of efficient and effective resources and to avoid waste (Anuar *et al.*, 2019). If Zakat Institutions have inefficiencies, they are inclined to improve their management systems. This study analyzes the level of efficiency using DEA, FDH and super-efficiency DEA method. The average efficiency score for Zakat Institutions based on groups is as shown in Figure 1.

Figure 1 shows the results for the most efficient group of Zakat Institutions. Zakat Institutions managed by the government comes in the first rank, followed by Zakat Institutions established by the corporation and social institutions in the second and third rank, respectively. Measuring the efficiency rating of Zakat Institutions based on their groups has never been done in any previous studies. However, the average efficiency of Zakat Institutions established by government is still categorized as inefficient because the result is 0.87 using DEA and FDH method, and 0.999 using super-efficiency DEA method. The resulted numbers are still below 1.

Furthermore, if it is viewed from the side of the average efficiency score of Zakat Institutions each year, government-based Zakat Institution has the highest average efficiency value compared to Zakat Institutions established by social institutions and corporations. Only in 2014, Zakat Institution formed by the government shifts to the second place after Zakat Institutions established by the corporation, with a score of 0.765. In 2017–2018, the government-based Zakat Institution obtains an efficiency value of 1 using the DEA and FDH method. Meanwhile, by using the super-efficiency method, the government-based Zakat Institution in 2017 obtains an

Table 5. Efficiency measurement, and average zakat institutions in Indonesia

Years

Zakat institutions' code	2014			2015			2016			2017			2018			Average		
	DEA	FDH	SD	DEA	FDH	SD	DEA	FDH	SD	DEA	FDH	SD	DEA	FDH	SD	DEA	FDH	SD
ZI Corp 4	–	–	–	–	–	–	1.00	1.00	1.18	1.00	1.00	1.07	1.00	1.00	1.23	1.00	1.00	1.16
ZI Corp 1	–	–	–	–	–	–	1.00	0.34	0.32	1.00	1.00	1.31	1.00	1.00	1.76	0.77	0.78	1.13
ZI Corp 3	1.0	1.0	2.36	0.19	0.21	0.19	0.16	0.19	0.16	0.16	0.20	0.17	0.16	0.19	0.16	0.34	0.35	0.61
ZI Corp 2	–	–	–	–	–	–	0.20	0.22	0.20	0.27	0.29	0.27	–	–	–	0.24	0.25	0.24
Average corporation																*0.587*	*0.59*	*0.788*
ZI Gov 1	0.76	0.78	0.76	0.84	0.86	0.84	0.75	0.72	0.75	1.00	1.0	1.13	1.00	1.0	1.50	0.87	0.87	0.99
Average government																*0.87*	*0.87*	*0.99*
ZI Social 8	0.85	0.87	0.85	0.97	1.0	0.97	1.00	1.0	1.03	1.00	1.0	1.12	1.00	1.0	1.04	0.96	0.97	1.00
ZI Social 3	0.59	0.61	0.59	0.67	0.69	0.67	0.66	0.68	0.66	0.68	0.65	0.63	0.68	0.70	0.68	0.65	0.66	0.65
ZI Social 6	–	–	–	–	–	–	1.00	1.00	2.36	0.17	0.18	0.15	0.17	0.19	0.17	0.44	0.45	0.89
ZI Social 9	–	–	–	0.96	1.00	0.96	0.20	0.23	0.20	0.20	0.24	0.21	–	–	–	0.46	0.49	0.46
ZI Social 1	–	–	–	–	0.21	0.19	0.20	0.22	0.20	0.15	0.16	0.14	0.15	0.17	0.15	0.17	0.76	0.17
ZI Social 5	–	–	–	–	–	–	0.28	0.30	0.28	0.28	0.26	0.24	0.28	0.30	0.28	0.27	0.29	0.27
ZI Social 2	0.15	0.17	0.15	0.16	0.18	0.16	0.12	0.15	0.12	0.10	0.17	0.14	0.10	0.12	0.10	0.14	0.15	0.14
ZI Social 7	0.11	0.13	0.11	0.19	0.19	0.13	0.11	0.13	0.11	0.07	0.08	0.06	0.07	0.09	0.07	0.10	0.13	0.08
ZI Social 4	0.02	0.04	0.02	0.02	0.04	0.02	0.02	0.46	0.02	0.03	0.08	0.06	0.03	0.05	0.03	0.03	0.05	0.03
Average social institutions																*0.35*	*0.43*	*0.42*

average value of 1,130. Then in 2018, it obtains an average score of 1,505. The super-efficiency
DEA approach improves the DEA and FDH method in measuring efficiency. If the efficiency
score using the DEA and FDH method is limited to a maximum of 1, the super-efficiency DEA
approach can show the score more than 1. Therefore, the difference of average efficiency score
between each group of Zakat Institutions can be analyzed.

Based on the results above, it is only natural that Government Zakat Institution
consistently has the highest average value of efficiency compared to the other groups.

Variable	DEA (%)	Super-efficiency DEA (%)	FDH (%)
Input			
Socialization expense	−29.47	−27.40	−29.47
Salaries expense	−27.64	−27.28	−27.64
Operational expense	−27.96	−28.08	−27.96
Output			
Zakat distribution	11.36.	12.66	11.36
Zakat fund	3.57	4.58	3.57

Source: MaxDEA dan Banxia Frontier Analyst 4.0 compiled by author (2020)

Table 6.
Total potential
improvement

	DMU			Times as benchmark		
No.	Super-efficiency DEA	DEA	FDH	Super-efficiency DEA	DEA	FDH
1	ZI Corp 4_2016	ZI Corp 4_2016	ZI Corp 4_2016	29 times	32 times	29 times
2	ZI Social 6_2016	ZI Social 6_2016	ZI Social 6_2016	23 times	25 times	23 times
3	ZI Gov 1_2018	ZI Gov 1_2018	ZI Gov 1_2018	15 times	16 times	15 times
4	ZI Corp 4_2018	ZI Corp 4_2018	ZI Corp 4_2018	12 times	14 times	12 times
5	ZI Corp 4_2017	ZI Corp 4_2017	ZI Corp 4_2017	8 times	11 times	8 times
6	ZI Corp 3_2014	ZI Corp 3_2014	ZI Corp 3_2014	7 times	10 times	7 times

Source: MaxDEA dan Banxia Frontier Analyst 4.0 compiled by author (2020)

Table 7.
Time as benchmark
for efficiency zakat
institutions

| Years	IRS	CRS	DRS
2014	ZI Gov 1, ZI Social 4, ZI Social 3, ZI Social 2, ZI Social 7, ZI Social 8	ZI Corp 3	–
2015	ZI Gov 1, ZI Social 4, ZI Social 1, ZI Social 3, ZI Social 2, ZI Social 7, ZI Social 8, ZI Corp 3, ZI Social 8	–	–
2016	ZI Gov 1, ZI Corp 1, ZI Social 4, ZI Social 1, ZI Social 3, ZI Social 2, ZI Social 5, ZI Social 7, ZI Corp 2, ZI Corp 3, ZI Social 9	ZI Social 8, ZI Social 6, ZI Corp 4	–
2017	ZI Social 4, ZI Social 1, ZI Social 3, ZI Social 2, ZI Social 5, ZI Social 7, ZI Social 6, ZI Corp 2, ZI Corp 3, ZI Social 9	ZI Gov 1, ZI Corp 1, ZI Social 8, ZI Corp 4	–
2018	ZI Social 4, ZI Social 1, ZI Social 3, ZI Social 2, ZI Social 5, ZI Social 7, ZI Social 6, ZI Corp 3	ZI Gov 1, ZI Corp 1, ZI Social 8, ZI Corp 4	–

Source: MaxDEA dan Banxia Frontier Analyst 4.0 compiled by author (2020)

Table 8.
Return to scale for
zakat institutions in
Indonesia

Government Zakat Institution is an official institution, and the only institution formed by the government (Presiden, 2001). One way to support the realization of social welfare is social administration or government intervention (Zakiyah, 2011). Government Zakat Institution has an adequate procedure in carrying out activities, all in terms of accounting information systems, management information systems and administrative procedures (Syaifuddin, 2019). Besides, the government has a duty in social supervision for the operational sustainability of Zakat Institution (Nahar, 2018). This result supports Al-Ayubi *et al.* (2018), which states that the Mass Organization Zakat Institutions, includes Zakat Institution established by the government, experienced an increase in the average efficiency during the management period of 2013–2015. Government policies also affect the efficiency of Government Zakat Institution. In Indonesia, local governments have been instructed to collect zakat from the State Civil Servants of approximately 22 regions. The government's support for Government Zakat Institution can also be seen in its distribution projects. Moreover, Government Zakat Institution has 548 representative offices (BAZNAS Center of Strategic Studies, 2019) and 181 zakat management units spread across Indonesia. Therefore, Government Zakat Institution is able to collect and distribute more funds while reducing distribution costs at the same time. In comparison, Zakat Institutions from other groups have 20 representative offices at maximum amount. Government Zakat Institution manages zakat and supervises nongovernmental Zakat Institutions in Indonesia (corporate and social institutions groups). As a result, Government Zakat Institution must be professional and efficient in their duties as the manager and supervisor.

In addition, Zakat Institutions established by corporations and social institutions has their average efficiency scores fluctuated continuously each year. The second rank is the cluster of Zakat Institutions formed by corporation. The president of Republic of Indonesia gives an instruction to optimize the collection of zakat in the state-owned and regional government-owned enterprises. The instruction aims to optimize the collection and utilization of zakat and support the realization of people's welfare and poverty alleviation (Presiden, 2014). On the contrary, among Indonesian companies, there is a new trend regarding CSR and zakat with the increasing participation in charity activities from the companies. The idea of zakat on the company assets as in connecting zakat with employee salaries and zakat on corporate assets becomes a more trending activities between corporations (Latief, 2013). In addition, based on the latest reported data, the potential of corporate zakat reaches US$9.96bn. The efficiency of Zakat Institutions formed by social institutions fluctuated to second and third rank during the research period. Zakat Institutions managed by social institutions target on the entire Muslim community in general, so they have their own challenges to engage *muzakki*, except those who have a particular connection to other institutions. Thus, Zakat Institutions established by social institutions must increase their ability to gain the trust from the Muslim community.

Figure 1.
Comparison of the average efficiency score of zakat institutions by group between the DEA, FDH and super-efficiency DEA methods
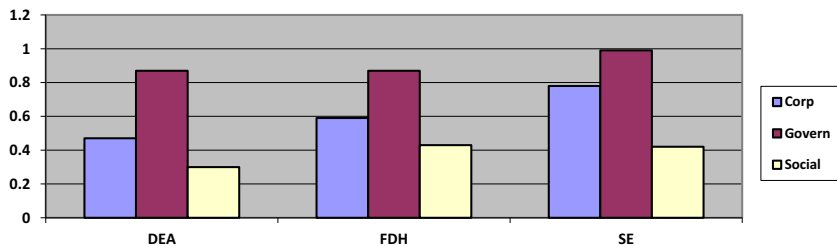
Source: MaxDEA dan Banxia Frontier Analyst 4.0 compiled by author (2020)

Based on the Islamic point of view, production is not just a worldly activity, but must be in line with the objectives of sharia (*maqashid sharia*) (Rozalinda, 2017). The welfare-based rule in *maqashid sharia* is an alternative for material and spiritual welfare (Elviandri *et al.*, 2018). Zakat Institution reaches an efficient level when it successfully fulfills five things that must be protected, namely, *hifdhu al-din* (protection of faith), *hifdhu al-'aql* (protection of reason), *hifdhu al-nafs* (protection of life), *hifdhu al- mal* (protection of wealth) and *hifdhu al-nasl* (protection of lineage) (Zakaria and Malek, 2014). Zakat Institution manages the operational expense by fulfilling *amil's* rights as zakat fund managers. Zakat Institution also focuses on human intellectual resources by maintaining and developing the appreciation to them. The contribution of human resources is directed at generating value for organization (Zakaria and Yusoff, 2011). Muslims who have intellectual intelligence and a value of human capital is the most beneficial asset held by the organization (Weatherly, 2003). Thus, human capital must be maintained because the improvement of human capital is also an investment (Chen and Lin, 2003). Furthermore, Zakat Institution issues the socialization expense to the use of Islamic rules protection, such as providing education or preaching to Muslims about the obligation to pay zakat.

Finally, this study uses three efficiency methods to determine the value of efficiency produced and test the consistency and robustness of the efficiency of each Zakat Institution. Government Zakat Institution is the group of Zakat Institutions that is consistently and robustly the most efficient. Following, Zakat Institutions formed by corporations and social institutions are Zakat Institutions that are consistent and robust in the second and third places, respectively.

6. Conclusion
Zakat Institution was formed to optimize the performance of zakat in providing sustainable benefits. On the contrary, Sustainable Development Goals are relevant to zakat's purpose, especially to alleviating poverty. For this reason, Zakat Institution must be managed in a professional and efficient way to collect and distribute zakat as mandated in Law 23 of year 2011.

This study produces efficiency measurements of Zakat Institution based on its cluster: government; corporations; and social organization, apart from the uniqueness, management method and culture in each cluster. In addition, three approaches; DEA, FDH and super-efficiency DEA, are used to test the consistency and robustness of the efficiency value results. All of three techniques culminate the same ranking order. Government Zakat Institution is the Zakat Institution that has the most efficient value. Meanwhile, Zakat Institutions managed by corporations and social organizations are in second and third places. It can happen because Zakat Institutions have benefits from their respective affiliated group. Zakat Institution from government cluster excels in the number of zakat partners and representative offices in various regions. Zakat Institution from corporation cluster has the advantage of zakat obligation paid from companies that affiliated with. Then, Zakat Institution from social organization cluster has the benefits from its wide range of area for zakat collection. However, Zakat Institutions from all groups need to improve their management efficiency. This study provides recommendations for Zakat Institutions of each cluster by providing potential improvement and a time as a benchmark that can be used as the reference for each Zakat Institution to observe and increase the efficiency level of zakat management. Thus, the input used can produce optimal output.

The limitation of this study is the completeness of the required data. The financial reports published by each Zakat Institution do not have a uniform content, making it challenging to gain comprehensive data. Furthermore, several Zakat Institutions publish incomplete financial statements. Even though the data used is incomplete, this study has attempted to do a comprehensive analysis of Zakat Institutions by analyzing the consistency and robustness of

efficiency by using three methods; DEA, FDH and super-efficiency. Further research can measure efficiency using other methods such as making indicators of the efficiency of Zakat Institutions to overcome the incompleteness of financial data. In addition, this study only considers data from financial statements. Further research can include other variables that are not included in this study, such as the amount of productive zakat distribution, consumptive zakat distribution and other variables such as size of Zakat Institutions, number of staff, number of branch offices and number of volunteers. It is also possible to compare the efficiency of Zakat Institutions based on scales, such as the analysis of the efficiency of the National Zakat Institutions, Provincial Zakat Institutions and Regency/Municipal Zakat Institutions.

7. Managerial relevancy

This study highlights the consistency of Zakat Government Institution as the most efficient Zakat Institution. This research has implications for several stakeholders. First for the Zakat Institution. This study makes recommendations for Zakat Institutions of each cluster by providing potential improvement indicating at how much input should be lowered and how much output should be increased. Zakat Government Institution excels in cost efficiency by having many partners and representative offices in various regions. For this reason, the Zakat Institutions from corporation and social institutions clusters can improve their efficiency by imitating the management carried out by the Zakat Government Institutions by having many partners and representative offices in various regions as well. In general, Zakat Institutions of all clusters, government, corporation or social organization need to ensure that the costs incurred are efficient (input) and produce maximum fund collection and distribution (output). In addition, Zakat Institutions can give financial data report for the public to avoid incompleteness of data during efficiency analysis. In terms of economics, zakat distribution will provide capital for zakat recipients (*mustahik*) to increase their income. Increased income has a positive impact on the economy by increasing purchasing power and consumption levels. As a result, to create the multiplier effect of zakat, the Zakat Institution must be serious about managing zakat funds efficiently.

Second for the government. The government as a regulator can make policies, such as the obligation to pay zakat to support management efficiency in Zakat Institutions. If Zakat Institutions work efficiently and optimally, then the government can use zakat to help the poor by distributing zakat funds and increasing *mustahik's* skills so that *mustahik's* income increases. The government can collaborate with Zakat Institutions in economic programs for poverty alleviation.

Third, this research has implications for the community. Although many of the Zakat Institutions still have not achieved optimal efficiency, the public is expected not to consider this issue as an excuse for not paying zakat to the Zakat Institution. This needs to be a common concern. The community can boost the efficiency of the Zakat Institution by providing advice in the management of zakat. By knowing the factors that have an influence on efficiency, the Zakat Institution will work optimally so that this will have a good impact on the surrounding community, especially the marginal community (*mustahik*).

References

Abioye, M.M.O., Mohamad, M.H.S. and Adnan, M.A. (2011), "Antecedents of zakat payers' trust: the case of Nigeria", *International Journal of Economics, Management and Accounting*, Vol. 19 No. 3, pp. 133-164.

Ahmad, M. (2019), "An empirical study of the challenges facing zakat and waqf institutions in Northern Nigeria", *ISRA International Journal of Islamic Finance*, Vol. 11 No. 2, pp. 338-356.

Al-Ayubi, S., Ascarya. and Possumah, B.T. (2018), "Examining the efficiency of zakat management: Indonesian zakat institutions experiences", *International Journal of Zakat*, Vol. 3 No. 1, pp. 37-55.

Alim, M.N. (2015), "Utilization and accounting of zakat for productive purposes in Indonesia: a review", *Procedia – Social and Behavioral Sciences*, Vol. 211, pp. 232-236.

Al-Mamun, A., Haque, A. and Jan, M.T. (2019), "Measuring perceptions of Muslim consumers toward income tax rebate over zakat on income in Malaysia", *Journal of Islamic Marketing*, Vol. 11 No. 2, pp. 368-392.

Andam, A.C. and Osman, A.Z. (2019), "Determinants of intention to give zakat on employment income: experience from Marawi city, Philippines", *Journal of Islamic Accounting and Business Research*, Vol. 10 No. 4, pp. 528-545.

Andersen, P. and Petersen, N.C. (1993), "A procedure for ranking efficient units in data envelopment analysis", *Management Science*, Vol. 39 No. 10, pp. 1261-1264.

Anuar, F.S., Alwi, N.M. and Ariffin, N.M. (2019), "Financial management practices and performance of zakat institutions in Malaysia", *IPN Journal of Research and Practice in Public Sector Accounting and Management*, Vol. 9 No. 1, pp. 1-26.

Atiya, N., Widiastuti, T., Cahyono, E.F., Zulaikha, S. and Mawardi, I. (2020), "A techno-efficiency analysis of zakat institutions in Indonesia", *International Journal of Zakat*, Vol. 5 No. 3, pp. 30-43.

Ayyubi, S.E. and Saputri, H.E. (2018), "Analysis of the impact of zakat, infak, and Sadaqah distribution on poverty alleviation based on the CIBEST model, case study: Jogokariyan baitul maal mosque, Yogyakarta", *International Journal of Zakat*, Vol. 3 No. 2, pp. 85-97.

Bahri, E.S., Aslam, M.M.A., Hj Hasan, A.A. and Wibowo, H. (2019), "Maqasid Al-Shariah in micro-entrepreneurs development: an overview", *International Conference of Zakat*, pp. 258-267.

BAZNAS (2020), "BAZNAS: zakat masyarakat yang tak tercatat Rp 61,25 triliun", BAZNAS, available at: https://baznas.go.id/Press_Release/baca/BAZNAS_:_Zakat_Masyarakat_yang_Tak_Tercatat_Rp_61,25_Triliun/680

BAZNAS (2021), *Outlook Zakat Indonesia 2021*, Pusat Kajian Strategis – Badan Amil Zakat Nasional (PUSKAS BAZNAS), Jakarta.

BAZNAS Center of Strategic Studies (2019), "Statistik zakat nasional", 2.2., BAZNAS – Sub Divisi Pelaporan, Jakarta.

Beik, I.S. (2020), "Menuju sistim zakat mandatory", BAZNAS, available at: https://baznas.go.id/pendistribusian/kolom/direktur-pp/3651-menuju-sistim-zakat-mandatory

Borger, B., De Kerstens, K., Moesen, W. and Vanneste, J. (1994), "A non-parametric free disposal hull (FDH) approach to technical efficiency: an illustration of radial and graph efficiency measures and some sensitivity results", *Swiss Journal of Economics and Statistics (SJES)*, Vol. 130 No. IV, pp. 647-667.

Budiantoro, R.A., Luthfi, F. and Herianingrum, S. (2018), "Measuring the efficiency of BAZNAS in managing zakat funds with stochastic frontier approach analysis, 2002–2016", *International Journal of Zakat*, Vol. 3 No. 1, pp. 89-107.

Charnes, A., Cooper, W.W. and Rhodes, E. (1978), "Measuring the efficiency of decision making units", *European Journal of Operational Research*, Vol. 2 No. 6, pp. 429-444.

Charnes, A., Haag, S., Jaska, P. and Semple, J. (1992), "Sensitivity of efficiency classifications in the additive model of data envelopment analysis", *International Journal of Systems Science*, Vol. 23 No. 5, pp. 789-798.

Chen, Y. and Du, J. (2015), "Super-efficiency in data envelopment analysis", *Data Envelopment Analysis*, Springer, Boston, MA, pp. 381-414.

Chen, H.-M. and Lin, K.-J. (2003), "The measurement of human capital and its effects on the analysis of financial statements", *International Journal of Management*, Vol. 20, pp. 470-478.

Cherchye, L., Kuosmanen, T. and Post, T. (2000), "What is the economic meaning of FDH? A reply to thrall", *Journal of Productivity Analysis*, Vol. 13 No. 3, pp. 263-267.

Chuweni, N.N. and Eves, C. (2017), "A review of efficiency measures for REITS and their specific application for Malaysian Islamic REITS", *Journal of Islamic Accounting and Business Research*, Vol. 8 No. 1.

Cokrohadisumarto, W. B M., Zaenudin, Z., Santoso, B. and Sumiati, S. (2019), "A study of Indonesian community's behaviour in paying zakat", *Journal of Islamic Marketing*, Vol. 11 No. 4, pp. 961-976.

Cooper, W.W., Seiford, L.M. and Zhu, J. (2011), *Data Envelopment Analysis History, Models and Interpretations*, Springer, Boston, MA, Vol. 178, doi: 10.1007/978-1-4419-6151-8.

Davidovic, M., Uzelac, O. and Zelenovic, V. (2019), "Efficiency dynamics of the Croatian banking industry: DEA investigation", *Economic Research-Ekonomska Istrazivanja, Routledge*, Vol. 32 No. 1, pp. 33-49.

Decree of the Minister of Religion (2015), "Decree of the minister of religion number 333 of 2015 concerning guidelines for granting permits to establish zakat institutions", pp. 1-11.

Deprins, D. and Simar, L. (1984), "Measuring labor efficiency in post offices, the performance of public enterprises: concepts and measurements".

Djaghballou, C.E., Djaghballou, M., Larbani, M. and Mohamad, A. (2018), "Efficiency and productivity performance of zakat funds in Algeria", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 11 No. 3, pp. 474-494.

Elviandari, E., Farkhani, F., Dimyati, K. and Absori, A. (2018), "The formulation of welfare state: the perspective of maqāid Al-Sharī'ah", *Indonesian Journal of Islam and Muslim Societies*, Vol. 8 No. 1, pp. 117-146.

Fall, F.S., Tchakoute Tchuigoua, H., Vanhems, A. and Simar, L. (2021), "Gender effect on microfinance social efficiency: a robust nonparametric approach", *European Journal of Operational Research*, Vol. 295 No. 2, pp. 744-757.

Hikmah, I.F. and Shofawati, A. (2020), "Analisis efisiensi 7 organisasi pengelola zakat (OPZ) nasional menggunakan data envelopment analysis (DEA)", *Jurnal Ekonomi Syariah Teori Dan Terapan*, Vol. 7 No. 6, pp. 1178-1192.

Kovalev, I.V., Zenutkin, N.V., Voroshilova, A.A., Testoyedov, N.A., Golovenkin, E.N. and Shatrov, A.K. (2021), "Analysis of nonparametric methods for assessing the comparative efficiency of agro-industrial enterprises", *IOP Conference Series: Earth and Environmental Science*, Vol. 839 No. 2, pp. 1-6.

Kundi, M. and Sharma, S. (2017), "Analyzing technical and super efficiency of aluminium firms in India", *Benchmarking: An International Journal*, Vol. 24 No. 6, pp. 1729-1741.

Latief, H. (2013), "Islamic philanthropy and the private sector in Indonesia", *Indonesian Journal of Islam and Muslim Societies*, Vol. 3 No. 2, pp. 175-201.

Lee, H.S. and Zhu, J. (2012), "Super-efficiency infeasibility and zero data in DEA", *European Journal of Operational Research*, Vol. 216 No. 2, pp. 429-433, doi: 10.1016/j.ejor.2011.07.050.

Lim, B., Lee, K. and Lee, C. (2016), "Free disposal hull (FDH) analysis for efficiency measurement: an update to dea introduction to FDH model the basics of FDH model", *The Stata Journal*, Vol. 10 No. 2, pp. 1-8.

Muhammad, S.A. and Saad, R.A.-J. (2016), "Moderating effect of attitude toward zakat payment on the relationship between moral reasoning and intention to pay zakat", *Procedia – Social and Behavioral Sciences*, Vol. 219, pp. 520-527.

Nahar, H.S. (2018), "Exploring stakeholders' views on a corporatized zakat institution's management performance", *International Journal of Ethics and Systems*, Vol. 34 No. 4, pp. 608-631.

Naves, S.A., Marques, A.C. and Moutinho, V. (2020), "Two-stage DEA model to evaluate technical efficiency on deployment of battery electric vehicles in the EU countries", *Transportation Research Part D: Transport and Environment, Elsevier*, Vol. 86, p. 102489.

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M., *et al.* (2020), "The socio-economic implications of the coronavirus pandemic (COVID-19): a review", *International Journal of Surgery*, Vol. 78, pp. 185-193.

Pratama, F.R.P. and Cahyono, E.F. (2019), "Pengukuran efisiensi dan produktivitas rumah zakat Indonesia dengan metode indeks malmquist", *Jurnal Ekonomi Syariah Teori Dan Terapan*, Vol. 6 No. 4, pp. 774-786.

Presiden, R. (2001), *Peraturan Pemerintah Republik Indonesia Nomor 8 Tahun 2001 Tentang Badan Amil Zakat Nasional*, Presiden Republik Indonesia, Indonesia, pp. 1-5.

Presiden, R. (2014), "Instruksi presiden republik Indonesia nomor 3 tahun 2014 tentang optimalisasi pengumpulan zakat Di kementrian/lembaga, sekertariat jendral lembaga negara, sekertariat jendral komisi negara", Pemerintah Daerah, Badan Usaha Milik Negara, Dan Badan Usaha Mili, Presiden Republik Indonesia, Indonesia, Vol. 3, doi: 10.1017/CBO9781107415324.004.

Rahim, R.A. (2015), "Ranking of Malaysian commercial banks: super-efficiency data envelopment analysis (DEA) approach", *Asian Academy of Management Journal of Accounting and Finance*, Vol. 11 No. 1, pp. 123-143.

Rahmat, R.S. and Nurzaman, M.S. (2019), "Assesment of zakat distribution: a case study on zakat community development in bringinsari village, sukorejo district, kendal", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 12 No. 5, pp. 743-766.

Rozalinda (2017), "Ekonomi islam: Teori dan aplikasinya pada aktivitas ekonomi", *PT RajaGrafindo Persada*, Depok, p. 315.

Ruiz-Torres, A.J. and López, F.J. (2004), "Using the FDH formulation of DEA to evaluate a multi-criteria problem in parallel machine scheduling", *Computers and Industrial Engineering*, Vol. 47 Nos 2/3, pp. 107-121.

Rustyani, S. and Rosyidi, S. (2018), "Measurement of efficiency and productivity of zakat institutions in Indonesia using data envelopment analysis and the malmquist productivity index", *International Journal of Zakat*, Vol. 3 No. 3, pp. 69-82.

Rusydiana, A.S. and Al Farisi, S. (2016), "The efficiency of zakah institutions using data envelopment analysis", *Al-Iqtishad: Journal of Islamic Economics*, Vol. 8 No. 2, pp. 213-226.

Rusydiana, A. and Hasib, F.F. (2020), "Super efisiensi dan analisis sensitivitas DEA: aplikasi pada bank umum syariah Di Indonesia", *Amwaluna: Jurnal Ekonomi Dan Keuangan Syariah*, Vol. 4 No. 1, pp. 41-54.

Ryandono, M.N.H., Qulub, A.S., Cahyono, E.F., Widiastuti, T., Aisyah, B.N. and Robani, A. (2021), "Efficiency analysis of zakat institutions in Indonesia: data envelopment analysis (DEA) and free disposal hull (FDH) approaches", *Academy of Accounting and Financial Studies Journal*, Vol. 25 No. 6, pp. 1-12.

Saad, R.A.J. and Farouk, A.U. (2019), "A comprehensive review of barriers to a functional zakat system in Nigeria: what needs to be done?", *International Journal of Ethics and Systems*, Vol. 35 No. 1, pp. 24-42.

Sari, M.D., Bahari, Z. and Hamat, Z. (2013), "Review on Indonesian zakah management and obstacles", *Social Sciences*, Vol. 2 No. 2, pp. 76-89.

Sherman, H.D. and Zhu, J. (2006), "Service productivity management: improving service performance using data envelopment analysis (DEA)", doi: 10.1007/0-387-33231-6.

Srivastava, P. (1999), "Size, efficiency and financial reforms in Indian banking, Indian council for research on international economic relations".

Syaifuddin, T. (2019), "Implementation of data envelopment analysis (DEA) in measuring the efficiency zakat fund management", *Indonesian Journal of Islamic Economics Research*, Vol. 1 No. 1, pp. 50-57.

Tulkens, H. (1993), "On FDH efficiency analysis: some methodological issues and applications to retail banking, courts, and urban transit", *Journal of Productivity Analysis*, Vol. 4 Nos 1/2, pp. 183-210.

Wahab, N.A. and Rahman, A.R.A. (2011), "A framework to analyse the efficiency and governance of zakat institutions", *Journal of Islamic Accounting and Business Research*, Vol. 2 No. 1, pp. 43-62.

Wahab, N.A. and Rahman, A.R.A. (2012), "Productivity growth of zakat institutions in Malaysia: an application of data envelopment analysis", *Studies in Economics and Finance*, Vol. 29 No. 3, pp. 197-210.

Wahab, N.A., Rahman, A. and Rahim, A. (2012), "Efficiency of zakat institutions in Malaysia: an application of data envelopment analysis", *Journal of Economic Cooperation and Development*, Vol. 33.

Wanke, P., Tsionas, M.G., Chen, Z. and Moreira Antunes, J.J. (2020), "Dynamic network DEA and SFA models for accounting and financial indicators with an analysis of super-efficiency in stochastic

frontiers: an efficiency comparison in OECD banking", *International Review of Economics and Finance*, Vol. 69, pp. 456-468.

Weatherly, L.A. (2003), "The value of people: the challenges and opportunities of human capital measurement and reporting", SHRM Research Quaterly, pp. 1-10.

Yu, S.H. and Hsu, C.W. (2020), "A unified extension of super-efficiency in additive data envelopment analysis with integer-valued inputs and outputs: an application to a municipal bus system", *Annals of Operations Research*, Vol. 287 No. 1, pp. 515-535.

Zakaria, M. and Malek, N.A.A. (2014), "Effects of human needs based on the integration of needs as stipulated in maqasid syariah and maslow's hierarchy of needs on zakah distribution efficiency of asnaf assistance business program", *Jurnal Pengurusan*, Vol. 40, pp. 41-52.

Zakaria, S. and Yusoff, W.F.W. (2011), "Transforming human resources into human capital", *Information Management and Business Review*, Vol. 2 No. 2, pp. 48-54.

Zakat Forum (2015), "Banyaknya lembaga zakat, berkah atau musykilah?", Zakat Forum, available at: https://forumzakat.org/banyaknya-lembaga-zakat-berkah-atau-musykilah/

Zakiyah, Z. (2011), "Islamic welfare system dealing with the poor in rural area", *Indonesian Journal of Islam and Muslim Societies*, Vol. 1 No. 1, pp. 37-67.

Zauro, N.A., Saad, R.A.J. and Sawandi, N. (2020), "Enhancing socio-economic justice and financial inclusion in Nigeria: the role of zakat, Sadaqah and Qardhul Hassan", *Journal of Islamic Accounting and Business Research*, Vol. 11 No. 3, pp. 555-572.

Zhu, J. (1996), "Robustness of the efficient DMUs in data envelopment analysis", *European Journal of Operational Research*, Vol. 90 No. 3, pp. 451-460.

Zimková, E. (2014), "Technical efficiency and super-efficiency of the banking sector in Slovakia", *Procedia Economics and Finance*, Vol. 12, pp. 780-787.

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