

THE EFFICIENCY OF ZAKAT OUTREACH IN TIME OF COVID-19 PANDEMIC

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Abstract: *The World Health Organization (WHO) declared the new Corona virus disease (COVID-19) as a pandemic on March 11, 2020. As a result of the pandemic and the implementation of lockdown (Movement Control Order) affecting many people such as job losses, declines in income, increase in unemployment, and other issues concerns, the significant changes in the collection and distribution of zakat contributions might occurred. The zakat institution is seen as having to work harder to distribute zakat funds equitably as the number of needy increases. Zakat institutions can be evaluated using measurable indicators such as zakat allocation and the number of zakat recipients in each district to measure zakat achievement. In order to determine the effectiveness of zakat distribution in each district, Data Envelopment Analysis (DEA) was carried out. The operations of zakat centers for twelve districts and one headquarter were compared before and during the COVID-19 period. The results showed the efficient zakat centers were Baling, Headquarter, Kulim, Langkawi and Sik prior to and during COVID-19.*

Keywords: Zakat, Efficiency, DEA, COVID-19

INTRODUCTION

Since March 11, 2020, Covid 19 has been declared as a global pandemic. This virus has infected and killed millions of people. Following the implementation of control measures such as large-scale social restrictions (e.g., PSBB in Indonesia) and other related terms such as lockdown and movement control order (MCO) in Malaysia, such a deadly effect has resulted in massive consequences. The COVID-19 recession has become the primary consequence in virus management around the world (Hudaefi & Baek, 2021; Novitasari et. al., 2020). Malaysia's economic growth is projected to decline to 4.5 % compared to 6.0 % projected in April 2020 by the World Bank.

Due to the covid-19 pandemic and the implementation of the MCO, indirectly the affects many people such as jobless, a decline in income, increased the unemployment rate, and many more issues concerns. In Malaysia, zakat institution as an Islamic social fund plays

an important role in addressing this problem by providing assistance to those affected. According to Hambari et. al (2020), Federal Territory Islamic Council (MAIWP) has run several programs to support those affected such as “Bantuan Zakat Kecemasan Covid-19” (Zakat Emergency Aid Covid-19). This special program is one of MAIWP’s efforts to help lessen the burden on ordinary people. Whereas in Perlis, several initiatives were implemented by MAIPs to mitigate the impact of pandemics and COVID-19 challenges through zakat campaign by sharing zakat information on electronic media, provide provision to those affected by COVID-19 either one off or regular assistance (Asni, 2021).

A zakat institution must emphasize the importance of management efficiency in distributing zakat to those who are eligible to receive it. According to research Kasim & Abdullah (2022), effective management of zakat distribution contributes to the eradication of poverty and enhancement of economic growth in a country's society. In addition, study done by Noorkartina et. al (2020) also indicated that there is positive long-term relationship between zakat and economic growth for several state in Malaysia. The image and credibility of zakat institutions were tarnished due to the issue of inefficiency in the management of zakat funds. This issue leads to the zakat taxpayers’ dissatisfaction and mistrust of the zakat institution (Wahid et. al., 2021).

The efficiency of zakat institutions in channeling the zakat funds to all asnaf groups who are eligible to receive it is crucial and closely related to the aspect of zakat payers' confidence in zakat institutions (Ag Omar, 2019). Mohd Jaapar & Kamarulzaman (2020) measured the effectiveness of zakat collection and distribution in Perak using two-stage DEA analysis. As the results, full efficiency of zakat collection was attained in 2017 while zakat distribution was in 2015. Due to the lack of specific guidelines for each criterion in the distribution of zakat causes the public question the transparency of the distribution of zakat. The study found that some people are not satisfied because the distribution of zakat is not provided to the deserving and needy but to the competent. Therefore, it is a negative view of zakat institutions' accountability in governance. This causes the community choose to pay directly to the asnaf without going through the zakat institution. Administering zakat is a very crucial duty as it conducts not only collecting and distributing zakat, but Ab Rahman et. al (2012) highlighted it is specifically related to spirit to uphold Islam as a religion for all humanity.

Fund allocation methods can be adapted to zakat distribution methods in optimizing the zakat collection. The main goals are to allocate the zakat collection effectively such as maximizing the utilization of fund and minimizing the surplus of annual zakat collection. While achieving these goals, satisfying few constraints (e.g., the physical ability of recipient, current living expenses and necessities) also fulfilled. In allocating zakat collection, there has been very limited research on methods to distribute the zakat fund, researchers mainly focused on enhancing the efficiency of zakat distribution management (Abu Bakar & Abd.Ghani, 2011). discussed the distribution proportions and form of distributions by Islamic Scholars to achieve quality of life of rightful recipients.

To the best of our knowledge, a dearth of studies on the fund allocation methods to zakat distribution methods in optimizing the zakat collection. Therefore, this study aims to assess the efficiency of zakat institutions in each district in allocating zakat funds before and during the COVID-19 period.

METHODOLOGY

The Data Envelopment Analysis (DEA) is used in this study to determine the relative efficiency of the production frontier leveraging the multiple inputs and outputs of the decision-making unit (DMU). Be it a study of the collection, distribution, or the institution itself, data envelopment analysis has been increasingly employed to examine the efficiency of zakat management. Hamzah & Krishnan (2016) measured the efficiency of zakat collection process. Sarasi et. al (2019) explored the optimal zakat allocation based on program conducted by zakat institutions. Meanwhile, Firdaus et. al. (2019); Krishnan & Hamzah (2017); Nurasyiah et. al (2019); Rusydiana & Al Farisi (2016); Yunani et. al (2020) used DEA to assess the performance of zakat institutions, whereas Ryandono et. al (2021) compared the results of both DEA and free disposal hull (FDH) on the efficiency of zakat institutions.

Due to the non-parametric nature of DEA, zero assumptions about the production function are required, and the DEA approach will develop the production function based on observed data, reducing variances. Furthermore, the efficiency obtained is a relative efficiency depending on the data collected. The original idea of DEA was to calculate the ratio between the weighted sum average of the outputs and inputs, as specified by equation (1), to measure the DMU efficiency.

$$\text{Efficiency of observed DMU} = \frac{\text{Weighted sum average of outputs}}{\text{Weighted sum average of inputs}} \quad (1)$$

Assume that we want to do an estimation of the efficiency of a set of DMU, for $j = 1, 2, \dots, n$. Then, assume that x_{ij} signifies the value of input type i for DMU _{j} in which $i = 1, 2, \dots, m$ while y_{rj} denotes the value of output type r for DMU _{j} in which $r = 1, 2, \dots, s$. Later, the Charnes-Cooper-Rhodes (CCR) DEA model is utilized to set the efficiency score of DMU _{k} , which expressed as below:

$$\begin{aligned} \text{Maximize } h_k &= \frac{\sum_{r=1}^s u_r y_{rk}}{\sum_{i=1}^m v_i x_{ik}} \\ \text{subject to} \\ \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} &\leq 1 \quad \text{for } \forall j \\ u_r &\geq 0 \quad \text{for } \forall r \\ v_i &\geq 0 \quad \text{for } \forall i, \end{aligned} \quad (2)$$

in which h_k in (2) resembles the efficiency score of DMU_k that is measured, u_r denotes the weight of output r , y_{rk} indicates the amount of output r regarding DMU_k , v_i signifies the weight of input i , while finally, x_{ik} symbolizes the amount of input i regarding DMU_k . The relatively challenging to solve fractional programming model (2) may actually be simplified into the primal CCR model (3), a straightforward linear programming (LP) model given by:

$$\begin{aligned}
 & \text{Maximize } h_k = \sum_{r=1}^s u_r y_{rk} \\
 & \text{subject to} \\
 & \sum_{i=1}^m v_i x_{ik} = 1 \\
 & \sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0 \quad \text{for } \forall j \\
 & u_r \geq 0 \quad \text{for } \forall r \\
 & v_i \geq 0 \quad \text{for } \forall i
 \end{aligned} \tag{3}$$

As per model (2) or (3), if $h_k = 1$, then it signifies that DMU_k is fairly efficient. In contrast, if $h_k < 1$, therefore, DMU_k can be marked as an inefficient DMU. It should be noted that the benchmarks or reference units used to determine if a DMU is efficient or inefficient are efficient DMUs.

An output-oriented variable return-to-scale (VRS) DEA model or Banker, Charnes and Cooper (BCC) DEA model was selected because this research's goal was to maximize the outputs. The following LP illustrates the mathematical form:

$$\begin{aligned}
 & \text{Maximize } h_k = \phi \\
 & \text{subject to} \\
 & \phi y_{rk} \leq \sum_{j=1}^n \lambda_j y_{rj} \quad \text{for } \forall r \\
 & x_{ik} \geq \sum_{j=1}^n \lambda_j x_{ij} \quad \text{for } \forall i \\
 & \sum_{j=1}^n \lambda_j = 1 \\
 & \lambda_j \geq 0
 \end{aligned} \tag{4}$$

where ϕ is the performance score in which the frontier can be achieved by multiplying the current output level.

Identifying DMUs

The goal of this study is to investigate the allocative efficiency of zakat operators in Kedah and provide the optimal solution for each one. In this context, zakat operators are described as a central point for collecting and distributing zakat money, for which personnel and *amil* are responsible. Kedah is divided into 12 districts, each with its own zakat management center. There is a headquarter that manages the entire zakat system means there is another zakat center that responsible to distribute the zakat fund, a total of 13 centers that administer the zakat money. Since one of the fundamental assumptions of DEA evaluation is that DMUs are homogenous, this analysis excludes any subdivision of districts, such as zakat collection at the Urban Transformation Center (UTC). As a result, 13 centers are deemed 13 DMUs.

Identifying Inputs and Outputs

The validity of DEA is highly reliant on the variables chosen for inputs and outputs. In terms of determining the inputs, the two inputs were selected, distributed funds and the number of administrators and *amil*. Additionally, the output variables include the number of zakat recipients and the collected funds incorporated into the efficiency models.

Data Collection

This study investigates the efficiency of zakat distribution through district management in distributing the fund before and during the COVID-19 phase. However, the post-COVID-19 evaluation is excluded due to a lack of data in 2021. The number of DMUs was determined using the thumb rule: three times the total number of inputs as well as outputs = number of DMUs. In total, thirteen DMUs were used for the efficiency evaluation, satisfying the thumb rule, with data spanning 2018 to 2020. The yearly reports of the examined zakat centers were used to collect data.

RESULT AND DISCUSSION

The distribution and collection of zakat in Kedah are shown in Figure 1. Figure 1 demonstrates that from 2018 to 2020, the investigated state had a large increase in its annual zakat collection. Even though there is the Coronavirus disease (COVID-19) outbreak, this situation indicates that yearly collection and annual distribution amounts increase.

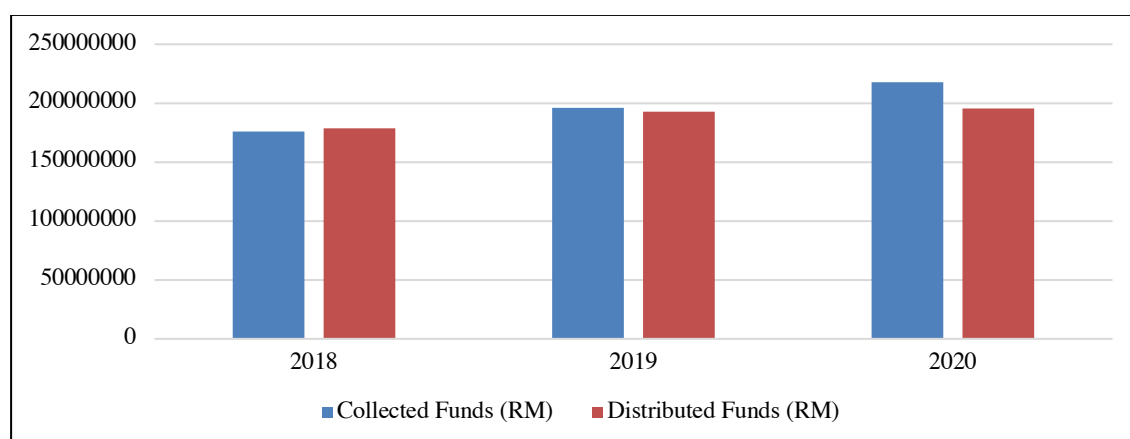


Figure 1. Annual Zakat Collection and Distribution during 2018-2020

Over three years, from 2018 to 2020, thirteen decision-making units (DMUs) were examined. The data availability for chosen samples implies that all observations can be employed to assess the efficiency of the DMUs. The efficiency score achieved from the output-oriented variable return-to-scale (VRS) Data Envelopment Analysis (DEA) model using DEAP software is presented in Table 1. Table 1 implies that six and five DMUs efficiently administered zakat funds during 2018 and 2019 respectively. However, eight were classified as technically efficient DMUs prior COVID-19. The bold font in the pure technical efficiency (PTE) column indicates that these DMUs achieved efficiency scores of one in both pure technical and scale efficiency (SE) scores. Prior to COVID-19, DMU₁ was the least efficient, with the lowest ratings in 2018 and 2019, respectively. During the COVID-19 time, the results decreased to only four DMUs consistently efficient, allocating appropriate zakat funds efficiently. For three years in a row, these four DMUs, Baling, the Headquarter, Langkawi and Sik maintained their overall efficiency. Nonetheless, DMU₁ was still the least efficient. According to Mohamad et. al (2021), DMU₁ (Bandar Baharu) has the lowest poverty index among the twelve districts, explaining the imbalance of lower collection yet higher allocation for that district.

The score gap between pure technical efficiency and scale efficiency for certain DMUs demonstrates scale inefficiency. Scale inefficiency implies that the firm cannot perform at its optimal size. For example, several DMUs scored 1 in pure technical efficiency. However, the lower result in scale efficiency indicates that these DMUs were not operating at their ideal size. The findings also suggest that zakat administering authorities in Kedah are, on average, better off in terms of pure technical efficiency than scale efficiency for each year. Only DMU₁, DMU₁₀, and DMU₁₁ have an increasing return-to-scale (IRS) in 2018, 2019, and 2020, indicating that an increase in input leads to a greater proportion of output. However, during COVID-19, most DMUs have shown that a rise in input results in a rise in output value that is less than the proportion of input, as evidenced by decreasing return-to-scale (DRS). Overall, the mean indicated a downward trend in efficiency from 2018 to 2020.

Table 1. Efficiency Score Pre-Covid-19 and During Covid-19 (Ote-Overall Technical Efficiency, RTS – Return to Scale)

D M U	HQ and Districts	Efficiency Score											
		Pre-COVID-19								During COVID-19			
		2018				2019				2020			
		OTE	PTE	SE	R T S I R S	OTE	PTE	SE	R T S I R S	OTE	PTE	SE	R T S I R S
1	Bandar Baharu	0.779	1.000	0.779	R S	0.784	1.000	0.784	R S	0.763	1.000	0.763	R S
2	Baling	1.000	1.000	1.000	-	1.000	1.000	1.000	-	1.000	1.000	1.000	-
3	HQ	1.000	1.000	1.000	-	1.000	1.000	1.000	-	1.000	1.000	1.000	-
4	Kulim	1.000	1.000	1.000	-	1.000	1.000	1.000	-	0.940	1.000	0.940	D R S
5	Kuala Muda	0.887	0.975	0.910	D R S	0.949	1.000	0.949	D R S	0.953	1.000	0.953	D R S

6	Kubang Pasu	1.000	1.000	1.000	-	0.920	0.980	0.938	D R S	0.900	0.957	0.941	D R S
7	Kota Setar	0.925	1.000	0.925	D R S	0.956	1.000	0.956	D R S	0.872	0.987	0.883	D R S
8	Langkawi	1.000	1.000	1.000	-	1.000	1.000	1.000	-	1.000	1.000	1.000	-
9	Pendang	0.857	0.865	0.991	D R S	0.876	0.883	0.992	D R S	0.881	0.886	0.993	D R S
10	Pokok Sena	0.875	0.943	0.928	I R S	0.818	0.905	0.903	I R S	0.945	1.000	0.945	I R S
11	Padang Terap	0.879	0.913	0.962	I R S	0.813	0.879	0.925	I R S	0.776	0.807	0.962	I R S
12	Sik	1.000	1.000	1.000	-	1.000	1.000	1.000	-	1.000	1.000	1.000	-
13	Yan	0.800	0.836	0.957	I R S	0.874	0.893	0.979	I R S	0.877	0.883	0.993	D R S
M e a n		0.923	0.964	0.958		0.922	0.965	0.956		0.916	0.963	0.952	

The authors propose an adequate amount for the outputs to demonstrate that the inefficient DMU benefited from the recommendations. According to LZNK, the funds that were greater than the collected amounts were due to the previous year's excess. The more funds gathered, the better because the surplus can be carried forward to the following year. As a result, the surplus collected funds are a favorable indicator since they entice new zakat payers and the existing zakat payers increase their monthly zakat payment as the sum of collected funds rises.

Tables 2 and 3 provide the number of recipients and total collection that can transform a DMU from inefficient to efficient based on the selected inputs. DMU inefficiency before and during COVID-19 was primarily due to insufficient funds allocated according to the inputs employed. Since the volume of money delivered is proportional to the number of beneficiaries, the number of recipients is likewise regarded as inadequate. Tables 2 and 3 compare the number of inefficient DMUs, with the number of inefficient DMUs increasing throughout COVID-19. The number of inefficient DMUs added one more to the group of the only eight DMUs before COVID19. Even though distributed funds rose in 2020, the main cause of inefficiency for seven districts during COVID-19 was insufficient allocated money. The Movement Control Order (MCO), which was enacted on March 16, 2020, was carried out throughout the year, forcing the zakat funds distributed to be limited. Due to lockdown restrictions, effective distribution of zakat funds was not achievable, and imbalance happened to the outputs when considering the chosen inputs. Several initiatives, including the intensive *daie* zakat program, financial aid to the higher education students, fare support for graduating students, and several other programs which had become regular in the distribution of zakat, had to be postponed, causing the inefficient distribution of money in 2020. However, several distribution schemes still can be allocated even though the pandemic condition, such as contributions to students to further their studies at local universities, school equipment

financial support, and a food distribution center in the mosque. Due to online learning regulations, those had to be reduced, and any outdoor activities are prohibited.

Table 2. Pre-COVID-19: Recommendation of Output for Inefficient DMUs to Become Efficient

D M U	2018				2019			
	Referenc e Units	Number of Recipients y_1	Collected Funds (RM) y_2	Cause of Inefficiency	Reference units	Number of Recipients y_1	Collected Funds (RM) y_2	Cause of Inefficiency
1	DMU ₄ , DMU ₆	1910	2,137,573.53	Insufficient y_1 and y_2	DMU ₂ , DMU ₈	1890	1,105,383.74	Insufficient y_1 and y_2
5	DMU ₄ , DMU ₆	10953	13,034,690.81	Insufficient y_1 and y_2	DMU ₃ , DMU ₄ , DMU ₁₂	11596	12,173,345.08	Insufficient y_1 and y_2
6		efficient			DMU ₂ , DMU ₄ , DMU ₁₂	8688	8,682,839.39	Insufficient y_1 and y_2
7	DMU ₄ , DMU ₆ , DMU ₈	12219	16,257,216.03	Insufficient y_1 and y_2	DMU ₃ , DMU ₄ , DMU ₁₂	12699	10,409,613.43	Insufficient y_1 and y_2
9	DMU ₄ , DMU ₁₂	5764	6,761,164.89	Insufficient y_1 and y_2	DMU ₃ , DMU ₄ , DMU ₁₂	6479	3,535,599.97	Insufficient y_1 and y_2
10	DMU ₆	2550	2,517,504.01	Insufficient y_1 and y_2	DMU ₂ , DMU ₈	2992	1,852,869.75	Insufficient y_1 and y_2
11	DMU ₄ , DMU ₆	3604	4,749,151.54		DMU ₂ , DMU ₁₂	4167	1,806,762.03	
13	DMU ₆	3470	3,425,640.44	Insufficient y_1 and y_2	DMU ₂ , DMU ₈	3498	3,653,638.79	Insufficient y_1 and y_2

Table 3. During COVID-19: Recommendation of Output for Inefficient DMUs to Become Efficient

D M U	2020			
	Reference units	Number of Recipients y_1	Collected Funds (RM) y_2	Cause of Inefficiency
1	DMU ₂ , DMU ₈	1464	1,326,756.81	Insufficient y_1 and y_2
4	DMU ₂ , DMU ₈ , DMU ₁₂	4802	8,444,787.94	Insufficient y_1 and y_2
5	DMU ₃ , DMU ₈ , DMU ₁₂	8975	13,291,902.28	Insufficient y_1 and y_2
6	DMU ₃ , DMU ₈ , DMU ₁₂	6726	8,806,193.18	Insufficient y_1 and y_2
7	DMU ₃ , DMU ₈ , DMU ₁₂	9319	9,040,693.18	Insufficient y_1 and y_2
9	DMU ₂ , DMU ₈ , DMU ₁₂	4582	3,733,129.03	Insufficient y_1 and y_2
10	DMU ₂ , DMU ₈	2044	1,843,376.28	Insufficient y_1 and y_2
11	DMU ₂ , DMU ₁₂	3576	2,080,710.61	Insufficient y_1 and y_2
13	DMU ₂ , DMU ₈ , DMU ₁₂	3163	4,043,008.09	Insufficient y_1 and y_2

CONCLUSION

The distribution of Kedah zakat increased every year from 2018 to 2020. Zakat centers in Kedah need to improve their strategies for managing collections and distributions of zakat for the future due to the extra surplus in 2020. The output-oriented variable return-to-scale (VRS) Data Envelopment Analysis (DEA) model was employed for this study, considering output factors might be optimized in zakat fund management. The output-oriented method was implemented because of the policy of zakat operators in Kedah to enable more zakat collection as well as increasing the number of recipients. By means of obtained results, inefficient units can be attained more efficiently by way of change that decision makers will have on outputs. It is obvious that the target on outputs will or affects positively the aim of zakat centers in each district. Inefficient decision-making units (DMUs) can be made more efficient by improving their outputs using the obtained results. It is self-evident that the suggested recommendations have a beneficial impact on the performance of inefficient DMUs.

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REFERENCES

- Ab Rahman, A., Alias, M.H., and Omar S.M.N.S. (2012). Zakat institution in Malaysia: Problems and Issues. *Global Journal Al-Thaqafah*, 2(1):35–41.
- Abu Bakar, M., and Abd.Ghani, A. (2011). Towards Achieving The Quality of Life in The Management of Zakat Distribution to The Rightful Recipients (The Poor and Needy). *International Journal of Business and Social Science*, 1(2):4.
- Ag Omar, Pg Mohd Faezul. (2019). Analisis Prestasi Kecekapan Agihan Zakat: Kajian Di Tabung Baitulmal Sarawak. *Labuan e-Journal of Muamalat and Society 13 (S1)*, 60-78.
- Asni, F. (2021). Pengurusan Kutipan dan Agihan Zakat Oleh MAIPS Ketika COVID-19 di Negeri Perlis: Suatu Sorotan Kajian. *International Journal of Islamic Economics and Finance Research*, 1–13. Available from: <https://ijiefer.kuis.edu.my/ircief/article/view/55>
- Firdaus, N., Ichsan, N., and Amjadallah, A. (2019). Efficiency Analysis of Zakat Organization in National Level and Region of Semarang City. Conference on Islamic Management, Accounting, and Economics (CIMAIE) Proceeding. Vol. 2, 2019, 1-12.
- Hambari, H., Arif, A.A, Zaim, M.A. (2020). The Role of Zakat Institution in Facing Covid-19. *International Conference of Zakat*, 119-126.
- Hamzah, A.A., and Krishnan, A.R. (2016). Measuring the efficiency of zakat collection process using data envelopment analysis. AIP Conference Proceedings. American Institute of Physics Inc.
- Hudaefi, F.A. and Beik, I.S. (2021). Digital Zakāh Campaign in Time of Covid-19 Pandemic in Indonesia: a Netnographic Study. *Journal of Islamic Marketing*, Vol. 12 No. 3, pp. 498-517. <https://doi.org/10.1108/JIMA-09-2020-0299>.
- Kasim, Amir & Abdullah, Adibah. (2022). The Efficacy or Effectiveness of Zakat Management Systems in Brunei, Malaysia and Indonesia.
- Krishnan, A.R., and Hamzah, A.A. (2017). Evaluating the Efficiency of a Zakat Institution Over a Period of Time using Data Envelopment Analysis. AIP Conference Proceedings. American Institute of Physics Inc.
- Mohamad, N. A., Desa, N. H. M., & Kasim, M. M. (2021). Development of Poverty Index for Districts in Kedah by Using CRITIC and Simple Additive Weighting Methods. *Universal Journal of Accounting and Finance*, 9(4), 790-795.
- Mohd Jaapar, A. and Kamarulzaman, N.H. (2020). The The Efficiency of Zakat Collection and Zakat Distribution of Islamic Religious Council Perak (MAIPk), Malaysia. *International Conference of Zakat*, 107–18. 10.37706/iconz.2020.236.
- Noorkartina Mohamad, Nor Ermawati Hussin and Nor Musfirah Mohamad. (2020). The Impact of Zakat on Economic Growth in Malaysia. *International Journal of Economics and Law*, 1(2):32–6.
- Novitasari, D.C., Hendradi, R., Caraka, R.E., Rachmawati, Y.L., Fanani, N.Z., Syarifudin, A., Toharudin, T., and Chen, R.C. (2020). Detection Of COVID-19 Chest X-Ray Using Support Vector Machine and Convolutional Neural Network. *Communications in Mathematical Biology and Neuroscience*, 1–19.
- Nurasyiah, A., Rosida, R., & Firmansyah (2019). The Efficiency Measurement of National Board of Zakat in West Java. *KnE Social Sciences*, 3(13):840 – 852.

- Rusydiana, A., and Al Farisi, S. (2016). The Efficiency of Zakah Institutions Using Data Envelopment Analysis. *Al-Iqtishad: Journal of Islamic Economics*, 8(2).
- Ryandono, M. N. H., Qulub, A. S., Cahyono, E. F., Widiastuti, T., Aisyah, B. N., & 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*, 25(6), 1-12.
- Sarasi, V., Primiana, I., and Masyita, D. (2019). Model of Optimal Zakat Allocation by Using Data Envelopment Analysis Approach. *Proceedings, International Conference of Zakat 2019*, 87 – 97.
- Wahid, H., Osmera, S.H., Noor, M.A.M. (2021). Sustainable Zakat Distribution through Wakalah Contract. *International Journal of Zakat*, 6(1):49–70.
- Yunani, A., Wahyudi, R., Fasa, M., and Maulida, S. (2020). Efficiency of Zakat Management Organization (OPZ) Bank Syariah: Data Envelopment Analysis Approach. *HamdardIslamicus*, 43(1):221–231.