
ANALYZING THE EFFICIENCY AND PRODUCTIVITY OF WAQF FUND MANAGEMENT IN INDONESIA AND MALAYSIA: A DEA AND MPI APPROACH

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ABSTRACT

Many waqf institutions face challenges when optimizing their performance due to varying capacities and operational conditions. The present research analyses the productivity and efficiency of the management of waqf funds in Indonesia and Malaysia from 2018 to 2023. This research employs data extracted from the annual reports of waqf management organizations. The data was analyzed using the DEAP 2.1 software regarding Data Envelopment Analysis and the Malmquist Productivity Index, which provided a larger comparative view of both the efficiency and productivity of waqf funds over time. During the observation period, we found that the average Total Factor Productivity Change (TFPCH) was 0.956, which shows a small dip in productivity. The main factor driving this productivity was technological change (TECHCH), which registered at 1.096, whereas the impact from technical efficiency (EFFCH) was pretty limited at 0.872. The analysis shows that in Indonesia, we should really work on making waqf distribution better, keep the operational costs in check, boosting waqf collection, and ensuring that assets are used efficiently. In Malaysia, the biggest areas to improve are waqf collection and distribution, while it seems like operational costs and asset management are in pretty good shape already. These findings offer valuable insights for policymakers and waqf institutions, highlighting the importance of improving technology and efficiency to better manage and sustain waqf funds in both countries.

INTRODUCTION

Waqf has been really important in Islamic social finance, acting not just as a way to share wealth but also as a sustainable force for socio-economic growth in Muslim communities (Sudi et al., 2024). It's also seen as a strong tool in Islamic finance that could boost national economic progress (Rofiq et al., 2022). The development of waqf institutions has spanned Islamic history, starting from the time of the Prophet Muhammad (SAW) and continuing to this day (Justine & Abd Jalil, 2022). Waqf plays a vital role in community building, especially in areas like education (Mujani et al., 2018; Rameli et al., 2021), healthcare (Ascarya & Tanjung, 2021; Bohari, 2015; Chaker et al., 2018; Conteh et al., 2020), socio-economic development (Hassan & Rahman, 2018; Sudi et al., 2024), and general welfare (Kasdi et al., 2022; Maulida & Rusydiana, 2025). Traditionally, although waqf has often been viewed mainly as a charity and as a non-profit organization, interest in its commercial and corporate dimensions within the worldly sphere has only emerged in recent years (Saad et al., 2017).

Indonesia and Malaysia, as Muslim-majority nations, hold substantial potential for waqf implementation. With Muslim populations of approximately 231 million and 20.1 million respectively (World Population Review, 2024), these nations play a key role within the global Muslim community. In Indonesia, the waqf sector has seen considerable growth. Data from the Waqf Information System of the Ministry of Religious Affairs (Kementerian Agama, 2022) indicates that waqf land in the country covers 440,500 sites with a total of 57.3 hectares. Additionally, waqf potential, specifically cash waqf, is projected to be IDR 180 trillion per annually (BWI, 2022). Waqf assets in Malaysia also show strong potential, with cash waqf collections reaching RM 8.2 million in 2022, the largest amount ever collected by the Waqf Foundation of Malaysia since its inception. Moreover, it is projected that Malaysia's waqf assets will surpass RM 1.3 trillion by 2023 (Yayasan Waqaf Malaysia, 2022).

Despite the significant potential of waqf in both Indonesia and Malaysia, waqf asset utilization in these countries has yet to be fully optimized for the advancement of the Muslim community. This limitation is often attributed to inefficiencies in waqf governance and mismanagement by waqf administrators, or nazhir (Aziz & Ali, 2018). In Indonesia, waqf institutions face key challenges, including limited outreach and a shortage of professional nazhir (Ningsih et al., 2022). The Indonesian Waqf Board (BWI, 2023a) reports that of the 400,000 nazhir throughout Indonesia, only 303 have been officially certified by BWI. It seems that traditional nazhir are still the main players in running waqf in Indonesia. This finding lines up with what Pyeman et al. (2016) pointed out, highlighting that waqf institutions are dealing with unbalanced organizational structures. Many of these institutions often have a limited number of staff and lack the know-how to properly manage waqf assets. Research also shows that waqf institutions in Indonesia haven't really reached an ideal efficiency level (Herindar & Rusydiana, 2022) and that their productivity has been on the decline since the COVID-19 pandemic hit (Uula, 2022). In addition, Pyeman et al. (2016), Hasan et al. (2020), and Ibrahim and Ibrahim (2020) found that most waqf

institutions across various Malaysian states are still struggling with inefficiency and haven't maximized their productivity yet.

Previous research has looked into how well waqf management works in terms of efficiency and productivity. A good example is the study by Hasan and Ahmad (2014) where they evaluated the efficiency of the waqf funds managed by the State Islamic Religion Councils (SIRC) in Malaysia. Pyeman et al. (2016) analyzed the waqf department efficiency scores of the SIRC in Malaysia during 2007-2012. Misbahrudin (2019) evaluated the efficiency of four State Islamic Religious Councils (SIRCs) in Malaysia from 2011 to 2015 using an output-oriented DEA model with a Variable Return to Scale (VRS) assumption. Another study by Hasan et al. (2020) examined performance efficiency over the period 2008-2010 in two Malaysian states, specifically Kelantan and Penang. Ibrahim and Ibrahim (2020) looked into how factors like corporate governance, location, and firm size affect the efficiency of 13 State Islamic Religious Councils (SIRC) when managing waqf in Malaysia. Herindar and Rusydiana (2022) assessed how efficiently waqf funds were managed in Indonesia from 2013 to 2020. Maulida and Laila (2024) analyzed the productivity of six Indonesian waqf institutions over the 2015 to 2021 period using the Malmquist Productivity Index (MPI). This paper aims to fill in some of the gaps in the current academic literature by focusing on evaluating the efficiency and productivity of waqf fund management, particularly in waqf institutions in Indonesia and Malaysia between 2018 and 2023. By applying both DEA and MPI methods to assess waqf institutions in these two countries, this study hopes to enhance the existing research and provide a clearer perspective on how performance varies and where improvements could be made in each country.

This study takes a close look at how well waqf institutions are doing, pinpointing areas where they can improve while comparing those found in Indonesia and Malaysia. It uses two main analytical methods: Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI). The goal here is to get a clear picture of how efficient and productive the waqf management is. The hope is that the results will help shape policies better and highlight opportunities to further develop waqf management down the line. By understanding productivity in this sector, we can push for more sustainable growth. What makes this research stand out is that it compares waqf fund management in Indonesia and Malaysia over six years using a combined DEA and MPI framework. This gives us a deeper insight into how these institutions perform and adds to the existing research on evaluating Islamic social finance.

LITERATURE REVIEW

Waqf

The term waqf comes from the Arabic verb waqafa, which means to “stop,” “restrain,” or “withhold.” In Islamic law, waqf refers to the permanent dedication of an asset (called mauquf) by its founder (waqif) for charitable or religious purposes. This means that ownership is fully transferred, ensuring that the asset itself can't be sold, while its benefits go to the specified beneficiaries indefinitely (Laluddin et al., 2021). This idea fits

with traditional legal definitions that highlight the importance of keeping the waqf property intact, while its use is carefully managed by a designated trustee (*mutawalli*), to support social and religious goals for as long as possible (Siddiqui et al., 2024). In Indonesia, waqf practices are regulated by important legal frameworks, including Law Number 41 of 2004 on Waqf, Government Regulation Number 42 of 2006 on Waqf, and the Indonesian Ulema Council (MUI) Fatwa Number 29 of 2002 regarding cash waqf. The Indonesian Waqf Board (BWI) is the independent body in charge of developing waqf in the country. Alongside BWI, private *nazhir* (waqf managers) can be individuals, organizations, or legal entities permitted to manage waqf. These private *nazhir* need to get certification from the Professional Certification Institute (LSP) under BWI and are directly overseen by the Ministry and BWI.

In contrast, in Malaysia, the management of institutional waqf is governed by the various laws and regulations that fall under the supervision of the State Islamic Religious Councils (SIRC). These councils operate in Malaysia's 14 states and the federal territories, and are accountable to the Sultan of their respective states (Justine & Jalil, 2022). Consequently, waqf management in Malaysia is centralized and exclusively controlled by the SIRC, which holds sole guardianship over all categories of waqf within each state. As such, private trusteeship of waqf is deemed illegal (Usman & Ab Rahman, 2023). To enhance the effectiveness and efficiency of waqf management, the Malaysian government established JAWHAR (the Department of Waqf, Zakat, and Hajj) in 2004. JAWHAR's role includes assisting the SIRC in waqf administration. In 2008, the Malaysian Waqf Foundation (YWM) was established under JAWHAR to assist SIRC in mobilizing waqf funds and developing waqf projects in commercial sectors (Rakhmat et al., 2022).

Efficiency

Efficiency refers to an institution's ability to maximize output with a given set of inputs or to achieve desired outcomes with minimal resource use (Belanès et al., 2015). Farrell (1957) introduced a framework for measuring economic efficiency, breaking it into Technical Efficiency (TE), how well inputs are converted into outputs and Allocative Efficiency (AE), how optimally resources are used based on prices. In practice, efficiency can be measured through simple ratios (e.g., BOPO, working capital) but more advanced techniques like Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) offer comprehensive evaluations. DEA is a non-parametric approach that's particularly popular in nonprofit and public sector research since it doesn't rely on a specific functional form and accommodates various inputs and outputs without needing price data (Emrouznejad & Yang, 2018). SFA is parametric and distinguishes inefficiencies from statistical noise but comes with the downside of requiring strong distribution assumptions, which can be problematic if the data is of varying quality (Coelli et al., 2005). Given the unique characteristics of waqf institutions and the type of data we have, DEA tends to be more adaptable and impartial when it comes to comparing efficiency across different organizations.

From an Islamic standpoint, the concept of efficiency underscores the importance of minimizing costs and using resources wisely, which aligns nicely with DEA's approach to maximizing outputs in relation to inputs, all without the bias toward profit maximization. From an Islamic perspective, the theory of efficiency is explained by Karim (2012), who states that production efficiency in Islam can be achieved through two approaches. The first approach is cost-minimization-based production efficiency. This involves producers minimizing production costs to reduce the average production costs. The second approach is optimal production efficiency. This involves maximizing output by fully utilizing production factors, enabling producers to maximize the quantity of the output generated as effectively and efficiently as possible in their production activities.

Productivity

The concept of productivity is defined as the ratio of output to input. In macroeconomic terms, Total Factor Productivity (TFP) measures the ability to generate greater output from available production factors, where TFP growth typically reflects technological progress or managerial effectiveness (IMF, 2024). Productivity is also defined as a combination of effectiveness (the achievement of intended goals) and efficiency (optimal resource utilization), implying that productivity increases when an entity "does more with less" (Kumar, 2023). This perspective complements efficiency measurements, as a unit may be technically efficient yet still unproductive if its output is low, or vice versa (Nurasyah et al., 2019). The scholarly literature highlights that productivity improvements may occur without technological innovation, provided that the inputs are reallocated more optimally (Sharpe & Fard, 2022). As innovation and organizational learning accelerate, TFP serves as a critical indicator of institutional advancement beyond mere resource utilization (Zelenyuk, 2023).

Previous Studies

In recent years, academic studies have assessed the efficiency and productivity of waqf management using DEA and MPI. Upon further exploration, these studies differ in terms of their analysis levels, input and output selection, and regional focus. Regarding the level of analysis, some studies show differences in the approach to efficiency analysis, whereas some use one-stage models focusing on technical efficiency, while others still adopt a two-stage approach to further analyze the factors influencing efficiency. For example, studies that use the one-stage model include Misbahrudin (2019), who evaluated the efficiency of four State Islamic Religious Councils (SIRCs) in Malaysia from 2011 to 2015 using an output-oriented DEA model with a Variable Return to Scale (VRS) assumption. Herindar and Rusydiana (2022) analyzed the efficiency of zakat institutions handling waqf funds from 2013 to 2020 using DEA. Meanwhile, studies have adopted a two-stage DEA to first analyze technical efficiency and then examine the factors affecting efficiency, such as Ibrahim and Ibrahim (2020), who used DEA and OLS regression. Hasan and Ahmad (2014) conducted an analysis involving two stages based on the grouping of waqf management functions, namely the collection and distribution of waqf. The two-stage approach enables

the exploration of managerial or structural determinants that affect efficiency levels, which cannot be revealed through the one-stage approach alone. Other previous studies have adopted the Malmquist Index as a technical complement to the data analysis to observe the longitudinal performance of institutions. For instance, Pyeman et al. (2016), Hasan et al. (2020), and Maulida and Laila (2024) used MPI to measure the productivity growth of waqf institutions by decomposing the changes into efficiency change (EFFCH) and technological change (TECHCH). The use of the MPI method is essential to capture the transformation of the production frontier shift over time (Coelli et al., 2005).

Another notable difference lies in the selection of the input and output variables analyzed. The variation in input selection is based on the different efficiency measurement approaches. Some studies mention that there are three main approaches in efficiency measurement: the production approach, the intermediation approach, and the profit (revenue) approach (Berger & Humphrey, 1997). In the production approach, within the context of financial institutions, the institution is viewed as a unit that produces services with inputs generally consisting of the physical resources required to perform transactions and process financial documents. The studies by Hasan and Ahmad (2014), Herindar and Rusydiana (2022), and Maulida and Laila (2024) adopt this approach. These studies assess that the efficiency of waqf fund management is determined by how effectively cost inputs can be converted into financial service outputs, in this case, the collected and distributed waqf funds. The intermediation approach views waqf institutions as intermediaries between the waqif and mauquf 'alaih, emphasizing total capital or incoming funds, as funds are the primary raw material transformed in the financial intermediation process. This approach is used in the study by Misbahrudin (2019). The third approach, profit (revenue) is still rarely found in studies on social financial institutions like waqf. However, some studies such as those by Pyeman et al. (2016) and Hasan et al. (2020) added output variables like the value of waqf projects to reflect the productive impact of waqf fund management.

The third difference lies in the regional focus. In efficiency measurements, several studies usually focus on the firm level or regional/national level. In waqf fund management efficiency studies, most focus on a single region/country. For example, Malaysia is covered in the studies by Hasan and Ahmad (2014), Misbahrudin (2019), Pyeman et al. (2016), Hasan et al. (2020), and Ibrahim and Ibrahim (2020). For the Indonesian perspective, there are the studies by Herindar and Rusydiana (2022), Maulida and Laila (2024), and Hanifa and Pramono (2025). Each country has different regulations, governance structures, and infrastructures, such as in Malaysia, where the State Islamic Religious Councils (SIRC) manage waqf funds, making coordination more centralized compared to Indonesia, which is more decentralized. Nonetheless, cross-country comparisons provide deeper insights into how institutional structures and environments affect efficiency.

The existing literature is methodologically rich, providing a strong foundation for further research. Some critical gaps were found, especially when it comes to picking the right input and output variables based on the approach being used, and when comparing

different countries. Addressing these gaps is essential for accurate evaluations, particularly of waqf fund management institutions that have social objectives and for cross-country comparisons to enrich the literature and generate new knowledge. This study aims to bridge that gap by evaluating waqf funds using two methods, DEA and MPI, focusing on an output-oriented production perspective, and looking at Indonesia and Malaysia side-by-side. This study also accommodates projections for improvement for DMUs that experience inefficiencies.

RESEARCH METHOD

This study uses non-parametric quantitative techniques, namely Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI). We chose DEA because it helps measure how efficiently the different decision-making units (DMUs) operate without needing set functional forms or pricing info. This makes it a great fit for evaluating non-profits like waqf organizations (Coelli et al., 1998). To add to that, we used the Malmquist Productivity Index (MPI) to see how productivity changes over time (Caves et al., 1982). MPI allow productivity to be broken down into two parts: technical efficiency change and technological change, which is useful for capturing the dynamic shifts in how waqf institutions perform. MPI's non-parametric nature and lack of reliance on price data make it ideal for analyzing entities in the public and social sectors (Hasan et al., 2020). With an output-oriented approach, the research aims to boost output while keeping input levels steady. Given the significant gap between how waqf funds are currently being gathered and distributed versus what they could achieve, focusing on outcomes seems like a better way to assess the efficiency and productivity of these funds.

This study relies on the secondary data derived from the annual financial reports of waqf institutions spanning the period 2018 - 2023. The financial reports for waqf institutions in Indonesia were obtained from the official websites of licensed waqf institutions. The data for Malaysia was sourced from the websites maintained by the State Islamic Religious Councils (MAIN) for all states. The documents analyzed included annual reports and financial statements. The research subjects were selected based on three steps as explained in Table 1.

Table 1.
Sample Screening Criteria

Step	Criteria	Number of Waqf Institutions
1	Official registration and licensing	Indonesia (20) Malaysia (14)
2	Availability of financial reports	Indonesia (7) Malaysia (6)
3	The presence of input and output items in each institution's financial reports	Indonesia (3) Malaysia (3)

Source: Data processed by the Author

This research adopts a purposive sampling technique, where the samples are selected based on predetermined qualifications. This sample can be classified as a decision sample (consideration), where samples are chosen based on the records or research objectives and sample quotas, which are taken based on specific quotas or categories that define the population dimensions (Wijaya, 2013). The data collection technique is adjusted to the conditions and circumstances of the objects being studied. In this study, the data collection is conducted by mining data from the official websites of the respective waqf institutions within the specified period. The sample selection takes into account several factors, including the accessibility of the annual financial reports published by the relevant waqf institutions during the observation period, as not all waqf institutions consistently publish annual financial reports. Another factor is the availability of input and output variables in the financial reports. Missing variables may affect the data processing results in the DMUs. Therefore, DMUs without complete variables must be excluded. Hence, this study uses purposive sampling to collect the financial report data.

Table 2.
Operational Variables

Type	Variable	Measurement	Rationale for Selection	References
Input	Assets	Total value of assets owned	Reflects the capital base and infrastructure capacity of institutions in delivering services.	(Hadini & Wibowo, 2021; Ibrahim & Ibrahim, 2020; Lestari, 2015; Naufal & Firdaus, 2018)
	Operational Expenses	Total annual operational costs	Represents the cost of running waqf programs, which affects efficiency and sustainability.	(Hasan & Ahmad, 2014; Herindar & Rusydiana, 2022; Ibrahim & Ibrahim, 2020; Lestari, 2015)
Output	Waqf Receipts	Total annual collection of waqf funds	Indicates fundraising performance and the institutions' ability to attract donors and mobilize resources.	(Akbar et al., 2022; Burhanudin & Indrarini, 2020; Hasan et al., 2020; Herindar & Rusydiana, 2022; Lestari, 2015; Pujiyanto & Kristianingsih, 2020; Pyeman et al., 2016)
	Waqf Distribution	Total annual disbursement of waqf funds	Reflects the institutions' effectiveness in channeling funds to beneficiaries and fulfilling its objectives.	(Burhanudin & Indrarini, 2020; Chumairoh & Rani, 2022; Firdaus et al., 2022; Hasan & Ahmad, 2014; Herindar & Rusydiana, 2022; Lestari, 2015; Zahra et al., 2019)

Source: Data processed by the Author

The input and output composition in this study is based on the core functions of waqf institutions as non-profit organizations focused on fundraising and fund distribution. Assets and operational expenses are selected as the input variables to represent the institutions' resource capacity and management efficiency. Waqf receipts and waqf distribution were chosen as the output variables, reflecting performance in generating and utilizing funds for social purposes. This variable formation aligns with previous studies and supports the use of an output-oriented DEA approach, which aims to evaluate how

effectively institutions maximize outputs from the given inputs. Output orientation is appropriate given the goal of improving service delivery and impact rather than minimizing resource use.

This study employs DEA and MPI to analyze efficiency and productivity in waqf institutions using the DEAP 2.1 software. DEA represents a methodology for assessing efficiency in production units and evaluating the efficiency of DMUs based on inputs and outputs, where functional relationships between these variables are not specified (Pujianto & Kristianingsih, 2020). In DEA, efficiency measurement can be approached from two distinct orientations: output-oriented and input-oriented. The input-oriented approach seeks the minimization of inputs with the maintenance of the output level, whereas the output-oriented approach aims toward the maximization of outputs without increasing the inputs. The principal goal of DEA is an evaluation of efficiency with what resources (inputs) are employed in order to achieve optimal results (outputs) (Naufal & Firdaus, 2018).

The two main DEA models were first introduced back in 1978 and have become popular tools for analyzing efficiency. CCR (Charnes, Cooper and Rhodes) and BCC (Banker, Charnes and Cooper) (Coelli et al., 1998). The CCR model assumes CRS, implying a constant input-to-output ratio. Assuming proportionality, an input increase by factor x yields an output increase by the same factor. This implies that all DMUs are operating at an optimal scale. The efficiency score derived from the CCR model is indicative of technical efficiency (TE). In 1984, the model was further developed by Banker, Charnes, and Cooper to accommodate Variable Returns to Scale (VRS), leading to the creation of the BCC model. The BCC assumes that DMUs cannot operate within an optimal scale, recognizing that the input-to-output ratio may fluctuate. Under VRS, an increase in input by a factor of x may result in a non-proportional change in output, either greater or smaller than the input increase. The BCC efficiency score reflects pure technical efficiency (PTE) (Farida & Azhari, 2018). In mathematical terms, the DEA formula is represented as follows (Burhanudin & Indrarini, 2020):

$$Efficiency = \frac{\sum_{i=1}^m U_i Y_{is}}{\sum_{j=1}^m V_j X_{js}} \leq 1, U_i \text{ dan } V_j \geq 0 \dots\dots\dots (1)$$

Description:

m = output

i = input

U_i = $s \times 1$ weight vector of outputs

V_j = $s \times 1$ weight vector of inputs

Y_{is} = output amount i produced

X_{js} = input amount j produced

This study employs MPI methodology for the evaluation of waqf institution productivity. The MPI productivity measurement is based on the ratios between output distance functions representing multifactor input and production technologies. This index offers several advantages over other methods of measurement. First, it employs a non-

parametric approach, which obviates the need for a specific form of functional representation for the production process. Secondly, MPI does not necessitate the assumption of specific production behaviors, including minimization of costs or maximization of profits. This makes it an appropriate choice when the objectives of producers are unknown or variable. Third, the MPI doesn't need price data, which is often hard to come by. Fourth, Djaghballou et al. (2018) showed that the MPI can be split into two components: efficiency change and technology change. The MPI was first put forward by Caves et al. (1982) as a way to compare production technologies using a distance function framework, highlighting specific output, input, and productivity indices. Coelli et al. (1998) improved this method by introducing the software DEAP version 2.1, building on the earlier work by Färe et al. (1994). The MPI formula is:

$$M_o(x^t, y^t, x^{t+1}, y^{t+1}) = \frac{D_{o,t+1}(x^{t+1}, y^{t+1})}{D_{o,t}(x^t, y^t)} X \left[\left(\frac{D^t_o(x^{t+1}, y^{t+1})}{D^{t+1}_o(x^{t+1}, y^{t+1})} \right) \left(\frac{D^t_o(x^t, y^t)}{D^{t+1}_o(x^t, y^t)} \right) \right]^{1/2} \dots\dots\dots(2)$$

Description:

- Mo = Malmquist Index (MI).
- Do = Distance function.
- xt = Input under the technology of the current period.
- xt+1 = Input under the technology of the next period.
- yt = Output under the technology of the current period.
- yt+1 = Output under the technology of the next period.

The formula (x^{t+1}, y^{t+1}) describes the latest production function, while the other one (x^t, y^t) shows the previous production function. $D_{o,t+1}(x^{t+1}, y^{t+1})$ is the time span of the observed use of technology. The notation t and $t + 1$ as well as x^{t+1}, y^{t+1} indicate that in MPI, the time series data used must span at least two years.

The formula $\frac{D_{o,t+1}(x^{t+1}, y^{t+1})}{D_{o,t}(x^t, y^t)}$ represents an efficiency change formula, also referred to as Efficiency Changes (EFFCHc). The formula $\left[\left(\frac{D^t_o(x^{t+1}, y^{t+1})}{D^{t+1}_o(x^{t+1}, y^{t+1})} \right) \left(\frac{D^t_o(x^t, y^t)}{D^{t+1}_o(x^t, y^t)} \right) \right]^{1/2}$ represents a formula for technical changes, also referred to as Technical Change (TECHCHc). The formula to determine the Variable Return to Scale (VRS), assumed with scale efficiency (SE), is as follows:

$$D_c(x, y) = D_v(x, y) x SE(x, y)$$

Next, Färe et al. (1994) developed a further formula from EFFCHc to derive the function of the technical efficiency change component to decompose it into pure efficiency change (PEFFCH) and scale efficiency change (SECH). Formula expression is as follows:

$$\frac{D_{o,t+1}(x^{t+1}, y^{t+1})}{D_{o,t}(x^t, y^t)} = \frac{D_{v,t+1}(x^{t+1}, y^{t+1})}{D_{v,t}(x^t, y^t)} x \frac{SE^{t+1}(x^{t+1}, y^{t+1})}{SE^t(x^t, y^t)} (PEFFCHv) (SECH)$$

The conclusion of the Malmquist TFP Change Index formula for calibrating Variable Return to Scale (VRS) can be outlined as follows:

$$M_o(x^t, y^t, x^{t+1}, y^{t+1})$$

The productivity factor TFPCHc is the multiplication of the total factor technical efficiency change EFFCHc, with the value of the technological change used TECHCHc over different time periods. Technical efficiency change is obtained from $(EFFCH) = (PECH) \times (SECH)$. Productivity change is obtained from $(TFPCH) = (EFFCH) \times (TECHCH)$. The definitions of the MPI variables are as follows: TFPCH represents total factor productivity change, which is the ultimate value that determines whether the company has experienced an increase or decrease in productivity. PECH represents the value of pure efficiency change. EFFCH represents the value of technical efficiency change. SECH represents the value of scale efficiency change. TECHCH signifies the value of technological change, referring to a shift in the production frontier over time. This shift represents improvements in the best-practice performance observed in the dataset, which implies that institutions can potentially produce more output with the same amount of input due to external progress or innovations reflected in the overall system (Coelli et al., 2005).

A waqf institution is considered to be efficient in its performance when its efficiency value equals 1 or 100%. Conversely, an output value of less than 1 indicates an inefficient institution. In addition to static efficiency, productivity over time is measured using the MPI. According to MPI criteria, a value below 1 indicates a decline in productivity, while a value above 1 signifies an increase. A value of 1 represents the absence of change in productivity.

This study relies entirely on the secondary data obtained from the publicly available annual reports of waqf institutions. One key limitation is the inconsistency in data disclosure across institutions, as not all waqf organizations report their financials with the same level of detail or format. Additionally, variations in accounting standards, reporting practices, or the classification of waqf-related transactions may lead to comparability issues. The absence of primary verification also raises the potential for reporting bias, which could affect the accuracy of the efficiency and productivity measurements. These limitations should be considered when interpreting the findings.

RESULT

Table 3.
Descriptive Statistics (\$ USD)

Indicator	Output (USD)		Input (USD)	
	Waqf Collections	Waqf Distributions	Assets	Operational Costs
Mean	8231879	2586786	25820410	3623894
Min	51	45	41351	65437
Max	64468563	41129091	91134117	12711763
St.Dev	17860598	8423508	27095021	3979218

Source: Data processed by the Author

The dataset includes financial information from waqf institutions in Indonesia and Malaysia between 2018 and 2023, converted into USD using the annual average exchange rate for each respective year to account for currency fluctuations. The data reveals

substantial disparities in waqf fund management across institutions. Waqf collections range from as low as \$51 to over \$64 million, while waqf distributions vary between \$45 and \$41 million. Assets show the largest spread, with a minimum of \$41,351 and a maximum of \$91 million, reflecting significant differences in institutional scale. Operational costs also vary widely, ranging from \$65,437 to \$12.7 million. This high variance across all indicators highlights the unequal capacity and financial resources among waqf institutions in the two countries.

The dataset shows large differences in the value of inputs and outputs across waqf institutions (non-normal distribution). This variation is expected due to the diverse sizes and capacities of the institutions included. Importantly, the methods applied in this study, DEA and MPI, are nonparametric techniques that do not require data to be normally distributed (Coelli et al., 2005; Färe et al., 1994). DEA is designed to compare DMUs of varying scales by focusing on relative efficiency rather than absolute values. Therefore, the presence of skewed data or high variance does not affect the validity of the analysis.

Table 4.
Summary of Waqf Management Efficiency Values

	2018	2019	2020	2021	2022	2023	Mean	Rank
Indonesia								
DD	0.086	0.053	0.071	0.028	0.035	0.024	0.049	4
LM	1.000	0.000	0.001	0.003	1.000	1.000	0.501	1
YM	0.003	0.004	0.004	0.004	0.003	0.011	0.005	6
Malaysia								
MAIPk	0.048	0.023	0.024	0.020	0.043	0.035	0.032	5
MAIM	0.114	0.117	0.144	0.014	0.014	0.014	0.069	3
MAIS	0.058	0.177	0.039	1.000	1.000	0.419	0.449	2

Source: Data processed by the Author

Based on Table 4, the efficiency values of waqf management in both countries fluctuate annually, with some waqf management institutions achieving maximum efficiency in different years. In general, when calculating the overall average of the 6 institutions over a period of five years, it becomes evident that LM, an Indonesian institution, demonstrates the most efficient approach with an average of 0.501, consistently achieving perfect efficiency (1.000) in 2018, 2022, and 2023, placing it at the top rank. MAIS (Malaysia) followed closely with an average score of 0.449, showing strong performance particularly in 2021 and 2022 when it reached full efficiency. In contrast, YM (Indonesia) showed the lowest average score of 0.005, indicating persistent inefficiencies over the six-year period.

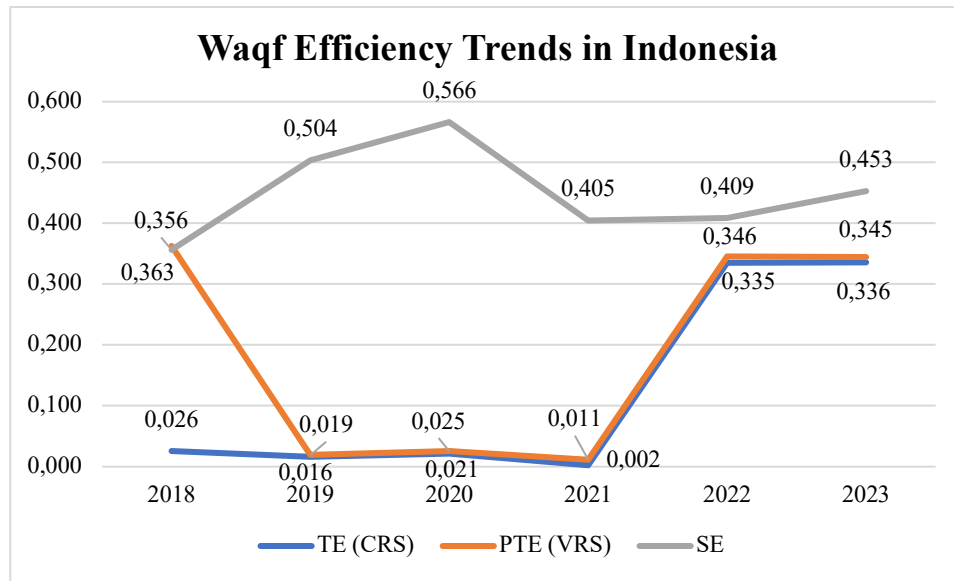
Table 5.
Efficiency Panel

Type of Efficiency	Mean	Min	Max	Std. Dev
2018				
TE	0.026	0.000	0.077	0.029
PTE	0.218	0.003	1	0.351
SE	0.365	0.000	1	0.378
2019				
TE	0.036	0.000	0.139	0.049
PTE	0.062	0.000	0.177	0.065
SE	0.423	0.023	1	0.330
2020				
TE	0.021	0.000	0.063	0.023
PTE	0.047	0.001	0.144	0.049
SE	0.484	0.054	1	0.376
2021				
TE	0.168	0.000	1	0.372
PTE	0.178	0.003	1	0.368
SE	0.381	0.020	1	0.423
2022				
TE	0.328	0.000	1	0.462
PTE	0.349	0.003	1	0.460
SE	0.377	0.019	1	0.429
2023				
TE	0.225	0.001	1	0.368
PTE	0.250	0.011	1	0.366
SE	0.374	0.020	1	0.388
All Years				
TE	0.134	0.000	1	0.309
PTE	0.184	0.000	1	0.336
SE	0.401	0.000	1	0.391

Source: Data processed by the Author

Based on Table 5, the average TE demonstrated variability from year to year, with the lowest value recorded in 2020 (0.021) and the highest in 2022 (0.328). This indicates an improvement in the more efficient use of inputs in 2022 compared to previous years. However, the average TE is still relatively low, suggesting that many units are still not optimizing input usage to produce output effectively. Similarly, the average PTE, which is generally higher than TE but still low, indicates that input efficiency remains a challenge for many units, despite operational scale issues also playing a role. Scale efficiency (SE) shows higher average values throughout the analysis period, ranging from 0.365 to 0.484. This indicates that most units operate at a suboptimal scale but with moderate stability. Overall, the low TE and PTE compared to SE suggest that most units have the potential to improve their technical efficiency without the need to change their operational scale. Efforts to

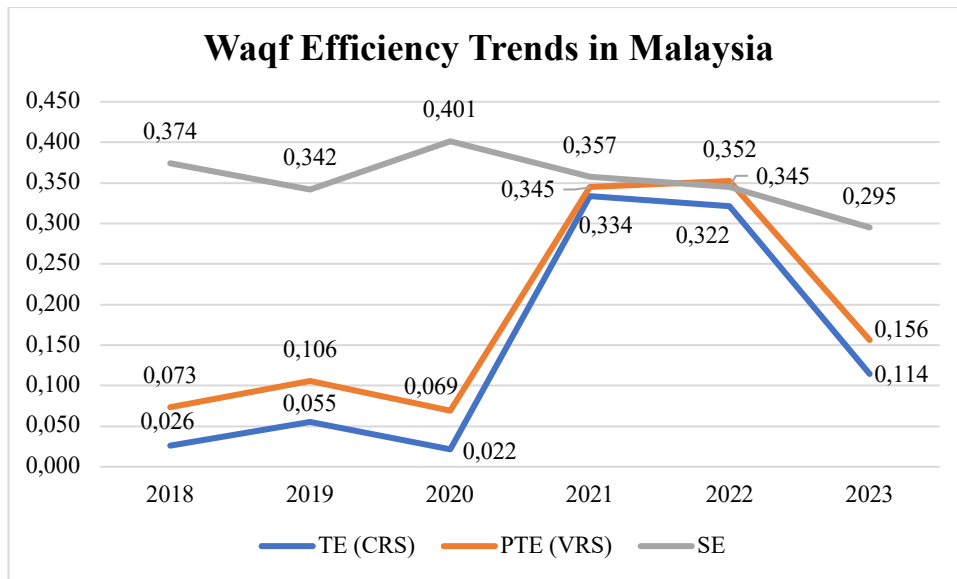
improve efficiency in the coming years can focus on better input management so then all units can achieve optimal productivity levels.



Source: Data processed by the Author

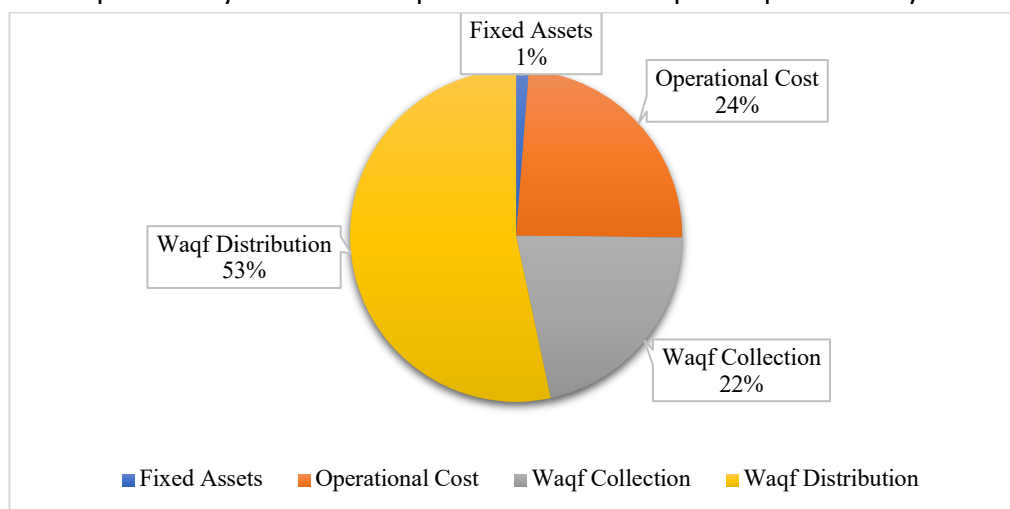
Figure 1. The Trends in Waqf efficiency in Indonesia

Fig. 1 depicts the trajectory of waqf management efficiency in Indonesia in the period from 2018 - 2023. Scale Efficiency (SE) peaked in 2020 at 0.566 before experiencing a slight decline to 0.405 in 2021, and gradually recovering to 0.453 by 2023. This suggests fluctuations in the institutional ability to operate at optimal scale. PTE dropped sharply from 0.368 in 2018 to 0.010 in 2019, indicating a decline in managerial efficiency before improving steadily in 2022 and stabilizing at 0.345 in 2023. Similarly, TE remained consistently low throughout the period, reaching its lowest point in 2021 (0.002), and then increasing to 0.336 (2023). These trends highlight that while some progress has been made in managerial efficiency and scale optimization, overall, technical efficiency still requires significant improvement. The consistent gap between SE and PTE/TE implies that internal management practices, rather than scale, are the dominant source of inefficiency in Indonesian waqf institutions.



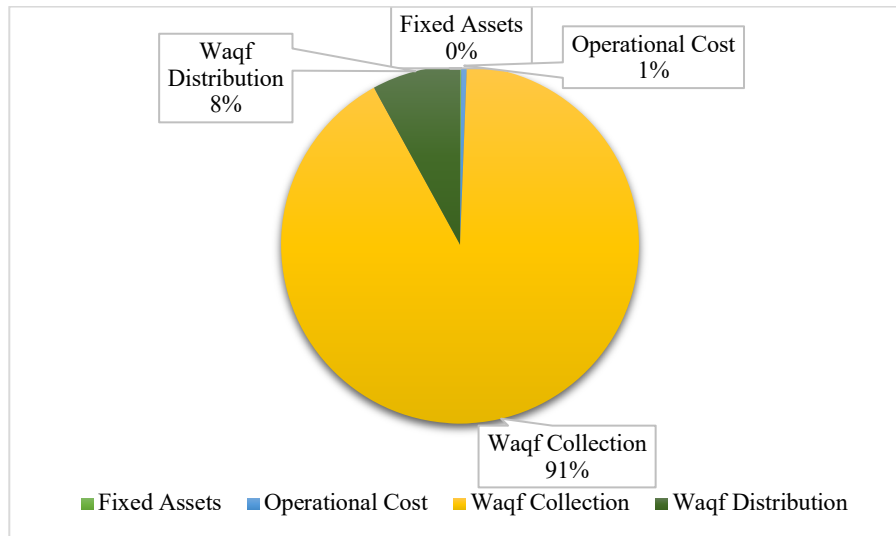
Source: Data processed by the Author
Figure 2. Waqf Efficiency Trends in Malaysia

Figure 2 shows that SE remained relatively stable, peaking at 0.401 in 2020 before gradually declining to 0.295 in 2023, indicating some weakening in scale optimization. PTE showed a gradual upward trend from 0.073 in 2018 to 0.352 in 2022, with a slight decline afterward to 0.156 in 2023. TE followed a similar pattern, remaining very low in the early years (0.026 in 2018), peaking at 0.334 in 2021, and dropping again to 0.114 in 2023. Despite some improvements during 2021–2022, both TE and PTE values remain relatively low and volatile, suggesting that the inefficiencies in converting inputs to outputs persists. Overall, although Malaysia has high scale efficiency, both TE and PTE show lower and fluctuating values. This indicates that while waqf management units are operating close to the optimal scale, there are challenges when efficiently utilizing the inputs in most units, which could potentially be further improved to achieve optimal productivity.



Source: Data processed by the Author
Figure 3. Potential Improvement of Waqf Management in Indonesia

Figure 3 shows that in order to achieve optimal efficiency, waqf managers in Indonesia need to focus on improving four main components: Waqf Distribution (53%), Operating Costs (24%), Waqf Collection (22%), and Assets (1%). This means that waqf distribution should be the top priority, ensuring that as much funding as possible is allocated to meet the needs of the waqf beneficiaries. Operating costs need to be managed more efficiently to avoid burdening the budget, while fundraising strategies should be enhanced to more effectively gather additional waqf funds. Assets should be well-managed, even though they account for a small proportion, in order to continue making an optimal contribution to supporting the operations and distribution of waqf funds.



Source: Data processed by the Author

Figure 4. Potential Improvement of Waqf Management in Malaysia

Figure 4 illustrates the potential for improvement in waqf management in Malaysia based on four key components: Assets, Operational Costs, Waqf Collection, and Waqf Distribution. From the graph, it is evident that the area with the largest potential for improvement lies in Waqf Collection, which accounts for 91% of the total improvement potential. This indicates that the fundraising process still has significant room for enhancement to become more efficient. Following that, Waqf Distribution shows a potential for improvement of 8%, suggesting opportunities for the more effective allocation of waqf funds. Operational Costs contribute only 1% to the potential improvements, indicating that operational cost efficiency is already quite optimal. Assets do not require further improvement, suggesting that assets are already being managed very well. Overall, efforts to enhance waqf management in Malaysia can be primarily focused on improving the collection of waqf funds, followed by minor improvements in fund distribution, allowing the entire waqf management system to become more efficient and impactful.

Table 6.
A summarization of the Mean Annual Values for the Malmquist Index

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2018-2019	0.004	59.402	0.016	0.226	0.211
2019-2020	229.352	0.000	52.654	4.356	0.077
2020-2021	1.094	1.573	1.050	1.041	1.720
2021-2022	1.176	3.004	1.207	0.974	3.532
2022-2023	0.482	16.707	0.544	0.887	8.051
Mean	0.872	1.096	0.894	0.976	0.956

Source: Data processed by the Author

Table 6 illustrates an enhancement among Indonesian and Malaysian waqf management institutions, indicated by the mean total factor productivity change (TFPCH) score of 0.956. This indicates a slight decline in overall productivity across institutions. This result is largely influenced by a high variance in specific years, with significant gains in 2021–2022 (TFPCH = 3.532) and 2022–2023 (TFPCH = 8.051) but notable declines in earlier periods, particularly in 2018-2019 and 2019-2020. The primary driver of productivity improvement was technological change (TECHCH) with an average score of 1.096, which in MPI reflects a shift in the production frontier. In contrast, technical efficiency change (EFFCH) and pure efficiency change (PECH) had average values below 1 (0.872 and 0.894, respectively), indicating underperformance in internal management practices. Scale efficiency (SECH) was relatively stable with a mean score close to 1 (0.976), implying that most institutions operated near optimal scale.

Table 7.
Malmquist Index Summary based on Waqf institutions

Waqf Institutions	EFFCH	TECHCH	PECH	SECH	TFPCH
DD	0.953	0.832	1.000	0.953	0.792
LM	0.760	1.044	0.756	1.006	0.794
YM	0.563	1.155	0.647	0.871	0.650
MAIPk	1.065	0.992	1.043	1.021	1.056
MAIM	1.000	1.078	1.000	1.000	1.078
MAIS	1.015	1.615	1.000	1.015	1.640
Mean	0.872	1.096	0.894	0.976	0.956

Source: Data processed by the Author

Based on Table 7, individually, the waqf institution MAIS stands out with the highest TFPCH of 1.640, driven by both a high amount of technological change (TECHCH = 1.615) and consistent efficiency levels. MAIM followed with a TFPCH of 1.078, supported by balanced performance in both EFFCH and TECHCH. In contrast, YM had the lowest TFPCH at 0.650, primarily due to low efficiency scores (EFFCH = 0.563; SECH = 0.871). Among Indonesian institutions, DD and LM also reported TFPCH values below 0.8, indicating limited productivity growth. MAIPk showed strong overall performance with a TFPCH of 1.056, driven by solid EFFCH and stable technology progress. These results highlight significant variations in productivity among waqf institutions, influenced mainly by

differences in efficiency and technological advancement. Institutions with lower scores may need to focus on improving their internal processes and leveraging external innovations to enhance their productivity.

Table 8.
Waqf Management Quadrant Categories

DMU	MPI	DEA	Quadrant
DD	0.792	0.049	IV
LM	0.794	0.501	IV
YM	0.650	0.005	IV
MAIPk	1.056	0.032	II
MAIM	1.078	0.069	II
MAIS	1.640	0.449	II

Source: Data processed by the Author

According to the quadrant analysis (Table 8), there are notable differences in the productivity and efficiency of waqf management in Indonesia and Malaysia. Quadrant I includes waqf management with high MPI productivity scores and DEA efficiency scores, indicating very good performance. In this study, no waqf management in either Indonesia or Malaysia achieved the optimum level of efficiency and productivity. Quadrant II includes waqf management with high MPI productivity scores but low DEA efficiency scores. Institutions in this group have a low “catching up” ability, with three institutions (MAIPk, MAIM, and MAIS) from Malaysia falling into this quadrant. Quadrant III includes waqf management with lower MPI outputs but comparatively elevated scores for the DEA efficiency index. These institutions have low productivity but relatively good improvements in efficiency. No waqf management institutions fall into this quadrant. Quadrant IV consists of waqf management with lower scores for both MPI productivity and DEA efficiency, indicating stagnant performance with significant room for improvement. Three institutions fall into this category - DD, LM, and YM - all of which are from Indonesia. Overall, waqf institutions in Malaysia show greater potential in terms of productivity compared to those in Indonesia. However, improving efficiency remains a key challenge for waqf institutions in both countries.

DISCUSSION

During the 2018-2023 period, the efficiency trend in waqf management in both countries fluctuated, with an average efficiency score that tended to be low. The low efficiency scores were attributed to relatively low TE and PTE scores, especially in 2019, although there was an improvement by 2022. This indicates challenges when optimizing input utilization to achieve maximum output. Nevertheless, waqf management units in both countries were operating near optimal scale, as evidenced by the high and steadily increasing SE values each year. These findings are consistent with other studies by Ibrahim and Ibrahim (2020) and Misbahrudin (2019), who stated that inefficiency in waqf management is more influenced by low TE and PTE scores than by SE. This suggests that inefficiency in waqf management is primarily caused by managerial weaknesses, and that

the size and scale of waqf institutions is not the main factor contributing to said inefficiency (Hasan et al., 2020).

This study identifies several areas needing improvement in the management of waqf in Indonesia if optimal efficiency is to be achieved. According to the research findings, efficiency can be improved by enhancing aspects such as waqf distribution by 53%, operational costs by 24%, waqf collection by 22%, and assets by 1%. Waqf distribution is the primary priority that must be addressed to achieve optimal efficiency. A dedicated team is needed to distribute and monitor waqf (Qurrata et al., 2021), as in Indonesia, misdirected philanthropy recipients often occur. Monitoring teams should be assigned to each district to track the progress of waqf beneficiaries. Additionally, waqf funds can be utilized through various Islamic financial investments to generate sustainable returns. Operational costs also require attention. Insufficient funds for said operational costs are a major challenge in waqf management today (Abas & Raji, 2018). Both in implementation and reporting, a waqf management system that is separate from other philanthropic activities is needed to ensure that operational funds remain focused and are not mixed with other activities. Another aspect that needs improvement is waqf collection. In Indonesia, waqf fund collection is still far from its potential (BWI, 2023b), largely due to the low waqf literacy among the public, even though Indonesia is a predominantly Muslim country (Fanani et al., 2021). Successful waqf fundraising requires more than just Indonesia's large Muslim population; effective marketing strategies are essential (Abdulkareem et al., 2020). Indonesian waqf institutions must establish efficient channels for fundraising through the strategic utilization of media. Consequently, the allocation of operational costs, particularly for promotion and marketing, must be increased.

In Malaysia, the main challenge in waqf management is the low collection of waqf funds, particularly cash waqf. Low cash waqf accumulation has been identified as a significant issue in several studies (Haron et al., 2016; Khan et al., 2022; Pitchay et al., 2018). According to Haron et al. (2016), there are a few things that could affect how waqf is collected, like not enough promotion or human resources. Pitchay et al. (2018) also point out that the cash waqf collection in Malaysia is pretty inconsistent, mainly because there's a lack of awareness and effective promotion, along with a waqf model that doesn't really draw in more donors. There's also the challenge of not being able to build credibility and develop waqf practices within the Muslim community, which makes it harder to move forward. Khan et al. (2022) backs this up by noting that issues with managing waqf, especially cash waqf, are significant barriers to collecting waqf in Malaysia. Additionally, the dearth of understanding about cash waqf among Malaysian Muslims has led religious councils to use various communication media to improve waqf literacy. The marketing approach remains scattered and unfocused, making the efforts to attract donors suboptimal. As a result, the funds raised from cash waqf remain low, which impacts the overall allocation of the budget for waqf management.

The productivity of waqf fund management, as indicated by the mean Total Factor Productivity Change (TFPCH) score of 0.956, reflects a slight overall decline across

institutions during the observed period. The year 2022-2023 marked a turning point with TFPCH peaking at 8.051, strongly driven by a surge in technological change (TECHCH = 16.707). In this study, productivity improvements were primarily influenced by shifts in the production frontier, reflecting technological progress, while changes in technical efficiency did not contribute optimally. These results emphasize the crucial role of adopting digital technology across all aspects of waqf operations from collection to distribution (Fanani et al., 2021; Salsabila et al., 2023). Previous studies, such as the work by Maulida and Laila (2024), also highlight the close relationship between waqf productivity and technology use. The utilization of technology not only increases the public interest in paying zakat and waqf but also helps optimize the operational management of waqf (Abidin & Utami, 2020; Salleh & Chowdhury, 2020). However, the implementation of digitalization and data integration for waqf remains a significant challenge for waqf institutions in Indonesia today (BWI, 2023b). The role of efficient and productive waqf instruments in addressing global humanitarian crises is becoming increasingly relevant. Technological innovations in waqf management enable more precise distribution and better access to aid for vulnerable populations, in alignment with the objectives of Islamic social finance in promoting social justice and solidarity within the ummah.

The finding was that technological change was the key driver behind productivity improvements. In context, technological change refers to shifts in the production frontier over time. This includes things like adopting digital systems, integrating data, and standardizing financial reporting, all of which help organizations get more output without needing extra input (Coelli et al., 2005). This is consistent with studies by Pyeman et al. (2016) and Hasan et al. (2020), who showed that in Malaysian SIRC, productivity growth linked to waqf was more about these shifts in the production frontier than internal efficiency boosts. We can see technological change as a sign of dynamic capabilities at work here. Hajiheydari et al. (2023) explain that these dynamic capabilities allow organizations to adapt and innovate by reshaping their internal processes to align better with digital transformation and sustainability goals. Oliveira-Dias et al. (2022) point out that dynamic capabilities act as internal forces pushing for sustainable business model innovation, especially as they respond to changing environments and tech opportunities. The high TECHCH values found in the analysis reflect a larger trend toward modernizing waqf operations through system upgrades and moving to digital data. However, it looks like this push for technology hasn't been matched by improvements in internal efficiency, which is evident in the lower EFFCH scores. This suggests that while organizations are making strides with external changes, getting their internal processes optimized is still a tough nut to crack for many waqf institutions.

CONCLUSION

This paper aims to assess how well Indonesian and Malaysian waqf management institutions are performing in terms of efficiency and productivity. The research shows that on average, waqf management institutions in both countries aren't very efficient. This is mainly because their scores in Technical Efficiency (TE) and Pure Technical Efficiency (PTE)

are below par. On a brighter note, Scale Efficiency (SE) looks solid and stable, which means that most institutions are running close to their best capacity. However, when it comes to their overall productivity, as indicated by the Total Factor Productivity Change (TFPCH), there's been a drop, with an average score of 0.956. Another key finding is that Technological Change (TECHCH) emerged as the main driver of productivity improvement (1.096), while the contribution from Technical Efficiency Change (EFFCH) remained limited (0.872). This rise in productivity indicates enhanced efforts to improve efficiency and leverage technology, which has positively influenced the overall performance of waqf institutions in both countries. The analysis of potential improvements indicates that in Indonesia, efforts should focus on optimizing waqf distribution, managing operational costs, enhancing waqf collection, and maintaining asset efficiency. In Malaysia, the largest opportunity for improvement lies in waqf collection and distribution, while operational costs and asset management appear to be already well-optimized.

This study underlines the importance of promoting standardized financial reporting and documentation for non-profit institutions, especially waqf. Standardization would greatly support future research on the development and performance of waqf institutions. To support better governance and sustainability, waqf regulatory bodies are encouraged to establish integrated national dashboards, and ensure the consistent classification of waqf financial data. These efforts would enhance transparency, comparability, and data availability, factors that are crucial for both research and public accountability. In parallel, waqf institution managers should begin adopting digital management systems, improving internal monitoring mechanisms, and investing in human resource development related to data literacy and financial accountability. By implementing such strategies, both policymakers and practitioners can work toward strengthening the performance, trustworthiness, and long-term impact of waqf institutions in meeting social and humanitarian objectives. However, this study is limited by the availability and consistency of secondary data across institutions, which may affect the accuracy of the efficiency measurements. Future research should consider incorporating primary data collection and qualitative analysis to capture the internal managerial practices and contextual factors influencing waqf performance.

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AUTHOR CONTRIBUTION

Syahdatul Maulida conceptualized the idea, wrote the manuscript, collected and processed the data, and finalized the manuscript.

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