Technical Efficiency Performance of Halal Food and Beverages Companies in Indonesia and Malaysia

Indria Ramadhani[ab] & Fatin Salwa Binti Haji Katri[a].

[a] *School of Graduate and Professional Studies, INCEIF University, Kuala Lumpur, Malaysia.*
[b] *Ikatan Ahli Ekonomi Islam Indonesia, Malaysia.*

Keywords
COVID-19; Competitiveness; Halal Food and Beverages; Technical Efficiency.

Abstract
Indonesia and Malaysia are among the top most influential countries globally for halal food and beverages (HF&B). As a result, there is a perception that these nations' HF&B companies are mature enough to have robust operational and managerial systems. This leads to a question on how HF&B companies handle unprecedented events. This paper examines the efficiency of HF&B companies, proxied by technical efficiency (TE) score in Indonesia and Malaysia over a five year period – covering the pre-COVID-19 period (2018-2019) and during the pandemic (2020-2022) –using Stochastic Frontier Analysis. The findings indicate that Indonesia's HF&B perform better over the period by showing 60% TE, whereas Malaysia's was at 50%. Interestingly, Malaysia's TE slightly increased during the COVID outbreak, whereas Indonesia showed a reverse pattern, with decreasing TE during the first year of the pandemic. Furthermore, both countries' HF&B require further improvement, as because between 40% and 50% of the production input is inefficient, which means the production outputs are not optimal for profit. The significant factors requiring improvement from industry players are managing the cash and inventory cycle, along with adding or upgrading any necessary fixed assets such as equipment to reach productivity at an optimum level. This findings also indicate the benchmark for the HF&B industry as well as the current stage for competitiveness among the countries.

Corresponding Author: 2300032@student.inceif.edu.my
https://doi.org/10.56529/mber.v3i2.301

1. Introduction

Uncertain economic conditions can cause many problems, one of which is related to companies' management to keep their business performance stable or improve it. Scholars agree that halal food and beverage (HF&B) companies, especially in Muslim majority countries, are considered to be defensive industries; firstly, because their product is a basic human need, and secondly, due to a strong demand side that creates robust market conditions (Ole-Meiludie *et al.*, 2014; Ryandono, 2021). Furthermore, many previous studies argue that food and beverage (F&B) industries operate in oligopolistic patterns, which causes high defensiveness in the face of any uncertainties (Setiawan *et al.*, 2021; Setiawan & Effendi, 2016; Setiawan & Oude Lansink, 2018). However, previous studies have not highlighted the role of efficient production performance in HF&B, exploring the operational side of a company and whether they are able to utilize their resources into profitability.

As Muslim majority countries and among the most influential countries in the HF&B sector, Malaysia and Indonesia must be active in promoting the HF&B sector for investment, research and development, halal regulation, trade agreements, and other components in order to be recognized and retain their position as global halal hubs (State of the Global Islamic Economy Report, 2023). Their increasing influence can be seen through the growing number of listed HF&B companies in the stock market. For example, in Indonesia, there were 55 listed HF&B companies in 2023 with average annual growth of 3-5% (Indonesia Financial Service Authority, 2023). Similarly, in the case of Malaysia, there wer over 30 HF&B companies listed on the stock market in 2023 (Bursa Malaysia, 2023).

Successful HF&B companies do not only rely on products but also the financial aspects such as debt ratio and revenue ratio, which must be maintained to certain benchmarks to ensure companies are holding minimum amounts of non-halal debt and income, for them to adherent sharia principles. As a result, multiple previous studies argue that sharia stocks are more robust when compared to non-sharia stocks due to the sharia compliance ratio as a part of risk mitigation (Putri *et al.*, 2020; Ryandono, 2021). This also implies in the case of HF&B. However, the sharia screening process fails to measure businesses' operational performance, as it only focuses on debt, revenue, and product ingredients.

Technical efficiency (TE) assessment can be a useful tool to indicate the amount of resources that companies must convert into income. In general, TE can be measured by two approaches: Data Envelopment Analysis (DEA) and Stochastic

Frontier Analysis (SFA). As to the purpose of this paper is to compare TE between two countries over a five-year period, the SFA approach is more suitable. First, it can be run using panel data, and second, its ability to indicate error term and inefficiency score provides broader implications (Lampe & Hilgers, 2015; Odeck & Bråthen, 2012; Rusydiana *et al.*, 2021).

Looking at previous studies, similar research in Indonesia mostly used the DEA method. These studies found that TE has high correlation with industrial concentration (Setiawan *et al.*, 2012), while inefficiency has a relationship with industrial size, value added, capital ratio, and investment ratio (Setiawan & Oude Lansink, 2018). Other studies instead focused on TE for small and medium F&B businesses (Machmud *et al.*, 2019). In Malaysia, studies have focused on halal agricultural products and found significant inefficiency (Mohd Noor *et al.*, 2016)

Previous research has not focused on the HF&B sector, despite the sector now being a priority sector for both Indonesia and Malaysia, according to the two countries' development blueprints (Deputy of Economy Indonesian Ministry of National Development Planning, 2019; Halal Development Corporation Berhad, 2020). Therefore, this research aims to measure the technical efficiency performance of HF&B companies in Indonesia and Malaysia using the SFA parametric approach and provide a comparative study between the two countries both before and during the COVID-19 pandemic.

The findings highlight that the HF&B sector should minimize the use of current assets, particularly inventory, to reduce the cash conversion cycle, while increasing fixed assets, liabilities, and equity to support overall efficiency. Before COVID-19, Malaysia's HF&B sector showed slightly higher efficiency than Indonesia, while during the pandemic, Indonesia experienced a temporary efficiency decline, recovering by 2022 with government support, yet Malaysia maintained a stable performance.

This research provides new insight for the businesses to indicate their positions compared to its peers and help them to establish further strategies. For policy makers, it gives a helicopter view of competitiveness between these two countries in the HF&B sector, and will encourage them to foster suitable regulations that can boost the industry. This can act as exemplary to regulators from other countries intending to pursue HF&B development for their foreign direct investment and overall socio-economic improvement.

This paper consists of five parts. First, the introduction covers the problem

statement, research objectives, novelty, and research gap. Then, the literature review explains the theory and highlights related empirical studies and hypotheses. Third, the methodology highlights the tools and variables used to conduct this studies. The fourth part is the result and discussion. Lastly, the conclusion summarizes the research and provides research implication, limitations, and recommendations for further studies.

2. Literature Review

2.1. Technical Efficiency

The theory of efficiency comes from a productivity approach that compares the ratio of output or expected results to the ratio of inputs or resource utilization. The inputs used in the production process cannot be completely absorbed in producing output; this is called waste. Waste that goes on without minimization will increase losses. In order to prevent wastage of inputs, by increasing the number of production outputs, the increased output condition with a fixed number of inputs indicates that the production system becomes more effective. An effective system in the long run can produce a fixed output by decreasing the number of inputs; this is known as efficiency. Archer (2010) defined efficiency as a measurement of effectiveness in order to minimize time, energy and skills wasted in a production. Koopmans (in Gass & Fu, 2013) defined efficiency as occurring when input-output has reached a certain point and cannot be increased without exacerbating productivity, so that efficiency can be used as an evaluation tool of the performance of production activity units. To measure efficiency, Coelli *et al.* (2005) described TE methods that reflect the company's ability to maximize output levels with optimum input usage.

One of the command methods to measure TE is SFA, which has several advantages compare to other tools. These include being able to (1) enter a random error to identify statistic noise; (2) know the existence of inefficiencies, (3) test hypotheses because it is a parametric method, and (4) use Panel Regression algorithms in SFA using Maximum Likelihood Econometric (MLE) so it is easier to test exogenous variables (Aigner *et al.*, 1977; Coelli *et al.*, 2005; Lampe & Hilgers, 2015). In measuring efficiency, TE refers to the ability of decision-making units (usually companies) to minimize inputs used in the production of a particular output, or the ability to obtain maximum output from a given input (Aigner *et al.*, 1977; Kumbhakar *et al.*, 2021; O'Donnell, 2018). The input-output selection approach using the production approach refers to research by Afrooz (2012); Čechura & Hockmann (2017); Čechura & Hockmann (2014); Náglová & Pechrová

(2019); and Rudinskaya (2017), where this approach adapts to the company's main activities. The value of TE with the SFA method ranges from 0 to1; the closer to 1, the better the level of efficiency.

2.2. Overview of Halal Food and Beverage Sector in Indonesia and Malaysia

The HF&B sector represents a dynamic and rapidly evolving sector globally. Scholars have investigated various facets of this industry, including the development and implementation of halal certification standards, consumer preferences and behavior, supply chain management, market trends, and the impact of globalization on halal food production and distribution (Azam & Abdullah, 2020). Research has also explored the intersection of halal requirements with food safety regulations, ethical considerations such as animal welfare and sustainability, and the role of technology in ensuring halal integrity throughout the supply chain (Randeree, 2019). Thus, existing research delves into the socio-economic implications of the halal food industry, including its contribution to employment, trade, and economic development in both Muslim majority and non-Muslim majority countries.

The HF&B industry in Indonesia is of significant interest due to the country's large Muslim population and the country’s emerging role as a global hub for halal products (Masruroh, 2020). Researchers explore various dimensions of this industry, including the regulatory landscape overseen by agencies like the Indonesian Ulema Council (MUI), the development of halal certification systems and standards (Ratanamaneichat & Rakkarn, 2013), consumer behavior and preferences in diverse regional markets, supply chain dynamics, and halal sector’s impact on Indonesia's economy. Additionally, scholars delve into Indonesia's efforts to position itself as a key player in the global halal market, leveraging its cultural heritage, agricultural resources, and manufacturing capabilities to meet the growing demand for halal products both domestically and internationally (Omar *et al.*, 2012). Through existing academic research, stakeholders gain insights into the challenges and opportunities facing Indonesia's HF&B industry.

Meanwhile, in Malaysia, the HF&B industry is a focal point of research due to the country's status as a global leader in halal certification and production. Scholars have investigated various aspects of this industry, including the regulatory framework established by government agencies such as the Department of Islamic Development Malaysia (JAKIM), the development of halal standards and certification processes, consumer behavior (Soraji *et al.*, 2017) and preferences within the local and international markets, supply chain management practices, and the economic impact of the halal industry on Malaysia's gross domestic

product and employment. Malaysia as a hub for halal food exports to both Muslim-majority and non-Muslim-majority countries, also face the challenges and opportunities presented by globalization, technological advancements, and changing consumer trends (Mohamad & Backhouse, 2014). More academic perspectives and understanding require for stakeholders in Malaysia's halal food and beverages industry gain valuable insights to enhance competitiveness (Mohamad & Backhouse, 2014), ensure compliance with halal requirements, and capitalize on emerging opportunities in the global halal market.

2.3. Empirical Review

Previous studies provide a variety of samples related to TE performance. Some studies such as Gardijan & Lukaˇ (2018) discussed the level of efficiency within F&B companies in Europe, with Giokas *et al.* (2015) and Rezitis & Kalantzi (2016) focusing in on the specific case of Greece. All results showed the use of input variables (labor, capital, raw material, and liquidity) significantly influenced increases in companies' TE scores. This means that F&B companies in general are part of a labor and capital-oriented industry.

Several other European-focused studies also provide interesting insights. In the case of the Czech Republic, Náglová & Pechrová (2019) found that government assistance could help companies to increase their TE score, while Čechura & Hockmann (2017) and Rudinskaya (2017) highlighted the TE able to generate heterogeneity of food manufacturing product of companies in Czech, create diverse product and promoting free trade market. Meanwhile, Čechura & Hockmann (2014) argue that Europe's most developed countries, such as Germany, French, Italy, and the Netherlands, have high efficiency scores due to advanced technology that supports the production system, especially during meat slaughtering processes, which significantly cut costs for companies. These findings indicate that food manufacturing efficiency needs complex support from external parties, internal parties, and other industry players.

In Indonesia, a study by Setiawan *et al.* (2012) found that higher efficiency scores have a positive relationship to support industrial concentration. However, on the other side, high concentration reduces research and development due to the 'comfort zone' position of companies and might cause long-term inefficiency and reductions in value (Setiawan *et al.*, 2021; Setiawan & Oude Lansink, 2018). Other studies, such as Machmud *et al.* (2019), discussed that in order to boost small and medium F&B enterprises, the significant factors are quality, reasonable price of raw material, and competent labor. In Malaysia, HF&B products still

lack good company management. Some products like meat and dairy show low efficiency due to traditional processing methods; these could be transformed by the incorporation of machinery, but significant research and development inputs are needed, along with advanced technology (Mohd Noor *et al.*, 2016).

This paper tries to fill the knowledge gap by focusing on halal listed companies, which produce significant amounts of products in Indonesia and Malaysia. The result will capture how well both Indonesia and Malaysia HF&B companies manage their resources in order to promote efficiency to increase income generation, especially pre-COVID-19 and during the pandemic, as these two different periods capture very different macroeconomic conditions. By comparing those two conditions, the defensiveness of the industry is tested and compared. Furthermore, the hypotheses of this research can be expressed as:

H1: HF&B efficiency is significantly impacted by current assets, fixed assets, liability, and equity.

H2: HF&B efficiency was defendable during the COVID-19 economic downturn.

3. Methodology

This study uses a quantitative panel data method covering the period 2018 to 2022, to compare the condition prior and during COVID-19. It takes secondary data from Refinitiv Datastream. The selection of research samples uses a purposive sampling method, which is F&B companies that are consistently registered in the Indonesia Sharia Stocks Index (ISSI) and FTSE Malaysia Sharia Hijrah Index during the research period. After the screening process, there are 12 Indonesian companies and 11 Malaysian companies which meet the criteria. The details of the screening process are captured in Table 1.

Table 1: Screening process

Step	Indonesia Sample	Malaysia Sample
All F&B companies	58	40
Halal F&B companies	55	33
Number of non-consistent and newly-listed halal F&B companies	46	22
Final sample	12	11

Source: Indonesia Financial Service Authority and Bursa Malaysia from 2018 to 2022

After attaining the sample, input and output variables were selected. Due to HF&B core business being the provision of products, this paper used a production input-output approach, which focuses on the amount of raw materials used to

generate output. The model measures four basic input variables and one output variable. The details and brief explanation are mentioned in Table 2.

Table 2: Input-Output Variables

Variable	Explanation	Expected Result
Input		
Current Assets	Measuring cash and cash equivalents, receivables, short-term investments, inventories, and prepaid expenses. A higher level of current assets owned by the company has an impact on the level of TE (Čechura & Hockmann, 2017; Čechura & Hockmann, 2014; Machmud *et al.*, 2019; Mohd Noor *et al.*, 2016; Náglová & Pechrová, 2019; Rudinskaya, 2017; Setiawan & Oude Lansink, 2018).	+
Fixed Assets	Calculating number of vehicles, production machinery, land, intangible assets, and long-term investments. the higher the value of fixed assets, the higher the TE of the company (Čechura & Hockmann, 2014; Machmud *et al.*, 2019; Náglová & Pechrová, 2019; Rezitis & Kalantzi, 2016; Rudinskaya, 2017; Setiawan & Oude Lansink, 2018).	+
Liability	The overall company debt, such as employee wages and short- and long-term debt. Total liabilities according to Gardijan & Luka˘ (2018); Giokas *et al.* (2015); and Náglová & Pechrová (2019) positively impact the company's TE because there is leverage effect and the assumption of productive debt can boost money creation for companies.	+
Equity	Contribution of capital originating from operations, shareholder equity, and retained earnings. Equity positively affects TE (Afrooz, 2012; Čechura & Hockmann, 2017; Machmud *et al.*, 2019; Mohd Noor *et al.*, 2016; Náglová & Pechrová, 2019).	+
Output		
Operating Income	The difference between revenue and production operating expenses, such as cost of goods, sales expenses, general expenses, and administrative expenses, to express the amount of the company's production or output (Čechura & Hockmann, 2014; Gardijan & Luka˘, 2018; Náglová & Pechrová, 2019).	

Mathematically the SFA TE equation can be formulated as follows:

$$y_{it} = \beta_0 + \beta_1 lnCA_{it} + \beta_2 lnFA_{it} + \beta_3 lnLi_{it} + \beta_4 lnE_{it} - u_{it} + v_{it} \qquad (1)$$

InEquation 1, y is a proxy for the output variable measured by operating income, whereas β_1 to β_2 represent the input variables separately (current assets, fixed assets, liability, and equity). u is the measurement of inefficiency, with a negative sign indicating that the inefficiency score is calculated by subtracting the efficiency score from 1. In other words, the sum of efficiency and inefficiency scores is always equal to 1. Where, v shows statistical noise, meaning other variables that exist outside the model. To ensure the appropriate model, independent variables are changed into previous performance results. By changing the input variables, the impact of time varying factors is included, whereas current performance is dependent on previous input variables (Desli *et al.*, 2003, Kumbhakar *et al.*, 2021). In total, two models will be developed: one using the current input variables and another incorporating previous input performance. The model with the highest gamma score will be selected, as it indicates the best performance in minimizing

the error term (Kumbhakar *et al.*, 2021). Using Frontier 4.1, the SFA TE score will show the result between 0-1, with scores closer 1 indicating more efficient company operational systems (Coelli *et al.*, 2005; Kumbhakar *et al.*, 2021).

4. Results and Discussions

4.1. Result

4.1.1. Descriptive Statistic

Table 3 provides descriptive statistics for Indonesia and Malaysia using USD in millions.

Table 3: Descriptive Statistic in USD millions

Description	Maximum	Minimum	Mean	Standard deviation
Indonesia				
Current Assets	3,793	24.97	570.96	882.2
Fixed Assets	8,846	21.3	1,083.37	2,247.16
Liability	9,152	10.8	1,052.25	2,214
Equity	3,446	23.78	602.08	917.18
Operating Income	1,319.4	1.5	177.83	307.94
Malaysia				
Current Assets	581.9	30.3	170.28	164.9
Fixed Assets	446	18.1	155.23	154.34
Liability	665.4	3.94	157.49	191.59
Equity	673.6	25.5	168.01	168.35
Operating Income	226.8	3.19	46.43	60.15

Source: Authors calculation

Indonesia's total operating income is almost six times higher than Malaysia. However, the highest contribution comes from liabilities, which means most Indonesia HF&B companies leverage their business by having debt. In the case of Malaysia, most companies rely on equity to support their operational activities. Both countries indicate that the lowest score is in operating income. It is also a signal that Indonesia has cumbersome on inequality of company operations compared to Malaysia, which can also be seen from the higher standard deviation and diversity mean score. Thus, on average Malaysia shows a stable range of mean for each variable, which might indicate that Malaysian HF&B companies are mostly in the same stage of development.

4.1.2. TE Result

Table 4: TE Result

Variable	Indonesia			Malaysia		
	Coefficient	Standard error	t-ratio	Coefficient	Standard error	t-ratio
β_0	-1.6174	1.3657	-1.18	0.4018	1.8205	0.22
$ln\beta_1 CA$	-0.0006	0.0002	-2.56*	-0.0020	0.0002	-8.33*
$ln\beta_2 FA$	0.8169	0.1270	6.43*	0.6915	0.2457	2.81*
$ln\beta_3 Li$	0.0011	0.0003	4.24*	0.0002	0.0004	0.45
$ln\beta_4 E$	0.2096	0.0821	2.55*	0.3053	0.1958	1.56
*Significant to 5%						
Source: Authors Calculation						

Based on Table 4, both countries have different factors influencing company efficiency. In Indonesia, the most significant factors for efficiency are fixed assets such as machine, land, and other intangible assets, although other factors also still play important roles, such as liability and equity.. Meanwhile in Malaysia, only current assets and fixed assets affect efficiency scores, albeit differently. The unique finding here is that in both countries, current assets have negative impacts on efficiency score; in other words, any additional amount of current accounts, like cash and receivables, can decrease company efficiency.

The analysis of HF&B TE scores (see Appendix 1) reveals an interesting trend. Only PT Akasha Wira International TBK and PT Nippon Indosari Corpindo TBK consistently improved their TE scores over the five years assessed in this study. Although PT Nippon Indosari Corpindo TBK started with the lowest score in 2018 (0.09), it rose to 0.51 by 2022. PT Akasha Wira International TBK also showed steady growth, reaching the highest score (0.91) in 2022. Looking across all companies, the average TE score fluctuates throughout the period, ranging from a low of 0.41 in 2022 to a high of 0.88 in 2019. The overall average TE score for the five years was 0.60.

Unlike the companies in Indonesia, no companies in the Malaysian HF&B sample (see Appendix 2) were able to consistently improve their TE score over the entire five-year period. Scores fluctuated year-to-year, with the lowest score in 2018 being 0.11 (Apollo Food Holdings Bhd) and the highest being 0.91 (Dutch Lady Milk Industries Bhd). The average score also varied, ranging from 0.48 in 2019 to 0.56 in 2018. Dutch Lady Milk Industries Bhd achieved the highest score in two years

(2020 and 2021), while companies like Malayan Flour Mills Bhd and Ajinomoto (Malaysia) Bhd consistently scored the lowest. There were some significant jumps in scores, like CCK Consolidated Holding Bhd's rise from 0.4 in 2021 to 0.85 in 2022. Overall, the average TE score for the Malaysian HF&B companies across the five years was 0.50.

4.1.3. Model Selection

The prediction of TE performance can be informed by both past and current performance data, as both conditions can influence changes in TE score volatility. Table 5 summarizes the key differences between the two models.

Table 5 Descriptive Statistic of TE Models

TE result	Indonesia		Malaysia	
	Model 1	Model 2	Model 1	Model 2
Mean	0.60	0.61	0.50	0.51
Minimum	0.91	0.93	0.93	0.92
Maximum	0.09	0.07	0.10	0.11
Standard Deviation	0.02	0.04	0.03	0.02
Gamma	0.91	0.90	0.97	0.96

Source: Author's calculation

While some models produce higher results, the overall differences between them are minimal, ranging from 0.01 to 0.02. This narrow gap can be attributed to the time-varying sensitivity of the SFA model. During the research period, economic turmoil likely impacted the changing input variables. However, the model is considered robust as the robustness test demonstrates a similar ranking of TE scores across all samples in both countries (see Appendix 1 and Appendix 2). Given the highest gamma value in Model 1 (Static SFA), which indicates the model's superior ability to predict TE scores, the findings will primarily focus on this model (Coelli *et al.*, 2005; Kumbhakar *et al.*, 2021).

4.2. Discussions

The analysis of 12 Indonesian HF&B companies (see Appendix 3) reveals several interesting diversification strategies. Half of the companies have ventured beyond just food and beverage products. For example, PT Akasha Wira International TBK offers beauty care products, PT Budi Starch & Sweetener TBK manufactures industrial packaging and chemicals, and PT Indofood Sukses Makmur TBK owns logistics and agricultural businesses. These diversified operations provide a buffer against risks like material shortages. Similarly, PT Sekar Laut TBK and PT Tunas Baru

Lampung TBK are vertically integrated, controlling their agricultural production chains. PT Wilmar Cahaya Indonesia TBK stands out as a trading company, avoiding manufacturing costs altogether. Notably, companies which diversified, except PT Budi Starch & Sweetener TBK, achieved the highest TE score at least once during the five-year period, suggesting a potential benefit to diversification.

In contrast to Indonesia, only three Malaysian HF&B companies (see Appendix 4) have ventured beyond core food and beverage products. CCK Consolidated Holding Bhd integrates its operations from farm to table, focusing on poultry and prawns. Malayan Flour Mills Bhd also raises poultry alongside flour and grain production. Spritzer Bhd, a beverage company, offers additional plastic products like PET bottles. Interestingly, these three Malaysian companies have diverse performances. Spritzer Bhd achieved the highest TE score at one point, while Malayan Flour Mills Bhd twice scored the lowest. CCK Consolidated Holdings Bhd falls in the middle, with fluctuating scores throughout the five years. Despite these differences, a common thread emerges between both countries: consumers are willing to spend on food and beverage products, together with related non-edible goods like hygiene products. This trend suggests an opportunity for F&B companies to expand their offerings and cater to a broader range of consumer needs.

4.2.1. Factors Affecting TE Score

The use of current assets as one of the input variables showed a significant negative influence, for both Indonesia and Malaysia HF&B. In proportion to cash and cash equivalents, trade receivables and inventories contribute the most to the current asset values. As a result, the greater cash value and cash equivalents owned by the company can lead to less cash channeling in operational activities and impact on declining operating income. The high contribution of trade receivables to current assets indicates that F&B companies use the credit system in their payments. A greater value of receivables can lead to high value of uncollectible receivables, and the longer the turnover before receivables can channeled back to operational activities can negatively affect a company's operating income. While other factors such as inventory also contribute significantly to current asset account, oversupply induces a domino effect on high inventory costs and inefficiencies. In general, high current assets can cause further problems to the cash conversion cycle of companies.The results of this study align with Vijayakumaran (2019) who found that receivables, cash, and inventory negatively impact company efficiency.

Conversely, the other input variables of fixed assets, liability, and equity show similar patterns to efficiency scores. Any increase of these variables raises the

efficiency score, especially in Indonesia where all three variables are positively significant at the 5% level. Both countries also see that fixed assets have significant impact, which means that HF&B companies are capital intensive and need more improvement from technology and machinery. These findings align with Ichsan *et al.* (2019) and Setiawan *et al.* (2021) who explained the main factors in improving food manufacturing industry are the use of better machinery and capital expenditure for technology, especially to keep up market competitiveness in the long-term.

In Malaysia, HF&B companies do not express a significant impact of liability and equity, which are crucial factors in the case of Indonesia HF&B companies. However, from the liability side, although liabilities have a positive effect, companies need to be careful because at some point the use of debt can lead to potential bankruptcies (Fikasari & Bernawati, 2021). The need to increase equity to support efficiency shows that being capable of accessing financing is an important activity for companies to ensure continuity of business, especially as equity is less risky than liability. Overall, the impact of both liability and equity on efficiency align with previous studies that stated F&B manufacturing company operations are complex (Afrooz, 2012; Čechura & Hockmann, 2017; Gardijan & Lukaˇ, 2018; Giokas *et al.*, 2015; Machmud *et al.*, 2019; Mohd Noor *et al.*, 2016; Náglová & Pechrová, 2019), meaning financial support not only relies on certain accounts but a need to balance between liability and equity to be productive and expansive.

4.2.2. Comparison of TE Before and During COVID-19

Graph 1 shows the overall fluctuating performance of the TE score over the five-year research period. In general, Indonesia HF&B companies have better TE scores than Malaysian companies between 2019 and 2022. This effect aligns with the Indonesia Halal Blueprint, which encourages HF&B companies to act efficiently to improve their competitiveness in domestic and global markets (Deputy of Economy Indonesian Ministry of National Development Planning, 2019). Meanwhile, Malaysian HF&B companies exhibited a downards pattern, with a significant decrease from 2018 to 2019. These findings supported research by Tandra *et al.* (2022), who found that Malaysia has sectoral competitive advantages in crude palm oil production and stating their countries as top global crude palm oil which makes them to be more focused in these sectors compared to others, such as food and beverages.

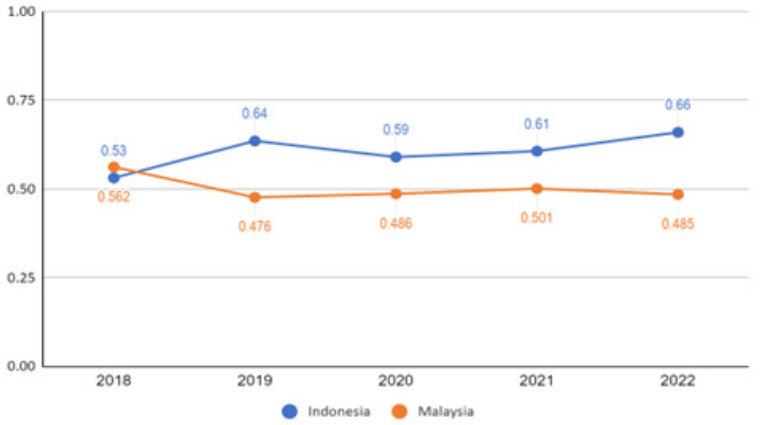

Figure 1. Comparison of TE Score Between Indonesia and Malaysia
Source: Authors calculation

Interestingly, in 2018-2019, just before the COVID-19 pandemic emerged, TE scores were relatively high, especially for Malaysian HF&B companies, which garnered the highest score in 2018 (0.562) before falling slightly in 2019 (0.476). The findings support previous studies by Mohd Noor *et al.* (2016), who found that HF&B products in Malaysia need further attention, especially from the technology and machinery side. Indonesian HF&B businesses, although scoring lower than Malaysian ones, saw improvements in TE scores from 0.53 in 2018 to 0.64 in 2019. The reason is because the Indonesian government targeted the country to become the global halal hub by giving intensive capital, especially to halal raw material. In addition, a stronger agricultural side was able to support HF&B companies to be able turn raw materials into final products, cutting additional supplier costs (Deputy of Economy Indonesian Ministry of National Development Planning, 2019).

The consequences of the COVID-19 pandemic were clearly seen in 2020 onwards. Both Indonesia and Malaysia imposed restriction movements and closed their borders in the late first quarter of 2020. Fascinatingly, Malaysia's TE slightly rose from 0.476 to 0.501 in 2019 to 2021, but dropped in 2022 to 0.486. This fluctuation is considered within the normal range, meaning HF&B companies in Malaysia can defend themselves from uncertain economic conditions, although they still need further support, including regualtory. These findings align with statements from Ole-Meiludie *et al.* (2014), who found that manufacturing companies who produce basic needs and non-cyclical products are more resilient compared to cyclical products.

For Indonesia, during the COVID-19 crisis, most HF&B companies were not able

to maintain their efficiency performance, causing an average downturn of the TE score to 0.59 in 2020. Surprisingly, for the following years of 2021 to 2022, the TE score increased to 0.61 then 0.66. Based on these findings, HF&B companies were successfully defensive during economic turmoil; it also indicates that external assistance from the government such as tax reduction for companies who produce necessities can help HF&B to survive (Ispriyarso & Wibawa, 2023).

In short, competitive patterns among HF&B in two countries have their own uniqueness like having diversified business, vertically integrated, to highly specify product. The differences see them experience different movements during normal and uncertain economic conditions. Although in general both countries witness fluctuating movements of TE, the crucial way to increase their efficiency is by minimizing current assets, while at the same time adding fixed assets that are able to efficiently boost operations.

5. Conclusion

Undefined circumstances in the economy trigger apprehension. Pandemics like COVID-19 provided a great lesson on how vulnerable the economy is, regardless of how advanced the world has become. Yet the F&B industry has been shown to be one of the most crisis-resistant industries. Despite experiencing many crises, this industry has never died out, thus it is worth using TE to measure operational effectiveness during a crisis. The formula to calculate TE in this paper integrates operating income, current assets, fixed assets, liabilities, and equity.

The results indicate that current assets have a negative impact on company efficiency, while other variables show a positive pattern. This means that to enhance company efficiency, it is crucial to maintain a certain minimum level of current assets due to the effect on the cash conversion cycle. Meanwhile, fixed assets, especially advanced machinery and research and development, become fundamental movements if HF&B want to increase their efficiency level along with increasing liability and equity. Furthermore, before the COVID-19 pandemic, both countries have different trends of TE scores, which continued until the pandemic: the TE scores of Indonesia showed an upward trend while Malaysia indicated a downtrend. This result gives new perspectives, especially for HF&B industries to rearrange their long-term strategy. For policymakers, the findings can contribute to aid further decisions to support HF&B companies in promoting their countries to be part of top halal hub globally. However, as this paper focuses solely on HF&B company operational variables, future research could explore other efficiency measurements and expand the study to other industries.

REFERENCES

Afrooz, A. (2012). Stochastic Frontier Aproach (SFA) to Measure Inefficiency in Food Industry of Iran. *Life Science Journal, 9*(4), 551–555.

Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formulation and Estimation of Stochastic Frontier Production Function Models. *Journal of Econometrics, 6*, 21–37.

Archer, T. S. (2010). The Efficiency Theory.

Azam, M. S. E. A., & Abdullah, M. A. (2020). GLOBAL HALAL INDUSTRY: REALITIES AND OPPORTUNITIES. *IJIBE (International Journal of Islamic Business Ethics), 5*(1), 47–59. https://doi.org/10.30659/IJIBE.5.1.47-59

Čechura, L., & Hockmann, H. (2017). Heterogeneity in Production Structures and Efficiency: An Analysis of the Czech Food Processing Industry. *Pacific Economic Review, 22*(4), 702–719. https://doi.org/10.1111/1468-0106.12217

Čechura Lukáš, Hockmann Heinrich, K. Z. (2014). W Orking P Aper S Eries. *Productivity and Efficiency of European Food Processing Industry, September*, 1–69.

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). A*n Introduction to Efficiency and Productivity Analysis* (2nd Editio). Springer.

Deputy of Economy Indonesian Ministry of National Development Planning. (2019). Indonesia Islamic Economic Masterplan 2019-2024. *In Indonesian Ministry of National Development Planning.*

Desli, E., Ray, S. C., & Kumbhakar, S. C. (2003). A dynamic stochastic frontier production model with time-varying efficiency. *Applied Economics Letters, 10*(10), 623–626. https://doi.org/10.1080/1350485032000133291

Fikasari, R., & Bernawati, Y. (2021). Internal or External Financing: New Evidence on Investor Reaction in Indonesian Manufacturing Firms. *Journal of Accounting and Investment, 22*(2), 242–253. https://doi.org/10.18196/JAI.V22I2.10711

Gardijan, M., & Lukaˇ, Z. (2018). *Measuring the relative efficiency of the food and drink envelopment analysis with missing data*. 695–713. https://doi.org/10.1007/s10100-018-0540-0

Gass, S. I., & Fu, M. C. (2013). Encyclopedia of Operations Research and Management Science Third Edition. In *Springer New York* (Vol. 48, Issue 7, p. 759). https://doi.org/10.2307/3010068

Giokas, D., Eriotis, N., & Dokas, I. (2015). Efficiency and productivity of the food and beverage listed firms in the pre-recession and recessionary periods in Greece. *Applied Economics, 47*(19), 1927–1941. https://doi.org/10.1080/00036846.2

014.1002886

Halal Development Corporation Berhad. (2020). Halal Industry Master Plan 2030 : Executive Summary. *In Ministry of Economic Affairs.* https://www.hdcglobal.com/wp-content/uploads/2020/02/Halal-Industri-Master-Plan-2030.pdf

Hassan, H. M. (2017). Islamic Investment in Singapore. *Islamic and Civilisational Renewal Journal, 8*(2), 268–271. https://doi.org/10.52282/ICR.V8I2.202

Ichsan, M., Dachyar, M., & Farizal. (2019). Readiness for Implementing Industry 4.0 in Food and Beverage Manufacturer in Indonesia. *IOP Conference Series: Materials Science and Engineering, 598*(1), 0–7. https://doi.org/10.1088/1757-899X/598/1/012129

Indonesia Financial Service Authority. (2023). *Daftar Efek Syariah*. https://ojk.go.id/id/kanal/syariah/data-dan-statistik/saham-syariah/Pages/Statistik-Saham-Syariah---Agustus-2023.aspx

Ispriyarso, B., & Wibawa, K. C. S. (2023). Reconstruction of the national economy post-covid-19 pandemic: Critical study of tax reforms in Indonesia. *Cogent Social Sciences, 9*(1). https://doi.org/10.1080/23311886.2023.2174517

Kumbhakar, S. C., Parmeter, C. F., & Zelenyuk, V. (2021). Stochastic Frontier Analysis: Foundations and Advances I. *In Handbook of Production Economics.* https://doi.org/10.1007/978-981-10-3450-3_9-2

Lampe, H. W., & Hilgers, D. (2015). Trajectories of efficiency measurement: A bibliometric analysis of DEA and SFA. *European Journal of Operational Research, 240*(1), 1–21. https://doi.org/10.1016/j.ejor.2014.04.041

Machmud, A., Ahman, E., Dirgantari, P. D., Waspada, I., & Nandiyanto, A. B. D. (2019). Data envelopment analysis: The efficiency study of food industry in indonesia. *Journal of Engineering Science and Technology, 14*(1), 479–488.

Masruroh, N. (2020). The Competitiveness of Indonesian Halal Food Exports in Global Market Competition Industry. Economica: *Jurnal Ekonomi Islam, 11*(1), 25–48. *https://doi.org/10.21580/ECONOMICA.2020.11.1.3709*

Mohamad, N., & Backhouse, C. (2014). A framework for the development of halal food products in Malaysia. *Proceedings of the 2014 International Conference on Industrial Engineering*, 7–9. https://core.ac.uk/download/pdf/288379329.pdf

Mohd Noor, M. A., Rizki Moi, M., & Abdul Kader, R. (2016). the efficiency of halal processed food industry in Malaysia. *Global Journal Al-Thaqafah, 6*(1), 37–46. *https://doi.org/10.7187/gjat10120160601*

Náglová, Z., & Pechrová, M. Š. (2019). Subsidies and technical efficiency of Czech

food processing industry. *Agricultural Economics (Czech Republic), 65*(4), 151–159. https://doi.org/10.17221/234/2018-AGRICECON

O'Donnell, C. J. (2018). *Productivity and Efficiency Analysis*. Springer Nature Singapore Pte Ltd. https://doi.org/10.1007/978-981-13-2984-5

Odeck, J., & Bråthen, S. (2012). A meta-analysis of DEA and SFA studies of the technical efficiency of seaports: A comparison of fixed and random-effects regression models. *Transportation Research Part A: Policy and Practice, 46*(10), 1574–1585. https://doi.org/10.1016/j.tra.2012.08.006

Omar, S., Agil, S., Zahrain, M., & Nor, B. M. (2012). Positioning the Halal food industry: The case of Malaysia. *NIDA Case Research Journal, 4*(2), 157–174. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=a7eb7beb0732eff46343dfbbacf4541696a7eec2

Putri, S. A. A. P., Nurhayadi, Y., & Heriansyah, D. (2020, October 16). Comparative Analysis of Conventional and Sharia Food and Beverages Company's Stocks Performance Companies Towards IHSG. *Proceedings of the 2nd International Conference of Business, Accounting and Economics, ICBAE 2020, 5 - 6 August 2020, Purwoker*. https://doi.org/10.4108/EAI.5-8-2020.2301131 Randeree, K. (2019). Challenges in halal food ecosystems: the case of the United Arab

Emirates. *British Food Journal, 121*(5), 1154–1167. https://doi.org/10.1108/BFJ-08-2018-0515/FULL/XML

Ratanamaneichat, C., & Rakkarn, S. (2013). Quality Assurance Development of Halal Food Products for Export to Indonesia. *Procedia - Social and Behavioral Sciences, 88*, 134–141. https://doi.org/10.1016/J.SBSPRO.2013.08.488

Rezitis, A. N., & Kalantzi, M. A. (2016). Investigating Technical Efficiency and Its Determinants by Data Envelopment Analysis: An Application in the Greek Food and Beverages Manufacturing Industry. *Agribusiness, 32*(2), 254–271. https://doi.org/10.1002/agr

Rudinskaya, T. (2017). Heterogeneity and efficiency of food processing companies in the Czech Republic. *Agricultural Economics (Czech Republic), 63*(9), 411–420. https://doi.org/10.17221/1/2016-AGRICECON

Rusydiana, A. S., Rani, L. N., & Cahyono, R. (2021). SFA Application on Islamic Economics and Finance Research. Library Philosophy and Practice, 2021, 1–25. RYANDONO, M. N. H. M. A. (2021). Sharia Stock Reaction Against COVID-19 Pandemic: Evidence from Indonesian Capital Markets. *The Journal of Asian Finance, Economics and Business, 8*(2), 697–710. https://doi.org/10.13106/JAFEB.2021.VOL8.NO2.0697

Setiawan, M., & Effendi, N. (2016). Survey of the Industrial Concentration and

Price-cost Margin of the Indonesian Manufacturing Industry. *International Economic Journal, 30*(1), 123–146. https://doi.org/10.1080/10168737.2015.1136666

Setiawan, M., Emvalomatis, G., & Oude Lansink, A. (2012). The relationship between technical efficiency and industrial concentration: Evidence from the Indonesian food and beverages industry. *Journal of Asian Economics, 23*(4), 466–475. https://doi.org/10.1016/j.asieco.2012.01.002

Setiawan, M., Indiastuti, R., Hidayat, A. K., & Rostiana, E. (2021). R&d and industrial concentration in the Indonesian manufacturing industry. *Journal of Open Innovation: Technology, Market, and Complexity, 7*(112), 1–12. https://doi.org/10.3390/joitmc7020112

Setiawan, M., & Oude Lansink, A. G. J. M. (2018). Dynamic technical inefficiency and industrial concentration in the Indonesian food and beverages industry. *British food Journal, 120*(1), 108–119. https://doi.org/10.1108/BFJ-04-2017-0226

Soraji, A. jakfar, Awang, M. D., & Mohd Yusoff, A. N. (2017). Malaysia halal trust: between reality and challenges. *International E-Journal of Advances in Social Sciences, III*(7), 197–204. https://dergipark.org.tr/en/download/article-file/298430

State of the Global Islamic Economy Report. (2023). State of the Global Islamic Economy Report. In *Dinar Standard*. https://haladinar.io/hdn/doc/report2018.pdf

Tandra, H., Suroso, A. I., Syaukat, Y., & Najib, M. (2022). *The Determinants of Competitiveness in Global Palm Oil Trade. Economies, 10*(6), 1–20. https://doi.org/10.3390/economies10060132

Vijayakumaran, R. (2019). Efficiency of working capital management and firm value: Evidence from Chinese listed firms. *International Journal of Financial Research, 10*(6), 133–144. https://doi.org/10.5430/ijfr.v10n6p133

APPENDICES

Appendix 1. Indonesia TE Score

Company	TE Score (Model 1)					TE Score (Model 2)				
	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
PT Akasha Wira International TBK	0.66	0.75	0.77	0.85	0.91	0.70	0.80	0.80	0.93	0.92
PT Budi Starch & Sweetener TBK	0.39	0.54	0.45	0.47	0.41	0.38	0.57	0.48	0.53	0.49
PT Indofood CBP Sukses Makmur TBK	0.73	0.82	0.81	0.66	0.77	0.66	0.76	0.75	0.85	0.76
PT Indofood Sukses Makmur TBK	0.59	0.64	0.61	0.66	0.77	0.41	0.63	0.71	0.79	0.73
PT Mayora Indah TBK	0.72	0.75	0.62	0.35	0.47	0.84	0.88	0.71	0.41	0.53
PT Nippon Indosari Corpindo TBK	0.30	0.49	0.33	0.73	0.85	0.19	0.36	0.21	0.34	0.62
PT Sekar Bumi TBK	0.09	0.11	0.22	0.26	0.51	0.06	0.16	0.17	0.29	0.50
PT Sekar Laut TBK	0.51	0.59	0.56	0.59	0.47	0.58	0.78	0.63	0.76	0.50
PT Siantar Top TBK	0.60	0.88	0.87	0.79	0.70	0.66	0.89	0.86	0.71	0.49
PT Tunas Baru Lampung TBK	0.55	0.46	0.56	0.52	0.49	0.84	0.69	0.76	0.74	0.73
PT Ultrajaya Milk Industry & Trading Company TBK	0.70	0.80	0.63	0.76	0.82	0.47	0.56	0.48	0.84	0.64
PT Wilmar Cahaya Indonesia TBK	0.54	0.80	0.65	0.65	0.74	0.48	0.72	0.51	0.56	0.58

Source: Authors Calculation

Appendix 2. Malaysia TE Score (Appendix)

Company	TE Score (Model 1)					TE Score (Model 2)				
	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Apollo Food Holdings Bhd	0.11	0.29	0.2	0.27	0.33	0.19	0.31	0.27	0.33	0.19
Ajinomoto (Malaysia) Bhd	0.4	0.66	0.43	0.23	0.17	0.73	0.82	0.83	0.47	0.14
CCK Consolidated Holdings Bhd	0.58	0.32	0.34	0.4	0.85	0.35	0.42	0.41	0.27	0.69
Dutch Lady Milk Industries Bhd	0.91	0.69	0.85	0.88	0.19	0.82	0.63	0.52	0.91	0.30
Fraser & Neave Holdings Bhd	0.59	0.81	0.78	0.7	0.57	0.75	0.83	0.82	0.80	0.75
Guan Chong Bhd	0.7	0.4	0.26	0.25	0.26	0.46	0.62	0.66	0.34	0.29
Hup Seng Industries Bhd	0.82	0.71	0.72	0.36	0.75	0.79	0.74	0.71	0.50	0.52
Kawan Food Bhd	0.46	0.13	0.5	0.63	0.25	0.36	0.20	0.38	0.37	0.37
Malayan Flour MIlls Bhd	0.12	0.1	0.16	0.33	0.22	0.13	0.11	0.20	0.29	0.15
Nestle (Malaysia) Bhd	0.9	0.89	0.69	0.75	0.81	0.82	0.75	0.70	0.59	0.63
Spritzer Bhd	0.59	0.24	0.42	0.71	0.93	0.32	0.37	0.32	0.89	0.92

Source: Authors Calculation

Appendix 3. Indonesia HF&B Companies Profile Overview

Company (Indonesia)	Date of Incorporation	Product & Services beside F&B
PT Akasha Wira International TBK	13-Jul-85	Beauty care products
PT Budi Starch & Sweetener TBK	12-Sep-79	Plastic packaging,
		Glucose and Fructose products for pharmacy industry, PP Woven Bag products, Sulphuric Acid products for industrial users including citric acid, fertilizer, rayon, colour essences, medicines, and detergent.
PT Indofood CBP Sukses Makmur TBK	30-Sep-09	N/A
PT Indofood Sukses Makmur TBK	12-Jul-91	Own shipping and packaging units. Principal activities range from research and development, seed breeding, oil palm cultivation and milling, to the production and marketing of branded cooking oils, margarine and shortening.
PT Mayora IndahTBK	3-Jan-78	N/A
PT Nippon Indosari Corpindo TBK	18-May-95	N/A
PT Sekar Bumi TBK	21-Feb-75	N/A
PT Sekar Laut TBK	1-Mar-78	Involved in restaurant & agricultural business
PT Siantar Top TBK	11-Jul-88	N/A (Local market)
PT Tunas Baru Lampung TBK	10-Jul-75	Engaged in plantations and manufacturing businesses. Produce CPO by-products such as cream soap and laundry soap that utilize fatty acids.
PT Ultrajaya Milk Industry & Trading Company TBK	20-Jan-73	N/A
PT Wilmar Cahaya Indonesia TBK	17-Feb-88	Engaged in local trade, export and import business.

N/A = only F&B products
Source: Refinitiv

Appendix 4. Malaysia HF&B Companies Profile Overview

Company (Malaysia)	Date of Incorporation	Product & Services beside F&B
Apollo Food Holdings Bhd	5-Mar-94	N/A
Ajinomoto (Malaysia Bhd)	14-Jul-61	N/A
CCK Consolidated Holdings Bhd	5-Aug-96	Engaged in the business of investment holding and the provision of management services. The Company operates through five segments: Poultry, Prawn, Food Service, Retail, and Corporate.
Dutch Lady Milk Industries Bhd	30-May-63	N/A
Fraser & Neave Holdings Bhd	15-May-61	N/A
Guan Chong Bhd	22-Mar-04	N/A
Hup Seng Industries Bhd	4-Oct-91	N/A
Kawan Food Bhd	21-Jan-04	N/A
Malayan Flour MIlls Bhd	24-Jun-61	The Company operates throughout three segments: Flour and grain trading, Poultry integration, and Others.
Nestle (Malaysia) Bhd	30-Nov-83	N/A

Spritzer Bhd	26-May-93	Manufacturing and selling of PET preform, PET bottles, caps, toothbrushes, and other plastic products; distribution of bottled water and other consumer products; operation of a mini golf course and recreational park, and investment holding.

N/A = only F&B products
Source: Refinitiv