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COST EFFICIENCY IN HALAL LOGISTICS: A DEA-BASED EVALUATION OF MALAYSIAN LOGISTICS PROVIDERS

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Abstract: *Halal logistics is a growing niche within the global supply chain, driven by increasing consumer demand for Shariah-compliant services. However, its implementation often incurs higher operational costs due to segregation requirements and certification processes. This study investigates cost-efficiency among Malaysian Halal logistics companies using Data Envelopment Analysis (DEA). By analysing inputs such as truck units and warehouse space against contract logistics value, the study identifies inefficiencies and proposes strategies for optimization. It uses both qualitative (interviews and observation) and quantitative (Data Envelopment Analysis, or DEA) approaches. The study also extends existing theories by incorporating religiosity factors, which refers to the implementation of Syariah principles in managing Halal products. The findings show that logistics costs arise from the segregation of Halal and non-Halal products and from having dedicated trucks or warehouses. The research findings can be beneficial for companies and authorities to improve Halal logistics activities and address issues raised by Halal logistics companies.*

Keywords: *Halal logistics, Cost-efficiency, Data Envelopment Analysis (DEA), Supply chain, Regulatory frameworks, Shariah principles.*

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Introduction

The dynamic business environment has dramatically changed the structure of logistics industry due to different requirements among the trading nations. One of the lucrative areas in the industry is the halal logistics. The demand towards an effective and acceptable halal logistics service is timely to meet the requirement of international trade of halal products across the world. According to Bernama (2023), the Malaysian Halal Food Industry will increase to US$ 113.2 billion (RM500.17 billion) by 2023 and contribute 8.1% to the country's GDP by 2025. As of 2021, there were about 200,000 businesses in the halal food industry. However, the demand for dedicated Halal logistics services is often low, which creates a conflict between high expenditures and low revenue. This lack of demand leads to the underutilization of assets like trucks and warehouse space, which directly impacts a company's cost-efficiency and profitability.

Halal logistics ensures the integrity of Halal products throughout the supply chain, from origin to consumption. Despite its importance, logistics providers face challenges in maintaining cost-efficiency due to stringent segregation requirements and limited demand. the halal sector is not merely adhering to conventional methods but is actively seeking cutting-edge solutions to contemporary challenges, such as employing technology for halal certification and safeguarding the authenticity of halal products in global supply networks (Fitri Razak et al, 2025). Halal logistics is a specialized and growing area within the global supply chain, motivated by the increasing demand from consumers for services that comply with Shariah principles. The purpose of Halal logistics is to ensure the integrity of Halal products throughout their journey, from their origin to their final consumption. This process involves strict requirements for segregation and cleanliness. However, logistics providers face a significant challenge: maintaining cost-efficiency while meeting these stringent requirements. The primary concern is that implementing these principles can lead to higher operational costs. This is not just a procedural change but necessitates significant investments in dedicated facilities, such as separate warehouses, transport fleets, and specialized handling equipment.

Problem Statement

Numerous studies have highlighted the difficulties inherent in implementing Halal logistics. Increased operational expenses have been the primary source of worry for logistics service providers. This is because they believe that incorporating Shariah policies into the logistics processes will result in additional activities at a higher cost. According to Ab Talib et al. (2013), Halal logistics are not cost-effective and require significant capital expenditures. This is because, in order to conduct Halal logistics, additional facilities are required to handle Halal items, as they must be completely separated from haram and hazardous products throughout the supply chain's handling, transportation, and storage operations. Therefore, in this context, what are the detailed facilities are needed? In study of Rantasila (2014), all the logistics functions or activities are equivalent to logistics cost (Logistics functions = logistics costs).

Determinants of logistics costs are very crucial and complicated. The more logistics process in the company, the more logistics costs will be identified (Muha, 2019). Logistics processes must be measured in order to enable to control the cost efficieciency. Measuring the impact of logistics activities is the key to reducing inefficiencies in a company's system, while at the same time increasing its opportunities for growth (Muha, 2019). However, Ab Talib et al. (2013) noted that while some businesses have engaged in Halal logistics, their Halal logistics s have not been their primary source of revenue. This is due to a lack of demand for the handling, transportation, and warehousing of Halal items (Halal logistics). Determinants of logistics costs

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As a result, establishing a Halal logistics practice will require significant investment to meet these unique handling requirements. Thus, the increased costs incurred by logistics service providers and the additional charges imposed on customers created bad opinions, and harmed the overall growth of the Halal industry and Halal logistics business. Additionally, Tieman (2011) proposed using different load carriers for Halal and non-Halal goods in storage, distribution, and transportation, as well as loading/unloading activities, in order to reduce the possibility of contamination and to ensure Halal integrity. The great dilemma about the total logistic costs is visibility since the costs incurred in the logistic processes are incorporated in many financial statements, it faces difficulties in identifying costs is the way in which they are classified and computed in the cost efficiency by the companies (Ramos, Dien, Gonzales, Chavez, Hazen, 2020).

However, as stated by a Halal Executive at one of Malaysia's freight forwarders in a Halal forum, even if he admitted that his primary present company is not Halal, applying Halal logistics processes does not result in considerable cost savings, as Ab Talib (2013) and Tieman (2013) demonstrated. According to a Halal executive at one of the ports, before Halal practices can be implemented in logistics activities, the status of product categories must be established, including Haram products, Halal products, general products (with no Haram-Halal value), Shubhah products, and hazardous products. This means that the categorised products must be grouped properly to avoid contamination while remaining Halal.

Additionally, each Halal logistics company's primary purpose is to maximise revenues. However, keeping Halal products in a separate warehouse and employing specialised technologies for handling Halal products requires a Halal logistics business to invest considerably in Halal logistics and monitoring Halal services, which nearly doubles the cost of each checkpoint (Sailani et al., 2016). Nonetheless, the given services are underutilised. Due to the fact that Halal and Haram cannot be compromised, a misunderstanding has developed between the Department of Islamic Development Malaysia (JAKIM) and the Halal logistics firms. Certain Halal logistics organisations argue that Halal criteria are set by religious authorities that lack understanding of logistics operations, as they feel that non-Halal products can be stored in a Halal warehouse without coming into direct touch with Halal products (Sailani et al., 2016).

Research Objectives

The main objective of this study is to explore the logistics costs and the concept of the operational efficiency in the Halal logistics practice by using the Data Envelopment Analysis (DEA) approach. In order to achieve the main objective, this study needs to:

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1) To measure the cost efficiency among the Halal-certified Logistics Companies with the use of the Data Envelopment Analysis Program (DEAP).
2) To provide recommendations on achieving better cost-efficiency for Halal logistics companies.

Literature Review

Challenges and Cost Implications of Halal Logistics

The halal logistics market continued its upward trajectory, fuelled by a rising global Islam population and an escalating demand for halal-certified products spanning sectors like food, pharmaceuticals, and cosmetics. Data from Malaysia's Department of Islamic Development (JAKIM) highlighted that Malaysia's halal product exports hit USD 11.2 billion in the initial nine months of 2024, marking a 7.5% uptick from the previous year. To cater to this surge, the logistics segment of the supply chain adapted, emphasizing certified handling, storage, and transportation. Concurrently, halal markets intensified efforts to regulate and promote halal logistics frameworks, bolstering consumer trust and ensuring market transparency (Mordor Intelligence, 2025).

Halal logistics differs from conventional logistics primarily due to the strict requirements for segregation and Shariah compliance throughout the supply chain. This includes everything from handling and transportation to storage. This specialization necessitates significant capital expenditure on additional facilities, such as separate warehouses and dedicated fleets, which leads to increased operational costs. Gunardi (2023) emphasized the importance of special transportation to protect Halal logistics, reducing the risk of cross-contamination and simplifying the delivery process for consumers. This action necessitates not only physical segregation of Halal and non-Halal items but also ensuring that all procedures and practices align with Halal standards, involving all organizational parties and incurring costs.

While the overall Halal market is expanding, the demand for specialized Halal logistics services often remains low. The classical supply chain prioritizes cost-oriented planning, while the halal supply chain focuses on maintaining halal quality at every stage and not breaking the halal quality chain (Doganer & Fidan, 2023). The development of a total Halal quality process involves several stages that result in a Halal value chain, where Halal values are maintained throughout the entire supply chain, leaving no room for doubt about Halal criteria.

Although logistics for Halal products are operationally managed like traditional logistics processes, certain additional issues need to be considered (Doganer & Fidan, 2023). This creates a conflict where companies face high expenses but low revenue, a situation exacerbated by underutilized assets and facilities. Thus, they must continuously adopt new technologies to remain competitive (Khan et al., 2023), considering environmental sustainability, ethical sourcing, and corporate social responsibility (Karia, 2022). Consequently, market trends, consumer preferences, and regulatory shifts significantly impact Halal Service Providers' ability to sustain long-term success. In addition to offering financial knowledge and resources to Halal enterprises, business incubators also establish supply chain networks and partnerships within the halal sector to foster knowledge sharing, collaboration, and enhanced business capabilities (Karia & Deng, 2025).

Halal logistics costs are not limited to traditional logistics activities but are heavily influenced by the religiosity factor. This includes costs associated with mandatory cleaning, maintenance,

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and the need for specialized personnel. The lack of a unified, standardized approach to these costs and the differing views between religious authorities and logistics providers further compounds the issue. In the context of Halal logistics, any products that are prohibited from being eaten or drunk in Islam are also considered prohibited. This includes pigs and any substances derived from pigs. If a pig-based content is included in the packaging material used for transporting a halal product, it will be considered haram (Quran, n.d.).

Husna et al. (2024), found that recognizing Halal logistics involves additional costs and charges, government support through logistics schemes is essential to help providers lower their operating expenses effectively. The field of international logistics faces numerous challenges, such as multiple consolidation points, break points, and varying cost structures. These challenges become even more complex with the implementation of halal practices, which demand strict compliance with halal requirements at every stage of transportation.

Dedicated Infrastructure and High Costs

Looking to 2025, the Malaysian government forecasts a 7.5% increase in halal exports, driven by strong trade agreements and active measures to promote halal certification among local businesses. This rising government support is encouraging both producers and logistics providers to adopt halal-compliant practices, boosting the demand for specialized halal logistics services. To further this initiative, the Malaysian government has rolled out training programs and workshops, emphasizing the significance of halal certification and the necessary steps to obtain it. They are also partnering with global halal certification bodies to ensure worldwide recognition of Malaysian halal standards, facilitating smoother exports of Halal products (Mordor Intelligence, 2025).

Halal logistics necessitates a thorough segregation of Halal products from non-Halal and hazardous items throughout the entire supply chain, including handling, transportation, and storage. To achieve this, logistics companies must invest heavily in additional facilities, such as separate warehouses, dedicated transport fleets, and specialized handling equipment. This requires significant capital expenditures and drives up operational costs, making Halal logistics less cost-effective. The document notes that a Halal executive stated that having a separate warehouse and specialized technology for Halal products can "nearly double the cost of each checkpoint". Two internal challenges that Halal auditors face when presenting Halal certification are the documentation process and the status of raw materials or ingredients. This research has revealed the problems in these areas and three other external obstacles that fall outside the scope of the Halal audit, including customer issues, a lack of equipment, and time allocation (Harun et al., 2023).

Underutilization and Cost-Inefficiency

The high costs are further exacerbated by the issue of underutilization. According to the study, the demand for Halal logistics services remains low. This creates a conflict between high investment and low revenue, as companies have invested in dedicated assets like trucks and warehouse space that are not being fully utilized. This directly impacts a company's cost-efficiency and profitability. Husna et al. (2024) found that recognizing Halal logistics involves additional costs and charges, government support through logistics schemes is essential to help providers lower their operating expenses effectively. The field of international logistics faces numerous challenges, such as multiple consolidation points, break points, and varying cost structures. These challenges become even more complex with the implementation of Halal practices, which demand strict compliance with Halal requirements at every stage of

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transportation. While a product may be Halal in nature, it can become Haram due to changes that may occur during its production and logistics processes (Doganer & Fidan, 2023).

Higher fuel prices increase transportation costs and cutting transportation costs is a critical challenge for any logistics company, including the halal logistics industry. There are not just financial constraints in implementing halal logistics services, but Halal logistics firms also have less demand because of the additional costs that users must pay, including high halal packaging prices and insurance fees (Karia, 2025). Halal packaging must meet strict standards, including tamper-proof seals, traceability labels, and contamination-free materials, which are often more expensive than conventional packaging.

Moreover, Halal logistics involves significant capital expenditure and investment in logistics facilities and equipment, such as dedicated halal warehouses and vehicles. Every activity along the supply chain is important for halal integrity to be preserved from the point of origin to the point of consumption. Various parties involved in the supply chain face the challenge of sustaining Halal product integrity (Shahruddin, et al., 2025). This is due to the likelihood of cross contamination or the high tendency of Halal and non-Halal products to get mixed during handling (Mohamed et al., 2022). It is not cost-effective because of the low consumer demand for Halal logistics. These are perceived to burden logistics service providers and weaken the desire to initiate or comply with Halal logistics standards (Karia, 2025).

DEA for Halal Logistics Efficiency

DEA is a non-parametric mathematical approach that is well-suited for measuring the performance of an organization with multiple inputs and outputs. This makes it particularly effective for evaluating logistics efficiency, where there are various factors at play, such as transportation, warehousing, and inventory management. The study uses DEA to measure the cost-efficiency among Halal-certified logistics companies by determining an "effective frontier" using linear programming techniques. Performance benchmarking with KPIs with Data Envelopment Analysis (DEA) is most commonly used in the transport sector for identifying best practices and improving operational efficiency. The primary purpose of DEA is to compare the effectiveness of organisations with various variables (Kant et al., 2025).

Data Envelopment Analysis (DEA) has emerged as a widely accepted non-parametric method for evaluating the relative efficiency of logistics companies, particularly those with multiple inputs and outputs. Fotova Čiković et al. (2022), indicate that the impact of DEA in the selection of sustainable suppliers in Halal logistics on the supply chain is on the verge to disrupt current supply chain processes and overall business processes in companies affecting its sustainability on market. DEA, as a non-parametric method, allows companies to evaluate supplier efficiency across multiple dimensions—such as cost, environmental impact, and social responsibility—without relying on subjective weighting systems. This objectivity enhances transparency and supports more strategic decision-making.

DEA is highly valued for its objectivity. It does not require a pre-assumed relationship between inputs (e.g., costs) and outputs (e.g., revenue), instead using linear programming to establish a "best practice frontier". This allows for the identification of the most efficient companies, which can serve as benchmarks for those that are underperforming. The Data Envelopment Analysis (DEA) method has been widely applied to measure operational efficiency in logistics-related contexts (Götz, et al., 2023). For instance, a study Peixoto et al. (2022), evaluated the operational performance of intermodal terminals involved in grain exports in Southeastern

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Brazil. Results showed that only 25% of terminals achieved full technical efficiency, while most suffered from scale inefficiencies, indicating underutilization of infrastructure. Research in Malaysia further extended DEA applications by introducing an efficiency optimization framework for publicly traded logistics firms that incorporates operational risk. By integrating the Basic Indicator Approach (BIA) to quantify operational risk capital as an output factor, the study identified inefficiencies and proposed targeted improvements (Lee, et al., 2023).

Misalignment of Regulatory Frameworks and Operational Realities

Key components of Halal logistics infrastructure include Halal-certified transportation operators, specialized warehouses and storage facilities, as well as ports and terminals designed to handle Halal products. In the context of Malaysia, the government has also taken initiatives to enhance Halal logistics through the development of dedicated Halal industrial parks and the promotion of Halal-certified logistics providers under JAKIM's certification framework (Mazuki,2025). A validated Halal logistics system must go beyond basic contamination prevention. According to Voak et al. (2023), such a system should incorporate proactive corrective measures that anticipate potential risks and implement mitigation strategies before product integrity is compromised. This includes real-time monitoring, traceability protocols, and contingency plans for handling breaches in halal compliance. For example, if a Halal-certified warehouse detects temperature fluctuations that could affect product quality, the system should trigger immediate corrective actions—such as rerouting goods or isolating affected batches—to preserve Halal status.

Implementing and maintaining a Halal supply chain involves significant costs and resource constraints, which can be particularly burdensome for businesses. To comply with Halal standards, companies must invest in obtaining Halal certification (Ahmad et al., 2024). In parallel, Rizki et al. (2023) highlight that the development of dedicated Halal logistics infrastructure cannot rely solely on private sector initiatives. Strong government involvement is essential to ensure that the necessary facilities—such as Halal-certified transport fleets, segregated storage units, and inspection checkpoints—are widely available and accessible. Without this support, many logistics providers, especially small and medium enterprises (SMEs), struggle to meet Halal standards due to high setup costs and limited technical expertise. Collaboration between regulators, industry players, and educational institutions is also essential to foster continuous improvement, ensuring that Halal logistics practices remain efficient, cost-effective, and aligned with Shariah principles (Mazuki, 2025).

Methodology

This study uses a multi-stage DEA approach with input orientation and variable returns to scale (VRS). Inputs include truck units and warehouse space; output is the contract logistics value. Data were collected from 9 logistics companies, including both JAKIM-certified and uncertified providers.

Research Design and Approach

This study employs both qualitative (interviews and observation) and quantitative (Data Envelopment Analysis, or DEA) approaches to measure the cost-efficiency of Halal logistics companies in Malaysia. The primary analytical tool is Data Envelopment Analysis (DEA). This method is well-suited for evaluating the performance of organizations with multiple inputs and outputs, a characteristic of logistics operations. It is a non-parametric technique rooted in mathematical programming that assesses the relative efficiency of decision-making units (DMUs) without requiring predefined weights or a specified production function. The study's

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focus on DEA is consistent with recent academic trends that use this method to investigate the relative efficiency of supply chain management (SCM).

Data was collected from Halal-certified logistics companies in Malaysia. The sampling process was a combination of purposive and snowball sampling to identify and engage with relevant respondents from both certified and non-certified companies that offer Halal services. The primary data was gathered through in-depth interviews with key personnel, including managers and Halal executives. This method allowed for a detailed understanding of the costs incurred during Halal logistics activities.

Data Analysis and Measurement

Application of DEA is relatively new in a process of selection of sustainable suppliers so it needs to be strongly and systematically developed further especially with its impact on development of sustainable supply chains. By analysing the relevant scientific sources, it can be concluded that a strategic approach to the application and use of DEA in the selection of sustainable suppliers can provide numerous advantages and benefits (Fotova Čiković et al. 2022). The core of the analysis is the DEA model, which is used to determine the cost-efficiency of each company. DEA identifies the most efficient companies by establishing a "best practice frontier". The efficiency scores of the other companies are then measured relative to this frontier. This technique allows for the identification of inefficient companies and provides insight into how they can improve their performance by comparing them to the most efficient ones.

The Data Envelopment Analysis (DEA) method has been widely applied to measure operational efficiency in logistics-related contexts (Götz, et al., 2023). The DEA model uses inputs and outputs to calculate efficiency scores. The inputs include resources such as capital investments, labour, and assets like trucks and warehouse space. Outputs are measures of performance and productivity, such as revenue generated from logistics activities. DEA measures the technical efficiency and provides a benchmark for subsequent studies on logistics performance. Recent studies have also shown the effectiveness of integrating DEA with other methods like machine learning to enhance the analysis and prediction of supply chain efficiency. According to Lee et al., (2023), the optimal solution of the proposed DEA model, the inefficient listed logistics companies can identify the inputs to be reduced and outputs to be raised. The qualitative data from interviews was analysed to contextualize the DEA results and to gain a deeper understanding of the operational challenges that contribute to inefficiency.

Results

This study's findings on the high costs and operational inefficiencies within the halal logistics sector, as analysed through Data Envelopment Analysis (DEA), are consistent with recent academic discourse while also providing new insights into the specific challenges faced by Malaysian companies. The results highlight that the cost-effectiveness of halal logistics is a multifaceted issue, going beyond simple financial metrics to include regulatory, labour, and infrastructural factors.

Input Used and Outputs Produced

The output of this study was the value of contract logistics, and the inputs of this study were the number of trucks and the warehouse space per square feet (sqft), as well as their costs. This study showed that the total value of contract logistics was RM49796000. Company H had the highest proportional value of contract logistics, 29.89% and company Q had the lowest

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proportional value of contract logistics, 2.13%. These were followed by company G, 23.14%, company C, 18.38%, company I, 8.66%, company J, 6.65%, company K (headquarters), 4.58%, company O (Klang branch), 4.04%, and company K (branch Penang), 2.52%.

This study also showed that the total unit of trucks for this study was 56 units. Company H had the highest unit of trucks, 12 units, and company Q had the lowest unit of trucks, 1 unit. These were followed by company C, 11 units, company J, 10 units, company G, 9 units, company K (Penang branch), 5 units, company K (headquarters), 3 units, company O (Klang branch), 3 units and company I, 2 units. It also showed that the total cost of warehouse space used was 81880 per square feet (sqft). Company H had the highest proportional warehouse space, 22.54% and company K (headquarters) had the lowest proportional warehouse space, 2.84%. These were followed by company C, 21.32%, company G, 18.86%, company J, 13.84%, company J, 6.65%, company I, 7.6%, company O (Klang branch), 5.1%, and company Q, 3.4%

An Input–Orientated Variable Returns-to-Scale (VRS) Data Envelopment Analysis (DEA)

This study assumed that Halal logistics companies are not operating at an optimal scale, due to imperfect competition and constraints on finance. Therefore, this study used an extension of the CRS model to account for variable returns-to-scale (VRS), as suggested by Banker, Charnes and Cooper (1984). The use of the CRS specification when not all DMUs are operating at the optimal scale will result in measures of technical efficiency, which are confounded by scale efficiencies (SE). The use of the VRS specification will allow the calculation of technical efficiency which is devoid of these scale efficiency effects.

The use of DEA in sustainable supplier evaluation and selection has shown an increasing trend in the past decade. This methodological shift is disrupting traditional supplier evaluation models, which often prioritize cost or delivery speed over sustainability metrics. By using DEA, firms can benchmark suppliers against best-in-class performers, uncover hidden inefficiencies, and make data-driven choices that support both operational resilience and market credibility.
The study revealed that 3 (33.33%) Halal logistics companies, namely company H, company I and company K (headquarters), were scaled as efficient (CRS) (see figure 6.1). Then, 4 (44.44%) Halal logistics companies, namely company H, company I, company K (headquarters) and company Q, were scaled as pure technical efficiency (VRS). The companies that achieved a technical efficiency score of less than one was not fully technical efficient. The study also revealed that the least pure technical efficiency (VRS) and technical efficiency (CRS) was found with company J, who scored 0.336 and 0.338, respectively.

The study also revealed that 3 (33.33%) Halal logistics companies, namely company H, company I and company K (headquarters), achieved scale efficiencies. However, there were 3 Halal logistics companies that almost achieved scale efficiencies, namely company C, company G and company J, with scores of 0.997, 0.973 and 0.994, respectively. Meanwhile, company Q had the lowest scale efficiency, 0.539.

A Cost Efficiency Data Envelopment Analysis (DEA)

This study was able to attain the price information for the inputs used. Therefore, this section shows the cost efficiency among Halal logistics companies, and the input reduction to make inefficient Halal logistics companies more efficient. This study considers cost minimisation with VRS assumption, as not all analysis units are considered to be operating at an optimal

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scale. Allocative efficiency reflects the ability of a firm to use the inputs in optimal proportions, given respective prices.

The study revealed that 2 (22.22%) Halal logistics companies, namely company H, and company K (headquarters), were scaled as cost-efficient since their score equalled 1 (see figure 6.3). These were followed by 3 (33.33%) Halal logistics companies, namely company G, company Q and company I, who scored 0.919, 0.838 and 0.795, respectively. Then, 3 (33.33%) Halal logistics companies, namely company I, company C and company O (Klang branch), scored 0.795, 0.637 and 0.561, respectively. Company J, was scaled as the least cost-efficient and scored only 0.322.

The study also revealed that 3 (33.33%) Halal logistics companies, namely company H, company K (headquarters) and company K (Penang branch), were scaled as allocative efficient since their scores equalled 1 (see figure 6.3). The results indicated that company H, company K (headquarters) and company K (Penang branch) have the ability to use their inputs in optimal proportions. The remaining 5 (55.55%) Halal logistics companies, namely company C, company J, company G, company Q, company O (Klang branch) and company I, were scored 0.969, 0.952, 0.938, 0.838, 0.802 and 0.795, respectively.

Discussion

Logistics costs in the Halal sector are distinct from conventional logistics due to the segregation requirement, which introduces extra costs. A significant challenge identified is the lack of demand for Halal logistics services, leading to the underutilization of resource. Halal logistics costs are distinct due to the strict requirement for segregation of Halal and non-Halal products. This is a primary driver of additional costs, as it necessitates dedicated facilities and processes to prevent cross-contamination.

Features of Halal Logistics Costs

The objective of setting Halal regulations is to prevent contamination and to control the quality of Halal logistics services by ensuring Shariah throughout all of the activities. However, the current regulations are not favoured by companies in case studies B and C. Companies in case study B have made more investments in facilities for Halal logistics and still struggle to get their return on investment (ROI).

For companies in case study C, even though they provide Halal logistics services, by making a special contract with customers (to guarantee Halal along the activities), they still face difficulties in getting recognition from JAKIM. The recognition or certification is important to enhance the companies' goodwill towards practising Halal, and to promote the company as well. Effective integration of Halal logistics and manufacturing practices is not only essential for compliance with religious standards but also for enhancing the competitive advantage and sustainability performance of organizations (Mohamad Karudin et al., 2024).

Critical issues in Halal logistics and supply chain management are the risk of cross contamination of Halal products with non-Halal products during storage, distribution and transportation, and hidden threats to Halal integrity across the logistics and supply chain networks: sharing containers, poor record-keeping of what inventory is in which container, where the container is in transit, the history of immediate suppliers, the history of hurried maintenance, and the non-segregation of space between Halal and non-Halal goods in the same containers increase the risk of Halal integrity being compromised (Karia, 2025). Tools used to

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handle Halal food items must not be shared with employees who handle non-Halal food products, since this will result in contamination of the Halal food product. However, the bulk of the industry continues to ignore these standards, with Halal and non-Halal goods still being carried in the same truckload or stored in the same warehouse, respectively.

Cost Efficiency Differences

Halal logistics incurs higher operational costs than conventional logistics due to the need for product segregation, specialized handling, and compliance with Shariah principles. However, cost efficiency varies across firms depending on Halal certified by JAKIM, Carried Non-Halal Products, Year of Establishment, as well as General Goods and the cost-efficiency among Halal Logistics Companies (Zailani et al., 2017). Companies with optimized resource allocation and strategic contracts tend to achieve better cost efficiency despite regulatory and market challenges. Cost efficiency in halal logistics shows a significant variation among companies, a finding supported by a Data Envelopment Analysis (DEA).

The study found a wide performance gap, with some firms being far more efficient than others. For example, Company H and Company K (Headquarters) achieved the highest possible efficiency score of 1.0, demonstrating top-tier performance. In stark contrast, Company J was the least efficient, with a score of only 0.322. This disparity highlights that simply having Halal certification does not guarantee efficient operations. Instead, the research indicates that a firm's efficiency is more closely tied to its pre-existing experience and background in the conventional logistics industry, suggesting that long-standing operational expertise is crucial for effectively managing the specific costs and complexities of Halal logistics. (Buldeo Rai et al., 2019) supports that effective logistics management is essential for businesses to remain competitive and meet customer expectations. It can lead to cost savings, increased efficiency, improved customer satisfaction, and better supply chain performance (Al Zadajali & Ullah, 2024).

In logistics and supply chain management, Halal certification extends beyond the product itself to include the integrity of handling, transportation, and storage. This means that Halal goods must be segregated from non-Halal items throughout the supply chain to prevent cross-contamination. Halal certification serves as a guarantee to Muslim customers that the goods they buy and consume are following Islamic dietary guidelines. Although it can be used for other goods and services, such as cosmetics, prescription drugs, and financial services, halal certification is primarily significant for food products (Rahman, et al, 2024). As consumer awareness grows, especially in Muslim-majority countries like Malaysia, Indonesia, and the Gulf states, Halal certification is increasingly viewed not only as a religious requirement but also as a mark of quality, safety, and ethical responsibility.

Improving Cost Efficiency

Cost efficiency can be improved through better asset utilization, proper planning, and by increasing the overall demand for halal logistics services. Effective management of the halal supply chain is positively related to the sustainable performance of the firms; thus, it could help managers create a sustainable organisation (Kurniawati & Cakravastia, 2023). Recent research by Khan et al. (2022c) examines the relationship between the sustainability and halal supply chain management. They provided a framework for the halal supply chain management by evaluating halal practices' impact on sustainability performance measures empirically. Increasing consumer and industry awareness about the importance of Halal logistics can drive demand, which in turn supports economies of scale and justifies the cost of compliance. As

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demand grows, logistics firms are more likely to achieve operational sustainability while maintaining religious integrity.

To enhance cost efficiency, research emphasizes the use of technological innovations to optimize logistics assets. Artificial intelligence contributes to the efficiency of supply chain operations through predictive analytics, machine learning algorithms, and intelligent automation. Technological innovation plays a pivotal role in enhancing cost efficiency within logistics operations, and recent research strongly advocates for the integration of advanced digital tools to optimize asset utilization. Among these technologies, artificial intelligence (AI) stands out as a transformative force in supply chain management. Advancements in emerging technologies, such as quantum computing, blockchain, and edge computing, are revolutionizing supply chain management by augmenting AI's capabilities. These technologies enhance computational power, data security, and real-time processing, enabling more efficient and resilient supply chain networks (Nweje & Taiwo, 2025) .Within halal supply chains, AI can be applied to monitor compliance risks, predict demand patterns, and optimize logistics, particularly in cold chain management for perishable products. Its capability to process large datasets allows for more accurate decision-making and early detection of anomalies that may compromise halal integrity (Setiawan et al. 2025).

Technologies are crucial for improving transparency and traceability, which in turn leads to better asset management and reduced costs associated with contamination risks and operational inefficiencies. For instance, blockchain technology is highlighted for its ability to increase the efficiency of the halal certification process (Taratori et al., 2021) and provide real-time tracking, thereby preventing cross-contamination and ensuring product integrity throughout the supply chain (Ngah et al., 2022). Furthermore, dedicated halal warehouses and temperature-controlled facilities are a form of asset utilization that, while requiring initial investment, ultimately reduces the risk of product loss and non-compliance, which are significant cost factors (Towards Automotive, 2025).

Conclusion

This study demonstrates that achieving cost-efficiency in Halal logistics is a viable goal, but it requires a strategic approach to overcome significant challenges. The research, utilizing a Data Envelopment Analysis (DEA) to evaluate Malaysian Halal logistics companies, found that factors such as the need for dedicated infrastructure, regulatory constraints, and underutilized assets profoundly impact cost-efficiency. DEA proved to be a valuable tool for assessing logistics performance and identifying inefficiencies, providing a clear benchmark for underperforming firms and pinpointing areas for improvement.

The findings highlight that while the overall Halal market is expanding, the demand for specialized Halal logistics services is inconsistent, leading to scalability issues and a low return on investment for companies that have made significant investments. This disparity in demand and investment underscores the critical need for increased consumer awareness to drive demand and ensure the economic viability of the Halal supply chain. The study also suggests that improving cost-efficiency can be achieved through better asset utilization, proper planning, and an increase in overall demand for Halal logistics services. This can be further supported by technological innovations like AI and blockchain to optimize logistics assets, improve traceability, and reduce costs. Additionally, adaptive regulations and greater collaboration between logistics firms and authorities like JAKIM are crucial for fostering a more efficient and sustainable Halal logistics ecosystem.

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