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# THE EFFECT OF SUPPLY CHAIN DIGITALIZATION AND SUPPLY CHAIN RISK MANAGEMENT ON MALAYSIAN HALAL MSMES' PERFORMANCE

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**Abstract:** *This study aims to examine the impact of supply chain digitalization (SCD) and supply chain risk management (SCRM) on the performance of micro, small, and medium enterprises (MSMEs) involved in Halal industry. Questionnaires consisting of four parts are developed based on previous studies and items are rated using 5-point Likert scale. Overall, 97 responses are collected through survey among MSMEs in Malaysia using convenience sampling technique. Multiple regression analysis is utilized to test the hypotheses. The findings reveal that 80.7% of the variance in firm performance could be explained by SCD and SCRM. In addition, SCD and SCRM have significant positive effect on firm performance at the significance level of 0.05. The findings imply that MSMEs could focus on introducing and expanding digitalization adoption in their business. Moreover, they should apply risk management to anticipate and prepare mitigations plan for business survival. This study is one of the first attempt to investigate the effect of SCD, SCRM and firm performance in the context of Halal industry.*

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**Keywords:** *Halal Industry, Supply Chain Digitalization, Supply Chain Risk Management, Firm Performance, MSMEs*

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## Introduction

Malaysian Halal industry has contributed as much as 7.4% to the Gross Domestic Product (GDP) in 2022 (RM108.5 billion), and is expected to increase to 10.8% by 2030 (RM231.1 billion). Halal industry's contribution to Malaysia exports in 2023 is RM53.72 billion and is expected to increase to RM75.2 billion in 2030.

In line with the rapid development of technology which has a high potential to increase business competitiveness, Malaysia Ministry of Economy aimed that 90% of Malaysian MSMEs, including those in Halal industry, to digitalize their operations by 2025 (Ministry of Economy, 2023). This is because new technology such as blockchain, artificial intelligence (AI) and big data offer vast opportunity to identify suppliers, gain insights about consumer behaviour, optimize operations, reduce risk, decrease waste in production, and forecast demands, which is expected to overcome the challenges faced by MSMEs especially in Halal industry. Moreover, the New Industrial Masterplan (NIM 2030) highlighted the vulnerabilities of MSMEs when it comes to volatility in supply and demand, geopolitical shift, overreliance on single sourcing, natural disasters and public health risks (Ministry of Investment, Trade and Industry, 2023), which called for a better supply chain risk management (SCRM).

Despite that, there is limited evidence on the extent of how supply chain digitalization (SCD) and SCRM could affect Halal MSMEs' performance. Previous studies about SCD had been conducted in Indonesia (Zainurrafiqi & Ghazali, 2024), India (Chaterjee et al., 2024), Morocco (Oubrahim et al., 2023), Pakistan (Arif et al., 2023), and Thailand (Chanchaichujit, 2024). Meanwhile recent studies on SCRM were mostly conducted in Turkey (Foli et al., 2023; Yanginlar et al., 2023) and China (Rauniyar et al., 2022). Due to the limited understanding about Malaysian MSMEs, therefore, this study is proposed to determine the effect of SCD and SCRM on MSMEs' performance.

While many studies found significant effect of SCD on firm performance (Chatterjee et al., 2024; Liu et al., 2022; Al Tera et al., 2024; Wang & Prajogo; 2024), Lee et al. (2022) discovered that digitalization did not positively affect Malaysian organization performance. Similarly, the effect of SCRM on firm performance should be confirmed with respect to the current context, although previous studies (Ganiyu et al., 2020; Munir et a., 2020; Munyi et al., 2020) found significant evidence.

This study applied Resource-Based View (RBV) theory, similar to previous studies (Chatterjee et al., 2024; Liu et al., 2022; Al Tera et al., 2024; Wang & Prajogo; 2024). RBV theory explains that a company's unique internal resources which are valuable, rare, inimitable and non-substitutable (VRIN) could lead to sustainable competitive advantage. In the context of this study, SCD and SCRM are regarded as such resources which are expected to increase Halal MSME's performance.

Accordingly, the objectives of this study are: (1) to determine the effect of SCD on the firm performance among MSME's in Halal industry, and (2) to determine the effect of SCRM on firm performance among MSMEs' in Halal industry.

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## Literature Review

### Resource-Based View (RBV) Theory

The main tenets of RBV theory describes the importance of a firm's internal resources, especially those that fit the VRIN criteria, in creating values for firms. According to this theory, companies that have VRIN resources would be able to leverage their strength to overcome the competition from other companies. In the context of Halal industry, the MSMEs comprised of ingredient suppliers, manufacturers, local logistics operators and sellers particularly in food and beverage, and cosmetics subsectors. With low entry barrier, new entrants easily penetrate the market and consequently create strong competition. Despite that, MSMEs involved in Halal industry have limited access to resources which can assist in developing better financial strength and Halal talents to attract more investors and customers. This incident happened because MSMEs failed to demonstrate transparent and reliable operational as well as financial management.

Therefore, based on the RBV theory, this study argues that MSMEs involved in Halal industry could capitalize on digitalization and risk management capability to increase data and process transparency to address such concerns. For example, MSMEs could digitalize the list of raw materials, instantly review and identify non-halal materials without doing it manually. Moreover, traceability apps would help MSMEs record and trace the origins of materials faster. Similarly, risk of Halal non-compliance would be reduced by data analytics and AI support in identifying potential risk. In addition, AI could provide recommendations on mitigations plan to proactively avoid Halal risks. Therefore, this study regards SCD and SCRM as unique internal resources and theorize the increase of firm performance among MSMEs which adopt SCD and SCRM to their ends.

### Supply Chain Digitalization (SCD) and MSMEs' Performance

SCD can be defined as the incorporation of new technology into traditional supply chain process to improve decision-making (Zhao et al., 2025). For example, new technology such as AI, Internet of Things, big data, blockchain and cloud computing could be utilized to manipulate existing data in order to create useful insights for making more accurate business decision. Previous studies involving service and manufacturing firms showed that SCD has a positive significant impact on firm performance (Chartterjee et al., 2023). In support, Liu et al. (2022) found a positive influence of SCD on financial performance and supply chain performance in Chinese large firms and SMEs. Al Tera et al. (2024) similarly found a significant positive effect of SCD on supply chain performance through their study conducted among Turkish manufacturing firms. Meanwhile, Wang et al. (2024) verified a positive correlation between SCD and UAE company's performance. Studies conducted in Malaysia showed that SCD has a significant positive effect on business operations, business competitiveness and multinational companies (Fayyaz & Qasim, 2021), and organization performance (Cher Hao Xuan & Nor Kamariah Kamaruddin, 2024). However, Lee et al. (2022) discovered that digitalization did not positively affect Malaysian organization performance. Therefore, the following hypothesis is proposed:

H1: Supply chain digitalization (SCD) has a positive effect on firm performance.

### Supply Chain Risk Management (SCRM) and MSMEs' Performance

Supply chain risk management is a systematic approach of identifying potential risks, assessing the likelihood and severity of risks to develop risk priority, mitigating critical risks, and

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monitoring potential failure and disturbance in the supply chain (Gurtu & Johny, 2021). It can be performed quantitatively, semi-quantitatively or using qualitative method depending on the capability of each company. Past studies showed that SCRM has a positive significant effect on organizational performance of enterprises in Ghana (Ganiyu et al., 2020). Furthermore, research conducted among electricity firms in Kenya confirmed that SCRM significantly increased firm performance (Munyi et al., 2020). A study conducted in Europe, Asia and America further confirmed the significant effect of SCRM on operational performance (Munir et a., 2020). Firm performance, operational efficiency and flexibility could be enhanced by SCRM (Shou et al., 2018; Manhart et al., 2020; Ramesh & Sarmah, 2021; Yanginlar et al., 2023), and thus, resulted in better supply chain performance as a whole (Waqas et a., 2023; Senna et al., 2024). Therefore, the following hypothesis is proposed:

H2: Supply chain risk management (SCRM) has a positive effect on firm performance.

Based on the hypotheses proposed, the research framework for this study is depicted in Figure 1 below.

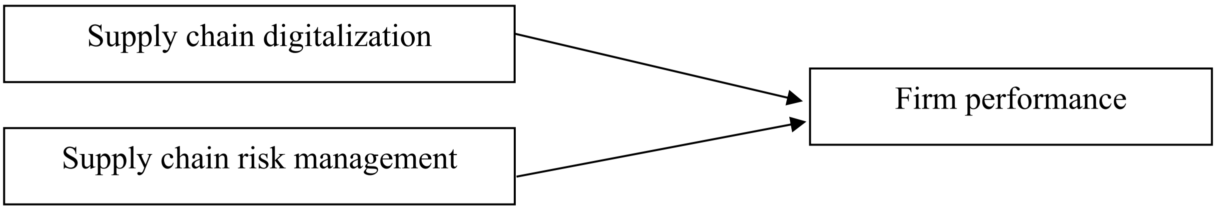


**Figure 1: Research Framework**

## Methodology

This study was conducted among Malaysia MSMEs in Halal industry. Operationally, all MSMEs involved with companies that have Halal certificates were eligible as the respondents of this study. According to the CEO of Halal Development Corporation, there are about 200,000 MSMEs involved with Halal certified companies (Daliza Mohamed Ariffin, 2022). MSMEs from these sectors were selected because they are the most vulnerable and should develop better capability to survive. The overall performance of Halal industry is also depended on the capability of supporting industries in the supply chain (e.g., supplier, retailer, logistics partner) in growing this industry. The sample size was determined based on Cohen (1992) which corresponded to a minimum of 97 samples for two independent variables. The samples were selected using convenience sampling technique.

Data were collected using questionnaires. The questionnaires consist of four parts: (1) demographic information, (2) SCD, (3) SCRM, and (4) firm performance. The details of instrument, domain, construct and items are shown in Table 1.

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**Table 1: Questionnaire Items**

| Domain | Constructs | Source(s) | Number of items | Total items |
|---|---|---|---|---|
| Supply chain digitalization | - | Wang et al. (2025) | 5 | 5 |
| Supply chain risk management | - | Trkman et al. (2016) | 39 | 39 |
| MSMEs' performance | Operational performance | Saif-Ur-Rehman et al. (2024) | 8 | 13 |
| | Competitive performance | Saif-Ur-Rehman et al. (2024) | 5 | |
| | | | **TOTAL** | 57 |

Three experts were appointed to determine the face and content validity of the questionnaire. All experts verified that the questionnaires were usable for data collection with minor amendment to the items to increase clarity. The questionnaire was also tested for reliability and the acceptable Cronbach's alpha is 0.7 (Hair et al., 2019; Nunally, 1978).

During data collection, the respondents were explained about the objectives of this study. Moreover, the researchers also ensured that all confidential information of the respondents will not be collected and disclosed by this study. The respondents also have the liberty to withdraw from this study even after the data collection is completed. This information was also provided in written statement in the online questionnaire format. Data were only collected from respondents who gave their consent. Generally, the survey took about 10-15 minutes to be completed.

The data were analysed using descriptive analysis (frequency, percentage, mean, standard deviation) and multiple regression analysis. On that note, a global test was conducted to measure the significant of the model based on the significance value of $\alpha$=0.05. Moreover, the contribution of the independent variables to the dependent variables was determined based on $R^2$ value. In addition, the analysis also tested whether SCD and SCRM have a significance effect on Halal MSMEs' performance based on the significance level.

## Findings and Discussion

A total of 97 valid responses were obtained from respondents across Malaysia. The following section, the descriptive analysis results, describes the profiles of companies participated in the survey.

### Descriptive Analysis

Based on Table 2, 59.8% ($n$=58) of the MSMEs are in food and beverage industry, representing the largest sub-sector in the study samples. This is followed by the cosmetics and personal care sector, which represents 16.5% ($n$=16) of the samples. Modest fashion, pharmaceutical, Islamic finance, logistics services, Muslim-friendly hospitality, and others each have less representation in the total samples.

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**Table 2: Halal Sub-Sectors**

| Sub-sectors | Frequency | Percentage |
|---|---|---|
| Food and beverage | 58 | 59.8% |
| Cosmetics and personal care | 16 | 16.5% |
| Modest fashion | 5 | 5.2% |
| Pharmaceutical | 3 | 3.1% |
| Islamic finance | 3 | 3.1% |
| Logistics services | 3 | 3.1% |
| Muslim-friendly hospitality | 1 | 1.0% |
| Others | 8 | 8.2% |

Pertaining to the company tenure, most MSMEs in the samples have been recently established (less than 5 years), contributing to 61.9% ($n$=60). In addition, 22.7% ($n$=22) of the samples have been operating for 5-10 years. Companies that operate longer than 10 years are represented by only 15 samples (15.4%).

**Table 3: Company Tenure**

| Company Tenure | Frequency | Percentage |
|---|---|---|
| Less than 5 years | 60 | 61.9% |
| 5-10 years | 22 | 22.7% |
| 11-20 years | 8 | 8.2% |
| 21-30 years | 4 | 4.1% |
| More than 30 years | 3 | 3.1% |

In terms of the number of employees, majority of the MSMEs involved in this study have 50 or less employees ($n$=81, 83.5%). Meanwhile, about 10.3% ($n$=10) of the samples hired 51 to 99 employees. Very few samples of this study have more than 100 employees.

**Table 4: Number of Employees**

| Number of Employees | Frequency | Percentage |
|---|---|---|
| 50 or less | 81 | 83.5% |
| 51-99 | 10 | 10.3% |
| 100-199 | 4 | 4.1% |
| 200-299 | 0 | 0.0% |
| 300 or more | 2 | 2.1% |

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### Assumptions Testing

The assumptions for multiple regression analysis were evaluated before the hypothesis testing is conducted. First, the independence of residuals was confirmed using the Durbin–Watson test, with a value of 2.26, indicating no significant autocorrelation (p = .210). Second, multicollinearity was assessed through Variance Inflation Factor (VIF) and Tolerance values. Both predictors had VIF values of 3.16 and Tolerance values of 0.316, which fall within acceptable thresholds, indicating no serious multicollinearity issues. Third, the normality of residuals was supported by the Shapiro–Wilk test (W = 0.986, p = .390), suggesting that the residuals were normally distributed. Visual inspection of the Q–Q plot further corroborated this finding. Lastly, examination of the residual plots indicated no clear pattern or funnel shape, supporting the assumption of homoscedasticity. Collectively, these results affirm that the data satisfied the key assumptions required for valid interpretation of the regression analysis.

### Multiple Regression Analysis

Table 5 shows the model fit measures. This study verifies that the model which test the effect of SCRM and SCD on MSMEs' performance is significant ($p$<0.001, α=0.05). Moreover, the adjusted $R^2$=0.807, indicates that 80.7% of the total variation in MSMEs' performance could be explained by SCRM and SCD. Therefore, the global test confirmed that SCRM and SCD play very important roles in determining the performance of MSMEs.

**Table 5: Model Fit Measures**

| | | | | Overall Model Test | | | |
|---|---|---|---|---|---|---|---|
| **Model** | **R** | **R²** | **Adjusted R²** | **F** | **df1** | **df2** | **p** |
| 1 | 0.901 | 0.811 | 0.807 | 202 | 2 | 94 | <.001 |

Note. Models estimated using sample size of N=97

Table 6 summarizes the multiple regression results. It shows that SCD positively and significantly affected MSMEs' performance (β=0.203, α<0.005). This finding bolstered previous studies carried out in China, Turkey, UAE, Malaysia and other countries (Liu et al., 2022; Al Tera et al., 2024; Wang et al., 2024; Cher Hao Xuan & Nor Kamariah Kamaruddin, 2024). This result could infer that digitalized supply chain help MSMEs make informed decision that help reduce cost, improve communication, and create more transparent information among supply chain members (Al Tera et al., 2024). Simple and affordable digital platforms which are readily accessible to MSMEs, such as data analytics features embedded in business social media accounts, would be able to provide insights about customer preferences and feedbacks which are important in continuous improvement process. Moreover, the adoption of digital financial tools, for instance, QR pay, PayPal and DuitNow, improve financial inclusion for MSMEs while offering easier payment experience to increase cash flow.

**Table 6: Multiple Regression Results**

| Predictor | Estimate | SE | t | p |
|---|---|---|---|---|
| Intercept | 0.489 | 0.1784 | 2.74 | 0.007 |
| SCRM | 0.671 | 0.0784 | 8.56 | <.001 |
| SCD | 0.203 | 0.0646 | 3.15 | 0.002 |

Dependent Variable: MSMEs' Performance

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In addition, the regression results also show that SCRM has a significant positive effect on MSMEs' performance (β=0.671, α<.001). Previous studies (e.g., Shou et al., 2018; Manhart et al., 2020; Ramesh & Sarmah, 2021; Yanginlar et al., 2023) similarly, came to the same conclusion after testing the relationship between SCRM and firm performance. Identifying, analysing, assessing, and controlling risk would help companies prepare for negative incidents, including supply shortages and production disruptions, hence increase the firm performance (Manuj et al., 2014). MSMEs may have limited capability to conduct quantitative SCRM, but obtaining industrial experts' perspectives about the possible risks would at least reduce, if not eliminate the risk impacts altogether. Reducing or eliminating risky events would eventually increase firm performance. Accordingly, the following model is developed based on the multiple regression results:

$$Y = 0.489 + 0.203\beta_1 + 0.671\beta_2$$

where,

$$Y = Firm\ performance$$
$$\beta_1 = supply\ chain\ digitalization$$
$$\beta_2 = supply\ chain\ risk\ management$$

Overall, the findings imply that MSMEs should focus on applying SCRM and SCD in order to increase their operational and competitive performance. Managing risk properly could help anticipate and avoid possible problems. Meanwhile, applying digital technology such as AI and IoT help to increase efficiency of business processes; thus, leading to better company performance.

**Conclusion**

This study aims to determine the effect of SCD and SCRM on the firm performance among MSME's in Halal industry. The findings show that SCD and SCRM significantly contributed to firm performance. From the theoretical lens, this study verified the outcome of previous similar studies. Therefore, in line with the RBV theory, this study confirmed that SCD and SCRM are unique resources that MSMEs should utilize to increase their competitive and operational performance. With smaller operations, MSMEs are more flexible than larger companies to introduce changes and digitalize manual processes across the supply chain. Digitalization provides better information and insights to help companies make decisions.

However, this study also found that risk management is relatively more critical in improving MSMEs' performance compared to digitalization. Most companies in Malaysia Halal industry operates in the food and beverage subsector. This subsector is characterized by low entry barrier and intense competition. As a result, companies in this subsector face greater risk of being eliminate from the market due to lower capital base and limited innovation capability. Hence, companies with stronger capabilities in identifying and mitigating business risks have better prospect to maintain a long-term business operation in the Halal industry.

From the managerial perspectives, MSMEs involved in Halal industry are recommended to adopt digitalization strategies, such as using digital payment and embedding AI or data analytics with existing system, to minimize the operations cost, optimize production, offer better quality service to customers, and improve traceability and transparency of halal products. Moreover, MSMEs need to understand risks that could be reduced or eliminated, and prepare actions plan for unavoidable risks.

This study is also constrained by several limitations. Due to convenience sampling technique applied in this study, the subsectors in the sample are not the true representation of the subsector's proportions in the actual population. Despite that, the food and beverage, and cosmetics companies comprised the majority of the study samples, reflecting the actual population. Therefore, future researchers could apply stratified sampling technique to ensure better representation of subsectors in their study samples. Moreover, future researchers could further expand the model proposed by this study by studying the effect of MSMEs' innovativeness to the firm performance. According to NIM 2030, the present R&D activities in Halal industry emphasize on Halal compliance, rather than creating more values in product and services for customers. The lack of focus could be the lack of innovativeness not only among the MSMEs, but also to the larger counterparts. In conclusion, although this study verified the significant effect of SCD and SCRM on firm performance, a study on how innovativeness could also lead to better Halal industry performance should be conducted in the future.

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