



**Faculty of Technology Management and Technopreneurship**

**OPERATIONAL SUPPLY RISK AND MITIGATION STRATEGY  
FOR HALAL FOOD MANUFACTURERS IN MALAYSIA**



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**OPERATIONAL SUPPLY RISK AND MITIGATION STRATEGY FOR HALAL  
FOOD MANUFACTURERS IN MALAYSIA**

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2023**

## DECLARATION

I declare that this thesis entitled “Operational supply risk and mitigation strategy for halal food manufacturers in Malaysia” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

  
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## APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Doctor of Philosophy.

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Date : 19/10/2022

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## DEDICATION

This thesis is dedicated to:

My beloved parents, Ruhani Muhamed and Azmi Musa

My parents-in-law, Hamsia Ismail and Marhaban Habi

My beloved wife, Nur Afiqoh Marhaban

My beloved son, Adam Haris

And to all my family.



## ABSTRACT

The globalisation of halal products leads to the vulnerability of the supply chain. Once the halal food supply chain has been breached, it is difficult to rebuild brands and regain consumer trust. Thus, the objective of the study is to investigate operational supply risk management for halal food manufacturers in Malaysia. This study obtained 369 respondents who participated in the main survey by utilising simple random sampling. Then, the dataset was tested using covariance-based software (AMOS) to determine factors of operational supply risk and mitigation strategy and test the hypotheses of the study. This study has revealed that quality, delivery, price and cost are defined as factors of operational supply risks. Meanwhile, behaviour-based management, buffer-based management, and traceability-based management are defined as factors of risk mitigation strategies. Further, this study revealed that halal food manufacturers proactively managed operational supply risks caused by the supplier. Moreover, behaviour-based management and buffer-based management mediate (reducing the effects of operational supply risks) the relationship between operational supply risks and risk consequences. This study significantly contributes to the theoretical knowledge by model development of operational supply risk management for halal food manufacturers, the implication of agency theory, a valid measurement instrument for operational supply risk management for halal food manufacturers, and methodological contribution. Furthermore, from a managerial perspective, the firms may identify the types of risk and their consequences at the supply level, and the firms may implement the appropriate mitigation strategy to manage operational supply risks.

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## **RISIKO BEKALAN OPERASI DAN STRATEGI MITIGASI BAGI PENGILANG MAKANAN HALAL DI MALAYSIA**

### **ABSTRAK**

*Globalisasi produk halal membawa kepada kelemahan rantaian bekalan. Apabila rantaian bekalan makanan halal tidak dipatuhi, sukar untuk membina semula jenama dan mendapatkan semula kepercayaan pengguna. Oleh itu, objektif kajian ini adalah untuk mengenal pasti dan menyatukan pelbagai faktor yang berkaitan untuk membangunkan konstruk pengurusan risiko bekalan operasi yang kondusif kepada rantaian bekalan makanan halal dan menguji hubungan antara faktor-faktor ini untuk menyiasat sejauh mana model itu boleh dilaksanakan dalam pengilang makanan halal Malaysia. Kajian ini memperoleh 369 responden yang mengambil bahagian dalam tinjauan utama dengan menggunakan persampelan rawak mudah. Kemudian, set data telah diuji menggunakan perisian berasaskan kovarians (AMOS) untuk menentukan faktor risiko bekalan operasi dan strategi mitigasi dan menguji hipotesis kajian. Kajian ini telah mendedahkan bahawa kualiti, penghantaran, harga dan kos ditakrifkan sebagai faktor risiko bekalan operasi. Sementara itu, pengurusan berasaskan tingkah laku, pengurusan berasaskan penampan dan pengurusan berasaskan kebolehesanan ditakrifkan sebagai faktor strategi mitigasi risiko. Seterusnya, kajian ini mendedahkan bahawa pengilang makanan halal secara proaktif menguruskan risiko bekalan operasi yang disebabkan oleh pembekal. Selain itu, pengurusan berasaskan tingkah laku dan pengurusan berasaskan penimbal menjadi pengantara (mengurangkan kesan risiko bekalan operasi) hubungan antara risiko bekalan operasi dan akibat risiko. Kajian ini secara signifikan menyumbang kepada pengetahuan teori melalui pembangunan model pengurusan risiko bekalan operasi bagi pengilang makanan halal, implikasi teori agensi, instrumen pengukuran yang sah untuk pengurusan risiko bekalan operasi bagi pengilang makanan halal, dan sumbangan metodologi. Tambahan pula, dari perspektif pengurusan, firma boleh mengenal pasti jenis risiko dan akibatnya di peringkat bekalan, dan firma boleh melaksanakan strategi mitigasi yang sesuai untuk mengurus risiko bekalan operasi.*

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## LIST OF ABBREVIATIONS AND SYMBOLS

HFSC	: Halal food supply chain
JAKIM	: Department of Islamic Development Malaysia
EFA	: Exploratory factor analysis
CB-SEM	: Covariance-based structural equation modelling
SRM	: Supply risk management
OSR	: Operational supply risks
RC	: Risk consequences
RMS	: Risk mitigation strategy
BBM	: Behavior-based management
BFM	: Buffer-based management
TBM	: Traceability-based management
CFA	: Confirmatory factor analysis
N	: Population
$n$	: Sample size
$\chi^2$	: Chi-square
GFI	: Goodness-of-Fit
RMSEA	: Root mean square error of approximation
AGFI	: Adjusted Goodness-of-Fit
CFI	: Comparative Fit Index
$\chi^2/df$	: Normed Chi-square

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of the problem

The increasing complexity of modern supply chains, together with increasing pressure on efficiency and delivery time, has resulted in increased vulnerabilities. Firms increasingly rely on complex networks of suppliers and partners to deliver products in the right quantities, with high-quality standards, reasonable price, and cost, and at the right place and at the right time in a market that is at the same time, however, increasingly fickle (Assefa, Meuwissen and Lansink, 2017; Bottani et al. 2019; Khan, Khan et al. 2019). It is argued that the food supply chains have faced continuous challenges from multiple factors, which include food price volatility, food and nutrition security, governance issues, and the distribution of value within the food supply chains (Gokarn and Kuthambalayan, 2017). For example, throughout the entire supply chain, fresh produce and meat are subject to a continuous and significant change in quality and risk of contamination (Yu and Nagurney, 2013). As a result, the food supply chain requires extra attention and must be built to be robust and resilient.

A halal supply chain is among the practical examples of a robust food supply chain that aims to prevent contamination and breach of food integrity by adopting the farm-to-fork principle (Tieman, 2017b). However, the impact of the current food supply chain complexity contributes to the halal food supply chain (HFSC) uncertainties (Ali, Iranmanesh et al. 2021). For example, the globalisation of halal products leads to the

vulnerability of the supply chain, whereby the chain becomes lengthier and more complex to design in order to secure the integrity of halal (Ali and Suleiman, 2018; Elias et al. 2019). According to Ali, Iranmanesh et al. (2021), the integrity of halal food is jeopardised by the presence of a prohibited animal (pigs, boars, swine, carnivorous animals, and birds that have died naturally), contamination with blood or *najis* (filth) (carrion and dead animals), the presence of intoxicants (alcohol), and the use of the incorrect (Tan et al. 2017). Thus, the difficulty in securing food integrity is a result of the complexity of product quality, which is intrinsically linked to safety, hygiene, and health (Ting et al. 2014; Scalia et al. 2016). For example, aspects such as raw materials, processing food, service and information, transportation, packaging, and storage are crucial parts of the food chain that contribute to food contamination (Ali et al. 2016; Rathore, Thakkar and Jha, 2017). Once the food supply chain has been breached, it is difficult to rebuild brands and to regain consumer trust (Cui and Basnet, 2015; Tieman, 2017b; Wang and Alexander, 2018). Therefore, managing risk along the supply chain will provide greater opportunities for advantages for the whole supply chain (Tummala and Schoenherr, 2011; Sharma and Balan, 2012; Chopra and Sodhi, 2014). Without an effective mitigation strategy, a firm might suffer greatly as a result of the negative consequences of these risk occurrences when they occur (Rosales et al. 2012; Gouda and Saranga, 2018).

Food supply chain risk management in halal contexts is essential to avoid food from breaching halal integrity and helps firms build resilient strategies in halal supply chains. Tieman (2017b) stated that to create a resilient halal food supply chain, it needs the involvement of mitigation strategies (for example, proactive and reactive strategies) to minimise the likelihood of delivering a compromised halal product and to avoid costly recalls, crisis management, and business recovery. Furthermore, examining risks in the halal food supply chain can enhance the sustainability, equitability, and performance of the

halal food supply chain (Khalid et al. 2016; Maman, Mahbubi and Jie, 2018; Khan, Khan et al. 2019; Ali, Iranmanesh et al. 2021; Sarwar, Zafar and Qadir, 2021). To secure halal products, every supply chain member must recognise risks both internal and external to their networks. Multiple studies recommend firms need to implement a plan to mitigate risks to minimise agency uncertainties in halal food supply chains (Tieman, 2017b; Fujiwara and Ismail, 2018). Thus, the halal food supply chain has its own uniqueness whereby the Islamic foundation (Sharia law) must be embedded in food processing (Fujiwara, 2017; Fujiwara and Ismail, 2018). As a halal food practitioner, it is compulsory to secure the source of halal (supply-side) from contamination directly or indirectly with the elements of haram (prohibited by Sharia law) to secure halal integrity.

## **1.2 Statement of the problem**

A growing number of organisations have been recognised by the Department of Islamic Development Malaysia (JAKIM) and operate with an annual growth rate of 13% (Jabatan Perangkaan Malaysia, 2017). The growth of this certification will give the local halal manufacturer the potential to penetrate the market worldwide. As reported by Halid (2021) in Berita Harian, global trends involving the halal economy, where the world's consumption of halal services and goods is expected to grow by 3.5% annually to reach US \$2.4 trillion by 2024, provide a good narrative with enormous prospects for Malaysia. However, to meet this trend of globalization, the readiness of the halal industry in Malaysia must be parallel so that the supply of halal from Malaysia is always sufficient and meets the standards of halal globalization.

However, recently, a series of high-profile halal issues and scandals involving well-known brands has eroded public confidence in manufacturers' and governments' ability to ensure the halal integrity of halal-certified products. A single halal issue can easily escalate

into a global crisis for brands. For instance, Cadbury Malaysia recalled two chocolate treats after they were found to contain traces of pork DNA (Shuib, 2014; Tan, 2014). A Japanese company (Ajinomoto) was forced to recall and boycott its halal-certified food products in Indonesia after it failed to recognise the supplier's use of porcine enzyme as a supply risk (Fujiwara, 2017). Supian (2018) notes that halal meat and poultry sold in the United Kingdom may have been sold illegally and not slaughtered in accordance with the Muslim faith's requirements. Such an incident had a detrimental effect on the company's reputation.

Thus, to assess halal supply chain robustness and resilience in practice, it is useful to develop a scale of halal supply chain vulnerabilities, indicating areas that require more extensive risk management (Tieman, van der Vorst, and Ghazali, 2012). Furthermore, exploring risks in the HFSC in order to comprehend the consequences and optimise resources in the HFSC would be beneficial. Comprehensive supply chain management research is required to address the halal food supply risk that may result in adverse risk effects in the HFSC.

Recent empirical research on HFSC has focused on halal certification (Ab Talib, Chin, and Fischer, 2017; Haleem, Khan, and Khan, 2019), halal assurance systems (Abd Rahman et al. 2017; Zulfakar, Chan, and Jie, 2018; Rashid and Bojei, 2019), and halal logistic services (Abd Rahman et al. 2017; Zulfakar et al. 2019; Zailani et al. 2018; Karia, 2019). Tieman (2017b) notes that the scarcity of studies addressing risk management in a halal context. For example, Fujiwara and Ismail (2018) used qualitative methods (case study) to mitigate the halal supply risks faced by small and medium-sized businesses and multinational corporations. Khan, Khan et al. (2019) proposed a fuzzy analytic hierarchy process for identifying and prioritising risk elements in the halal food supply chain.