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OPERATIONAL EFFICIENCY AND WASTE IN HALAL MANUFACTURING: INSIGHTS FROM CASE STUDIES OF MALAYSIAN MSMES

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Abstract: *This study explores waste in halal manufacturing firms in Malaysia to increase operational efficiency. Based on the multiple case study method, three micro, small and medium enterprises (MSMEs) in halal food sector are selected using purposive sampling technique. Interview protocol is developed comprising three parts; opening, waste in halal manufacturing, and closing. The managers or owners of the MSMEs are interviewed for about 30-45 minutes and recorded. The interview data are transcribed and analyzed using thematic analysis. The findings reveal eight themes, i.e., defect, overproduction, waiting time, non-utilized talents, transportation, inventory, motion and extra processing, called DOWNTIME waste. It implies the urgency to introduce and adopt supply chain digitalization and supply chain risk management in enhancing operational efficiency among MSMEs, the key players in halal supply chain. This study extends the operations management literatures by developing the nexus between DOWNTIME waste in lean management with halal industries context. In addition, the findings advanced the current understanding of operational challenges facing halal MSMEs through a qualitative exploration, offering depth beyond quantitative waste analysis found in the existing literature.*

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Introduction

In today's increasingly competitive business landscape, operational efficiency is a key aspect to maintaining the competitiveness of manufacturing companies. Operational efficiency demonstrated a positive significant effect on manufacturing performance (Handoyo et al., 2023). Research further suggests that manufacturing companies which operates efficiently have better competitive advantage (Ali et al., 2022). The lack of operational efficiency could lead to negative outcomes. Less efficient companies had lower ability to absorb the impact of disruptions, suggesting riskier operations (Essuman et al., 2020). As a result, operational efficiency was regarded as an important criterion in supplier selection (Harikrishnan et la., 2025; Meena et al., 2023).

Nevertheless, previous studies have shown that MSMEs' operations are inefficient and involve a lot of waste. For example, waste of transportation, unnecessary motion, and waiting was found in a study of MSMEs in Indonesia (Wahyudi et al., 2024). A case study of food MSME also found that the products they distributed to retailers were not successfully sold and eventually damaged, causing waste (Meilenda & Syarif, 2024). Moreover, waste in MSMEs could increase because they were not able to make accurate forecasting on product demand and operational risk (Mamun, 2023). In addition, MSMEs had difficulties to adhere to quality procedures during manufacturing process and eventually led to defective products (Nallusamy & Ambedkar, 2016). Generally, MSMEs often face difficulties in minimizing operating costs (Vijayalakshmi & Rajalakshmi, 2018).

Since MSMEs lack the ability to control waste, many MSMEs are not transparent with potential investors about the management and financial controls within the organization (Ministry of Investment, Trade and Industry, 2023). With less capital, the ability of MSMEs to grow is increasingly hampered. This situation causes MSMEs to be seen as less attractive supply chain partners. The presence of MSMEs is considered a risk to the entire supply chain (Mamun, 2023; Babu & Yadav, 2023).

However, halal supply chain, particularly in Malaysia is dominated by MSMEs, accounting for 88.3% of the total industry players (Ministry of Investment, Trade and Industry, 2023). Due to the weakness of MSMEs, the New Industrial Master Plan 2030 (Halal Industry) through Strategic Thrust 6 (producing more home-grown halal champions) urges MSMEs to improve their competitiveness. The competitiveness of halal MSMEs can be boosted if waste that affects the operational efficiency of halal MSMEs is identified and minimized (Gupta et al., 2025; Anuar et al., 2023; Huang et al., 2022).

Although waste in halal MSMEs is well recognized as a critical issue requiring solutions, previous studies have largely ignored this topic. A bibliometric analysis of "halal" and "halal supply chain" studies published from 2006 to 2019 showed that the focus has been on halal branding, slaughtering and stunning, additives in halal food, and halal related food chemistry and sciences (Haleem et al., 2020). On the other hand, Bahara et al. (2025) reviewed 1,224 studies about halal SMEs published from 2012 to 2023 suggested more studies on operational efficiency through lean methodologies to increase halal SMEs' competitiveness. Similarly, Kurniawati and Cakravastia (2023) also recommended more studies on operations to optimize

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halal supply chain. Accordingly, the objective of this study is to explore waste in halal MSMEs particularly in food manufacturing industry.

Literature Review

Operational Efficiency

Production is a process of transforming input into output (finished goods). Labor, capital and inventory are necessary inputs for production. Operational efficiency is the ability of a particular production process to achieve greater desired outputs by utilizing fewer inputs (Fu & Jacobs, 2022; Qin et al., 2025). Similarly, Mantje et al. (2023) explained that operational efficiency relates to the identification and elimination of non-value-added process and activities, and improving the work process to reduce waste that harms firms' profits. Technically, operational efficiency is a ratio of the inputs measured against the output (Sharma et al., 2014).

An efficient operation reduces production cost, saves time and optimized resources, creating an advantage for better competitiveness (Li et al., 2021). For that reason, many firms strive to achieve better output to outperform their competitors. Despite that, a major problem constraining these firms lies in the poor operational efficiency, which not only stems from the internal structure and process, but also the members of the supply chain (Ghafoori et al., 2024).

However, past literatures emphasize on studying the factors contributing to higher operational efficiency in firms. For example, Hakimi et al. (2024), Prince (2024), and Obiki-Osafiele et al. (2024) argued that technology adoption would increase operational efficiency. In parallel, many prior studies validated that AI, data analytics, big data, IoT, and machine learning improved operational efficiency (Riipa et al., 2025; Kalla & Smith, 2024; Wang & Aviles, 2023; Badhan et al., 2023).

This study argues that understanding the type of waste occurred in firms should be the first step in developing efficient operations. Without in-depth understanding of the waste that occurs in production operations, the corrective actions chosen to improve existing processes may not be very accurate, even with the current technology adoption.

Waste in Manufacturing

Waste is anything that does not add value either from the customers' or the manufacturers' perspectives. In food manufacturing, Hasnan et al. (2023) identified nine different types of inefficiencies: (1) too long manufacturing lead time, (2) low productivity, (3) absence of systematic quality management, (4) low compliance with food safety requirement, (5) lack of innovations in product development, (6) lack of training, (7) lack of effective or sustainable marketing strategies, (8) poor traceability system, and (9) lack of documentation.

In more general studies, waste has been categorized based on Ohno (1988) seven types of waste, namely overproduction, inventory, waiting, defects, over-processing, motion, and transportation. Overproduction refers to producing more than required by the market demands, while inventory relates to excessive raw materials, finished goods or work-in-process. Waiting is idle time spent before the next process in production could be continued, whereas defects mean products that have to be scrapped or rework. On the other hand, over-processing is performing work more than the customers' required. Motion is regarded as waste caused by

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unnecessary movement of human or equipment. Conversely, transportation is the waste of moving raw materials or products from one place to another using long and unnecessary routes. The concept of waste proposed by Ohno (1988), commonly known as TIMWOOD waste, has been adopted in previous lean management studies (e.g., Verma & Jha, 2024; Leksic et al., 2020; Bubber et al., 2022). Research found that waiting time emerged as the most significant waste, accounting 33.2% of total waste in MSMEs (Verma & Jha, 2024). Moreover, defect and motion are the common waste occurred in a coffee business (Faridzi, 2023). While transportation has been the waste that significantly caused the occurrence of other wastes, waiting is most frequently generated by other types of waste (Salomon & Kosasih, 2023). This study attempts to understand waste occurred in MSMEs using the case study method.

Methodology

This study embarks on an exploratory multiple-case study design (Yin, 2003) to understand waste in halal manufacturing MSMEs. Given the lack of prior research in this area, the study aims to explore the types, sources, and patterns of waste across three selected MSMEs, thereby providing preliminary insights for future theory development and practice improvement. The multiple-case design was adopted to reduce the possibility of making spurious conclusion based on idiosyncratic cases as in the single-case design (Montello & Sutton, 2006; Fletcher & Plakoyiannaki, 2011).

The cases were selected using purposive sampling technique based on predetermined criteria, i.e., (1) halal certified firms, (2) MSMEs, and (3) manufacturing industry. Halal industry was the primary interest of this study because it is one of Malaysia's key economic contributors according to the New Industrial Master Plan 2030 (Ministry of Investment, Trade and Industry, 2023). Three cases were selected, following the recommendation from Creswell (2007), suggesting not more than 4 or 5 cases for each study.

An interview protocol which contained semi-structured questions was used for data collection. The interview process unfolds through five stages (Whiting, 2008), starting from the apprehension phase, and followed by exploration, co-operative, participation and conclusion phases. In specific, this process enables the researchers to build rapport with the research participants, explore their thoughts about waste occurred in the manufacturing process, actively engage, offering rich information, and finally reflecting and concluding the interview.

The interviews were conducted for about 30-45 minutes and recorded for data analysis. The researchers explained the objective of the study, ensured anonymity of the participants and confidentiality of the data to gain participants' consent before commencing the interviews. This study applied thematic analysis phases (Braun & Clarke, 2006) comprising six phases, namely, (1) getting familiar with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. This study also harnessed the use of the conventional thematic analysis with ChatGPT (Naeem et al., 2025).

Findings and Discussion

Case 1

The first case selected in this study is a halal food manufacturing company based in Melaka. Established in 1990, the company produces traditional local foods such as *asam pedas* paste, chili paste, *dodol*, and *gula* Melaka. Initially, the owner made *gula* Melaka for personal use, but

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growing demand from neighbors motivated her to start the business with only RM500 in capital. Later she started receiving order from local supermarket and as orders increased, she expanded the product line to include other traditional snacks such as *putu kacang, batang buruk, inang-inang, and kerepek ubi*. After 19 years, the company launched Malaysia's first instant *asam pedas*, designed to provide a convenient solution for busy working mothers, selling between 4,000 and 5,000 pouches per month. To date, the instant *asam pedas* has been exported to Singapore and Dublin, while the company's *dodol* products have been exported to Pakistan, Hong Kong, and Singapore.

Case 2

On the other hands, the second case is a halal company established in 2008 in Pulau Pinang. It sells halal herbs-based products such as *misai kucing, mas cotek,* Sabah snakegrass, lemongrass and *sancha inchi* tea, roselle cordial, and moringa noodle. This company started as an agricultural industry, supplying varieties of herbs for local sourcing. However, it consequently ventured in food supplement industry, which focused on identifying active ingredients in herbal plants for new product development by leveraging on the R&D engineering background of the company's owner. This company actively collaborates with Malaysian universities, Forest Research Institute Malaysia (FRIM), and Malaysian Agricultural Research and Development Institute (MARDI) to support its expansion.

Case 3

The last case involves a halal sushi producer that has been operating since 2013. The company began its operation in Perak. Sushi was neither common nor easily available in Malaysian market 30 years ago. At that time, the owner, a young girl, had to travel from her hometown in Teluk Intan to Ipoh to enjoy her favorite food, sushi. Due to limited supplies, sushi was also relatively expensive. In 2011, she finally decided to start her own sushi business together with her husband, a sushi chef. Their business concept was simple: to offer affordable and easily accessible sushi infused with local flavors. From a small sushi kiosk, this company has now expanded nationwide through a grab-and-go purchasing concept.

Waste in Halal MSMEs

Table 1 shows the summary of themes emerged from the interview data. Compared with Ohno's TIMWOOD waste, this study categorized the waste identified in the three case studies into eight types of DOWNTIME waste, in line with the Lean Enterprise Institute (2001). DOWNTIME waste means the waste related to defect, overproduction, waiting, non-utilized talent, inventory, motion and extra-processing. Compared to TIMWOOD waste, DOWNTIME waste introduced a new waste i.e., non-utilized talent, which were evident in Case 1 and 2.

According to the Lean Enterprise Institute (2001), non-utilized talent is regarded as unused employee creativity. In Case 1, the MSME allocated an excessive number of workers to operate a single machine, causing idle time among some of the workers. In that situation, the workers also did not proactively seek alternative tasks during this period. The interview with Case 2 proven similar result. This finding supported Pixley et al. (2021) who found non-utilized talent as the top waste mentioned by the small and medium manufacturers in their study.

In addition, all cases indicated waste caused by defective products. In Case 1, workers unintentionally used wet gloves which accumulated moist in the *dodol* packaging. Eventually, it caused the spoiling of *dodol* more quickly. Uncontrolled heating and poor-quality coconut milk are other reasons causing spoilt *dodol.* On the other hands, Case 2 showed that the fruits

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and leaves being used to make herbal products were sometimes too ripe or rotten. The variation led to unsafe final products.

Table 1: Interview Themes

DOWNTIME Waste	Case 1	Case 2	Case 3
Defects	Damaged packaging plastics; spoiled *dodol* due to wet gloves; manual packaging errors	Fruits rotten or too ripe, and overdried leaves. Defective herbs reused as biodegradable fertilizer	Sushi damage during packaging and stacking.
Overproduction	Excess *dodol* produced beyond demand, increasing overhead and utility costs	Poor marketing expertise causing the lack of understanding about the demand for each product, leading to overproduction	Overproduction during weekends due to "just-in-case" mindset leads to excess inventory and spoilage; caused by poor demand forecasting.
Waiting	Delays between processing and wrapping stages; caused by unskilled workers, poor communication, or material shortage (e.g., coconut milk shortage)	Long drying process (up to 10 hours); dry leaves in the morning, and stem in the afternoon due to inadequate equipment	Waiting time due to variable staff performance and lack of synchronization; delays in process flow.
Non-Utilized Talent	Assigned too many workers to handle a machine. Operators lack proactiveness when idle	Lack of empowerment, training, and engagement among staff	No evidence
Transportation	Inefficient delivery scheduling; damaged vehicles; unnecessary trips increasing fuel costs	Unnecessary movement of herbs/ raw materials due to logistic company's internal problem	No evidence
Inventory	No evidence	Poor inventory management due to manual recording or basic Excel usage.	Overstocking perishable ingredients; trendy ingredients expired when the trend declined.
Motion	Slow worker movement, poor layout, warehouse is too far from the processing facility	No evidence	Staff take longer to locate ingredients due to disorganized storage.

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Extra Processing	Over-processing from redundant tasks such as *dodol* stirring	Redundant paperwork	Slicing and food plating process that do not significantly enhance the flavour or presentation of the sushi rolls.

In Case 3, the sushi was damaged due to poor packaging and stacking especially when customers buy in large quantity. These findings corroborated with Hossain et al. (2019) who revealed that defects are the most frequent defects in companies. Similarly, this study validated Faridzi (2023) and Rahmawati et al. (2023) who also believed that the defects occurred due to employees' inconsistent work performance and high dependencies on manual labour compared to machines.

Overproduction was also observed in all cases. The MSMEs explained that they have limited understanding about the customer demands and forecasting techniques, which would allow better prediction of the quantity of products likely to be purchased by customers. The participant from Case 3 specifically informed that they often produced more sushi during weekends just in case there was a spike in demands. Earlier studies also confirmed that the occurrence of overproduction in food industry was caused by the lack of transparency and insufficient information about demand (Messner et al, 2021). Moreover, food producers only depended on subjective judgement to decide on the quantity of production (Messner et al, 2021).

Waste due to waiting was evident in all three cases. In Case 1, a shortage of coconut milk, a very important ingredient in *dodol* production, caused idle time during the production process. Meanwhile, in Case 2, the drying process of leaves and stems from the herbal plants required specialized equipment and long hours to complete. As a result, workers had to wait for the previous drying process to finish, even though a new batch of herbs was ready to be dried. In Case 3, waiting occurred because the workers had different skill levels, which led to a bottleneck at the less-skilled workers. This finding corresponds with prior studies which verify the occurrence of waiting time in business (Verma & Jha, 2024; Salomon & Kosasih, 2023; Hossain et al., 2019).

In terms of transportation waste, Case 3 did not show any sign of occurrence. However, in Case 1, such waste occurred due to the use of small-sized vehicle to transport the products, resulting more frequent trips from the production facility to the sellers. In Case 2, there were unnecessary movement of products and raw materials caused by inefficient routing of the logistics partner. This finding also supported previous studies of MSMEs' transportation waste (Brianti & Nuswantara, 2024; Rahmawati et al., 2023, Ulewicz et al., 2022).

Waste from carrying high inventory occurred only in Case 2 and 3. In Case 2, the herbal product manufacturer still relied on basic stock recording methods, either using manual or simple Excel spreadsheets. Without inventory recording technologies such as RFID, ERP, and IoT-based inventory tracking, they had to depend on employees' accuracy and timely recording of stocks. Case 3 tended to keep buffer stocks and carried too much trendy ingredients for sushi making. The waste occurred when perishable items were spoiled as the trend declined. Inventory waste was also identified in food manufacturers in Indonesia (Nomleni et al., 2025). This poor inventory management technique practices by MSMEs leads to excess inventory and stockouts (Murthy & Na, 2024).

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Waste due to unnecessary motion was evident in Case 1. The warehouse was located far from the production facility. Unless the warehouse was relocated closer to the production line, workers have to make frequent raw material deliveries. This is the reason why unnecessary motion caused the occurrence of other waste such as waiting (Salomon & Kosasih, 2023). In Case 3, ingredients were not properly organized, requiring more time to locate by the employees during the sushi production. Earlier studies (e.g., Brianti & Nuswantara, 2024; Rahmawati et al., 2023) also verified similar issues in MSMEs' production. However, Case 2 did not show any occurrence of unnecessary motion which supported the findings by Ridwan et al. (2024) who conducted a study on a tofu producer.

The final type of waste that occurred in all cases was the extra processing. In Case 1, the workers continued to stir the *dodol* after the process had been completed. Meanwhile, in Case 2, administrative works were often performed manually, resulting in reports which contained redundant information already available in other documents. In Case 3, the sushi chef tended to carry out excessive slicing and elaborate sushi plating. Traditionally, sushi is a Japanese cuisine well-known for its aesthetics presentation. However, not all customers appreciate the plating. Customers' cultural background influenced the sentiments they hold toward a product or service (Nakayama & Wan, 2019). Waste due to extra processing was found in fashion (Rahmawati et al., 2023), and food manufacturing MSMEs (Ridwan et al., 2024).

Conclusion

This study aims to explore waste that caused inefficiency in MSMEs' production. Based on the case studies, DOWNTIME waste was evident with defect, overproduction, waiting, and extra processing being the common wastes occurred in all the three cases. The waste typically stemmed from manual labor and the lack of technology adoption. Therefore, waste should be reduced or eliminated because it affects a firm's operational efficiency and the overall competitiveness (Gupta et al., 2025; Anuar et al., 2023; Huang et al., 2022). Operational efficiency improvement process in MSMEs could start with implementing lean management, and adopting technologies such as artificial intelligence, IoT, and automation. Furthermore, supply chain risk management is equally important to help MSMEs identify possible waste. There are several limitations of this study. While detailed description of DOWNTIME waste occurred in the three cases were available, it only captured the incidents at the three selected halal MSMEs. These MSMEs operate in food manufacturing industry, which do not represent other halal subsectors such as pharmaceutical, fashion and tourism. Thus, future researchers could sample more data from other halal subsectors to enrich the current literature. In addition, it would be interesting to determine how digitalization and risk management would enhance the operational efficiency and competitiveness of halal supply chain.

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