

Beyond Halal

Exploring Dietary Preferences,
Novel Ingredients and Techniques

Edited by Amal A.M. Elgharbawy, Muhamad Shirwan Abdullah Sani,
Azura Bt. Amid, Hamzah Mohd Salleh, Feri Kusnandar



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Preface

In recent years, the question of what it truly means to eat halal has evolved into a much broader and more complex discourse. No longer confined to questions of permissibility alone, halal food is increasingly viewed through the lens of ethics, sustainability, health, and innovation. This edited volume, *Beyond Halal: Exploring Dietary Preferences, Novel Ingredients and Techniques*, was conceived in response to these evolving dynamics. It reflects a growing awareness—among scholars, practitioners, and consumers alike—that the future of halal food systems must be as multifaceted and forward-looking as the challenges and opportunities they face.

The idea for this book emerged through ongoing research, teaching, and professional engagements within our respective academic and industrial networks. As editors and contributors working across diverse disciplines—from Islamic jurisprudence and food technology to supply chain integrity and consumer studies—we recognized a shared imperative: to move beyond conventional discussions of Halal compliance and to explore the intersecting themes of dietary preferences, biotechnology, ethical sourcing, and regulatory innovation.

This volume was curated with the intention of bridging disciplines and fostering dialogue. Each chapter reflects not only scholarly rigor but also a commitment to practical relevance. Whether it is the integration of nanomaterials in food production, the sustainability potential of insect proteins, or the role of digital tools such as blockchain and metabolomics, the insights offered here aim to push the boundaries of current Halal discourse. Together, they represent an attempt to reframe Halal not simply as a regulatory category, but as a living framework shaped by science, ethics, and consumer consciousness.

The journey of assembling this book has been deeply collaborative. We are fortunate to have worked alongside an exceptional group of authors from diverse institutional and disciplinary backgrounds. Their contributions represent the intellectual heart of this project. We also wish to express our sincere appreciation to the International Institute for Halal Research and Training (INHART), the International Islamic University Malaysia (IIUM), for its continued support in advancing research at the intersection of halal, ethics, and innovation.

We are grateful to our peers, mentors, students, and research partners whose engagement and feedback enriched the development of this book. Their insights challenged us to think more deeply, ask more difficult questions, and continually refine our perspectives. We also extend our thanks to the readers of this volume—whether you are researchers, industry professionals, educators, regulators, or inquisitive consumers. Your interest in this work signals a shared commitment to not only understanding halal but also reimagining its future.

It is our hope that this book serves not only as a scholarly resource but also as an invitation—to think critically, engage meaningfully, and explore courageously what lies *beyond Halal*.

Uncovering the loophole in the halal food industry

Noor Yuslida Hazahari and Nurul Auni Mohd Noor

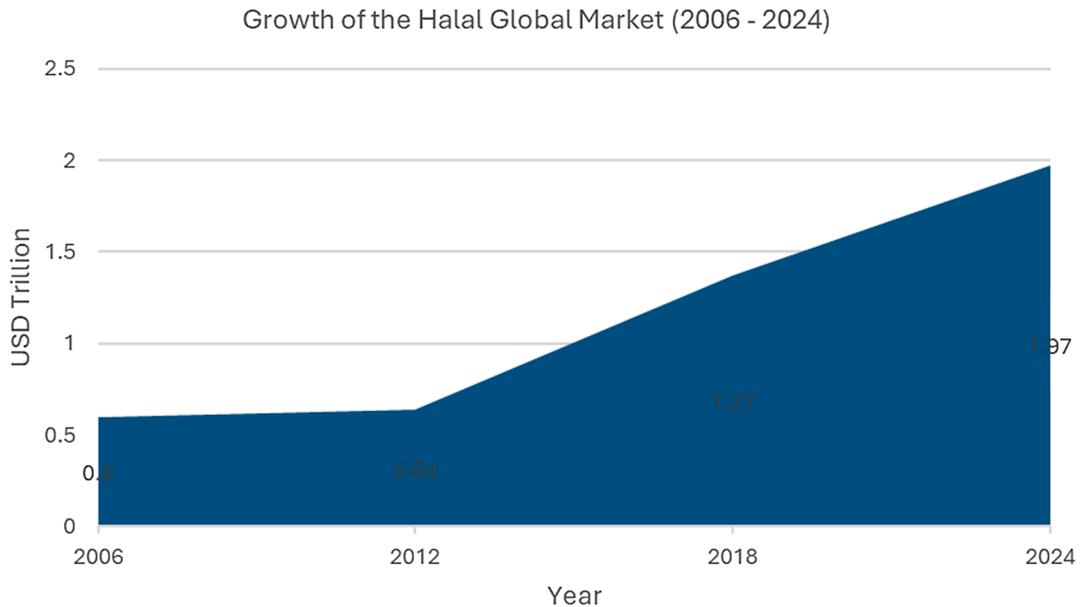
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1. Introduction

The global food industry has seen the rise of the halal sector as a key player, distinguished by its ethical standards and financial success. This sector's prominence is mainly due to the expanding Muslim demographic, which is anticipated to hit 2.2 billion by 2030 (Nurrachmi, 2017). Accounting for 16.6% of worldwide food spending in recent years, the halal food segment has solidified its position as a significant market (Nor et al., 2023). With an estimated valuation of USD 667 million, the halal food sector has consistently grown over the last 10 years (Zulkffi et al., 2023). A recent analysis has indicated a rising trend in halal food spending, with an expected compound annual growth rate (CAGR) of 6.3% between 2018 and 2024. Forecasters suggest the sector will maintain its industry stronghold due to four key factors (Nor et al., 2023). Primarily, the rapid expansion of Islam boosts the demand for halal products globally. Additionally, the appeal of halal food crosses cultural boundaries, attracting both Muslims and non-Muslims alike, mainly due to its ethical production and safety standards. This trend is exemplified in the United Kingdom, where the consumer base for halal meat extends far beyond the Muslim population. Furthermore, the growing economic influence of halal consumers underscores its significance as a mainstream market. Lastly, there is an increasing awareness among Muslims about the importance of consuming strictly halal food.

Fig. 3.1 presents a visual overview of the steady growth in the global halal food market over nearly 2 decades. The graph reflects the increasing global demand for halal-certified products, driven by demographic shifts, rising consumer awareness, and broader acceptance of halal principles beyond the Muslim community. This upward trend underscores the halal sector's evolution from a niche market to a substantial component of the global food industry, laying the groundwork for discussions on certification challenges, regulatory diversity, and future strategic enhancements.

Halal industry development requires vigilant oversight from relevant organizations or bodies to ensure effective management and consumer protection. Halal certification is pivotal in building trust among consumers. Muslims, in adherence to their faith and devotion to Allah, are required to eat only halal food, making halal certification essential, particularly for those residing in countries with a non-Muslim majority. Furthermore, the halal mark on product packaging helps identify goods and instills consumer confidence in their halal choices (Hasanah et al., 2023). Muslim buyers are increasingly knowledgeable

**FIGURE 3.1**

Growth of the halal global market (2006–2024).

Halal Products Research Institute (HPRI), University Putra Malaysia (UPM).

about ensuring food additives and preservatives are free from prohibited (haram) substances as per Islamic law before purchasing (Zulkfli et al., 2023), positively impacting the global food industry.

Interestingly, halal-certified products are gaining popularity among non-Muslims, too, drawn by quality assurance and alignment with their lifestyle preferences (Wan Ismail et al., 2020). Earning consumers' trust to choose products with the halal emblem secures a steady cash flow, bolsters product sales, and contributes to the economy. For instance, the halal food sector was responsible for almost 5.8% of Malaysia's gross domestic product in 2020 (Yener, 2022).

The discussion begins by clarifying the definition of halal food within the certification process and introducing key international bodies involved in its regulation. It then explores current industry challenges, including systemic loopholes and the application of technology to enhance transparency and compliance. A comparative analysis of global halal certification practices highlights the legal and regulatory differences across regions and the resulting complications. The final section presents strategies to improve consumer understanding of halal certification while offering forward-looking perspectives on the sector's growth and sustainability.

2. Defining halal food

“Halal”—an Arabic term—translates to what is permissible, allowable, or acceptable within the shari'ah (Islamic law), guiding Muslims toward consumables that meet these criteria in their daily

diets. Islamic dietary laws stipulate that followers are permitted to consume food except those explicitly deemed prohibited, or *haram*, as outlined in the Qur'an and Hadith (Khan & Haleem, 2016). The foundational rules governing the consumption of permissible versus prohibited items are derived from a specific verse in the Qur'an.

Prohibited to you are dead animals, blood, the flesh of swine, and that which has been dedicated to other than Allah, and [those animals] killed by strangling or by a violent blow or by a head-long fall or by the goring of horns, and those from which a wild animal has eaten, except what you [are able to] slaughter [before its death], and those which are sacrificed on stone altars, and [prohibited is] that you seek decision through divining arrows. That is grave disobedience. This day, those who disbelieve have despaired of [defeating] your religion; so, fear them not, but fear Me. This day, I have perfected your religion for you, completed my favor upon you, and approved Islam as your religion. However, whoever is forced by severe hunger with no inclination to sin, indeed, Allah is Forgiving and Merciful. [Al-Ma'idah 5:3]

The scripture explicitly forbids Muslims from consuming certain types of meat, including pork, blood, and predatory animals, as well as improperly slaughtered or dead animals, among others. Furthermore, halal food certification hinges on specific slaughtering practices, one of which mandates the use of a razor-sharp blade to ensure quick and comprehensive bleeding out, leading to the animal's death, all while prioritizing the animal's welfare (Fuseini et al., 2017). Modern slaughtering techniques, designed to expedite the process, have sparked debates over their compatibility with halal standards. For example, the practice of preslaughter stunning, intended to paralyze/immobilize the animal before actual slaughtering, is met with varying levels of acceptance. Some Islamic authorities accept only reversible stunning, ensuring the animal remains alive and uninjured until the moment of slaughter (Hakim et al., 2020). However, some reject all stunning forms due to concerns over their compatibility with halal principles.

Islam's emphasis on halal food consumption reflects a broader goal of leading a meaningful life deeply rooted in Islamic teachings. The growing awareness among Muslims to exclusively consume halal food stems from a desire to preserve Islamic values, sustain life, protect future generations, and uphold dignity and integrity (Lutfika et al., 2022). Adherence to halal standards worldwide is crucial for ensuring the availability of halal food products. However, these standards vary significantly across regions due to differences in cultural practices, legal frameworks, and interpretations of Islamic law (Azam & Abdullah, 2021). Numerous halal standards are currently implemented worldwide, with some countries—such as Malaysia—adopting multiple national and sector-specific standards. This reflects the diversity and complexity of maintaining halal integrity across geographical and cultural contexts. While over 50 halal-related standards exist worldwide, the list above highlights some of the most referenced and officially recognized frameworks across various regions. The number continues to grow as countries develop or refine their standards to meet local and international needs (Table 3.1).

3. The halal certification process

In Muslim-majority nations, particularly across the Arab world and North Africa, halal certification is commonly mandated for specific product categories, especially meat and its derivatives, to ensure compliance with Islamic dietary laws. In contrast, countries with significant Muslim

Halal standard	
1.	OIC/SMIIC 1:2019 General Requirements for Halal Food (second edition)—(for OIC countries)
2.	UAE.S/GSO 2055-1:2015 Halal Food—Part 1: General Requirements for Halal Food—(for GCC)
3.	MS 1500:2019 Halal Food—Production, Preparation, Handling and Storage—General Guidelines (third revision)—(for Malaysia)
4.	MUIS-HC-S001 General Guidelines for the Handling and Processing of Halal Food—(for Singapore)
5.	HAS 23000 Criteria of Halal Assurance System—(for Indonesia)
6.	BAS 1049:2023 Halal Food—Requirements and Measures—(for Bosnia Herzegovina)
7.	CAC/GL 24-1997—(for Codex Alimentarius Commission)
8.	Malaysian Halal Certification Procedure Manual (third revision; Domestic and International)—(for Malaysia)
9.	PBD 24:2007 Halal Food—(for Brunei)
10.	THS 24000:2552 General Guidelines of Halal Products—(for Thailand)
11.	SASO 2172 “General Requirements for Halal Food”—(for Saudi Arabia)
12.	ES:4249/2003 Requirements and Provision for Labeling Halal Food—(for Egypt)
13.	PS:3733-2016 Pakistan Standard Specification for Halal Food Management Systems Requirements for Any Organization in the Food Chain—(for Pakistan)
14.	Uganda Standard US 909:2011 General Standard for Halal food—(for Uganda)
15.	Austria Standard ONR 142000:2009 Halal food—Requirements for the food chain—(for Austria)

populations—whether as a majority or a sizable minority—such as Malaysia, Indonesia, Brunei, India, China, South Africa, and various Western nations demonstrate an even broader demand for halal-certified goods. This is primarily because many food products in these regions are imported or produced by non-Muslim entities, raising the importance of formal verification processes to confirm their halal status (Bonne & Verbeke, 2008). To address these concerns, comprehensive halal certification systems have been established to safeguard the rights of Muslim consumers and ensure confidence in food safety and religious compliance.

Malaysia, in particular, has positioned itself as a global leader in the halal food sector. In response to growing international demand and to maintain its competitive edge, the Malaysian government has implemented stringent regulations and developed a globally recognized halal certification system under the Department of Islamic Development Malaysia (JAKIM). The Malaysian halal standard has been recognized and accepted by over 41 international certification bodies across approximately 31 countries, meaning these bodies either refer to or align their certification schemes with Malaysia’s halal standards to facilitate trade and mutual recognition (Lutfika et al., 2022). The widespread acceptance of Malaysia’s halal certification reflects its credibility and strategic role in shaping global halal governance.

The criteria for achieving halal certification within the food and beverage sector are categorized into two main areas: foundational references and managerial duties. Foundational references refer to the halal standards, legal provisions, and religious rulings that collectively establish the requirements for halal compliance. These include: (i) MS 1500:2019, the primary halal standard in Malaysia, which outlines the general requirements for the production, preparation, handling, and storage of halal food

(third revision); (ii) relevant legislation such as the Food Act of 1983 (Act 281), the Food Regulations of 1985, and the Food Hygiene Regulations of 2009; (iii) fatwa (Islamic rulings) concerning halal and haram matters, as issued by recognized religious authorities—namely the State Fatwa Committee and the National Fatwa Committee; and (iv) other supporting guidelines and regulations that uphold food safety and hygiene in accordance with Islamic law.

In addition to compliance with these foundational references, the management team of any applicant must also fulfill specific operational and documentation requirements to qualify for halal certification (Fig. 3.2).

Halal certification is administered by various recognized authorities worldwide, each responsible for ensuring compliance with Islamic dietary laws within its respective jurisdiction. In Malaysia, the JAKIM serves as the central halal-certifying authority, developing national standards and overseeing implementation across industries (Asa, 2017). In the United States, several prominent private bodies provide halal certification, including the Islamic Food and Nutrition Council of America (IFANCA), Islamic Services of America (ISA), and the American Halal Foundation (AHF). These organizations certify a wide range of products, including food, pharmaceuticals, and cosmetics, mainly for domestic and export markets.

In Australia, halal certification is provided by bodies such as the Australian Halal Development and Accreditation (AHDAA) and the Supreme Islamic Council of Halal Meat in Australia Inc. (SICHMA), both of which play crucial roles in certifying meat and other goods for export, mainly to Muslim-

Multinational category	Medium industry category	Small industry category	Micro industry category
i. Establish an Internal Halal Committee (IHC)	i. Establish an Internal Halal Committee (IHC)	i. Appoint a Muslim supervisor and a) a permanent post for Malaysian citizens working along the food handling/ processing supply chain.	i. Appoint a minimum of one Muslim worker: a) A permanent post and full-time work in the food handling/ processing section.
ii. Appoint a Halal Executive (HE)	ii. Appoint a Halal Executive (HE)	ii. Appoint a minimum of one Muslim worker: a) A permanent post and full-time work in the food handling/ processing section.	
iii. Appoint a minimum of two Muslim workers and a) shall be permanent posts, Malaysian citizens, and work full-time in the food handling/ processing section, and b) This requirement shall apply to all shifts in the factory's operation section.	iii. Appoint a minimum of two Muslim workers and a) shall be permanent posts, Malaysian citizens, and work full-time in the food handling/ processing section, and b) This requirement shall apply to all shifts in the factory's operation section.		
iv. Establish a Halal Assurance System (HAS) with reference to MHMS 2020.	iv. Establish a Halal Assurance System (HAS) with reference to MHMS 2020.		

FIGURE 3.2

Specific requirements for halal certification.

majority countries. New Zealand relies primarily on the Federation of Islamic Associations of New Zealand (FIANZ) for halal oversight, especially in meat exports. In Singapore, halal certification is overseen by the “Majlis Ugama Islam Singapura” (MUIS), which manages a highly structured and internationally recognized halal framework (Asa, 2019).

In Indonesia, the government-established Halal Product Assurance Organizing Agency (BPJPH)—under the Ministry of Religious Affairs—is now the central authority, supported by LPHs (Halal Inspection Bodies) and the Fatwa Committee. Thailand’s halal certification is overseen by the Central Islamic Council of Thailand (CICOT), which ensures halal compliance across various sectors. In China, the China Islamic Association (CIA) oversees halal certification to ensure that products meet the dietary requirements of the local Muslim population.

These certification bodies play vital roles in their respective countries and regions, ensuring that halal products meet religious and regulatory standards (Asa & Azmi, 2018). Global halal authorities, including JAKIM and the Standards and Metrology Institute for Islamic Countries (SMIIC), mutually recognize many of these bodies for their consistent trade practices. This international cooperation highlights the increasing importance of halal certification in fostering trade, enhancing consumer trust, and upholding religious integrity across diverse markets.

Possessing halal certification is a robust marketing strategy that significantly enhances the market presence of a halal-certified business (Mansur et al., 2022). This enhancement stems from consumers’ trust in the halal label, which encourages repeat purchases of the company’s halal food products. Furthermore, the inclusion of the halal logo has become a critical requirement for accessing modern retail environments such as supermarkets and hypermarkets, thereby facilitating the expansion of small- and medium-sized enterprises (SMEs) globally (Hasanah et al., 2023).

The emphasis on halal certification in the food industry is crucial for upholding Islamic standards, which refer to the comprehensive set of guidelines derived from the shari’ah (Islamic law) that govern the permissibility, hygiene, safety, ethical sourcing, and overall integrity of food production. These standards ensure that food is not only lawful (halal) but also clean (tayyib), safe for consumption, and free from contamination with prohibited (haram) substances. As global demand for halal food continues to grow, halal-certified businesses gain a competitive edge and experience increased revenue, allowing them to thrive in both Muslim and non-Muslim markets.

4. Identifying loopholes in the halal food industry

The global expansion of the halal food sector has compelled manufacturers to seek halal certification from recognized authorities to maintain their market relevance. Nonetheless, the stringent certification procedures and standards have led some to bypass these requirements, resulting in incidents of food fraud, tampering, and misuse of the halal emblem worldwide. Some manufacturers might replicate existing halal standards instead of adapting to new ones alongside changes or updates in their production processes to avoid the costs associated with implementing the latest halal guidelines (Islam et al., 2023). Additionally, the employment of dubious ingredients and the risk of cross-contamination with forbidden substances have eroded consumer trust in the halal certification system (Denyinghot et al., 2022). This problem is often attributed to a lack of or insufficient understanding of Islamic jurisprudence among producers.

As issues within the halal food industry become more complex, the mere presence of a halal certificate or logo on products may no longer suffice to guarantee consumer trust, especially against the backdrop of increasing incidents of food fraud, misleading advertisements, incorrect halal labeling, and counterfeit certifications (Deuraseh & Sufredin, 2021). For example, research highlighted the extensive illegal trade of nonhalal meat in the United Kingdom, valued at over £1 billion annually.

In response to these challenges, the halal food industry has turned to innovative technologies to safeguard its integrity. Ensuring consumer confidence in halal products is crucial, but preserving Islamic principles and spiritual well-being to nurture future generations is paramount. The commendable efforts by researchers to develop new technologies to support halal certification processes, such as polymerase chain reaction (PCR) to detect porcine DNA in commercially available meat products, are noteworthy (Sajali et al., 2022) (Fig. 3.3).

Fig. 3.3 provides a structured overview of the procedural steps involved in obtaining halal certification in Malaysia, as governed by the JAKIM. The diagram outlines the sequential flow, beginning with the application submission by the company, followed by documentation review, premises inspection, sample analysis (if required), and decision-making by the certification panel. It also highlights the roles of relevant stakeholders, including the halal executive committee, laboratory personnel, and shari'ah advisors, throughout the evaluation process. Each stage emphasizes due diligence in ensuring shari'ah compliance, food safety, and traceability. The figure also distinguishes between domestic and international application tracks, offering insight into the rigorous and transparent approach Malaysia employs to protect the integrity of its halal certification system.

5. Impact of loopholes

Vulnerabilities within the halal food sector have had a significant impact on both companies and consumers financially. The sector's growth has paved the way for online food purchases, which has, in turn, led to an increase in cybercrime incidents (Abd Razak & Ramli, 2022). Using traditional and cutting-edge technologies, cybercrime poses economic threats through fraudulent transactions that can damage businesses (Azizah, 2021). Additionally, these crimes affect the market's integrity, exposing consumers to potential financial losses (Mohd Riza et al., 2022). This scenario has eroded consumer confidence in the reliability of the halal food industry, potentially diminishing online market engagement.

Such chaotic conditions have prompted regulatory bodies to intervene against breaches of halal standards, particularly those outlined in MS 1500:2019—Halal Food: General Guidelines for Production, Preparation, Handling and Storage, as well as other supporting guidelines issued by the JAKIM and enforced through the Halal Assurance System (HAS) Manual and related operational documents.

In Malaysia, JAKIM, along with the Department of Islamic Religious Affairs/State Islamic Religious Council (JAIN/MAIN) at the state level, has classified violations into three categories: minor, central, and severe offenses (Zakaria & Abdullah, 2019). Minor offenses, which call for corrective measures upon inspection, typically involve cleanliness and hygiene issues within the premises and among staff. Major offenses may lead to the suspension of halal certification, especially in cases involving unauthorized changes to suppliers or falsifying halal-related documents (Amin & Abdul Aziz, 2015). The most severe category, serious offenses, can result in the revocation of halal

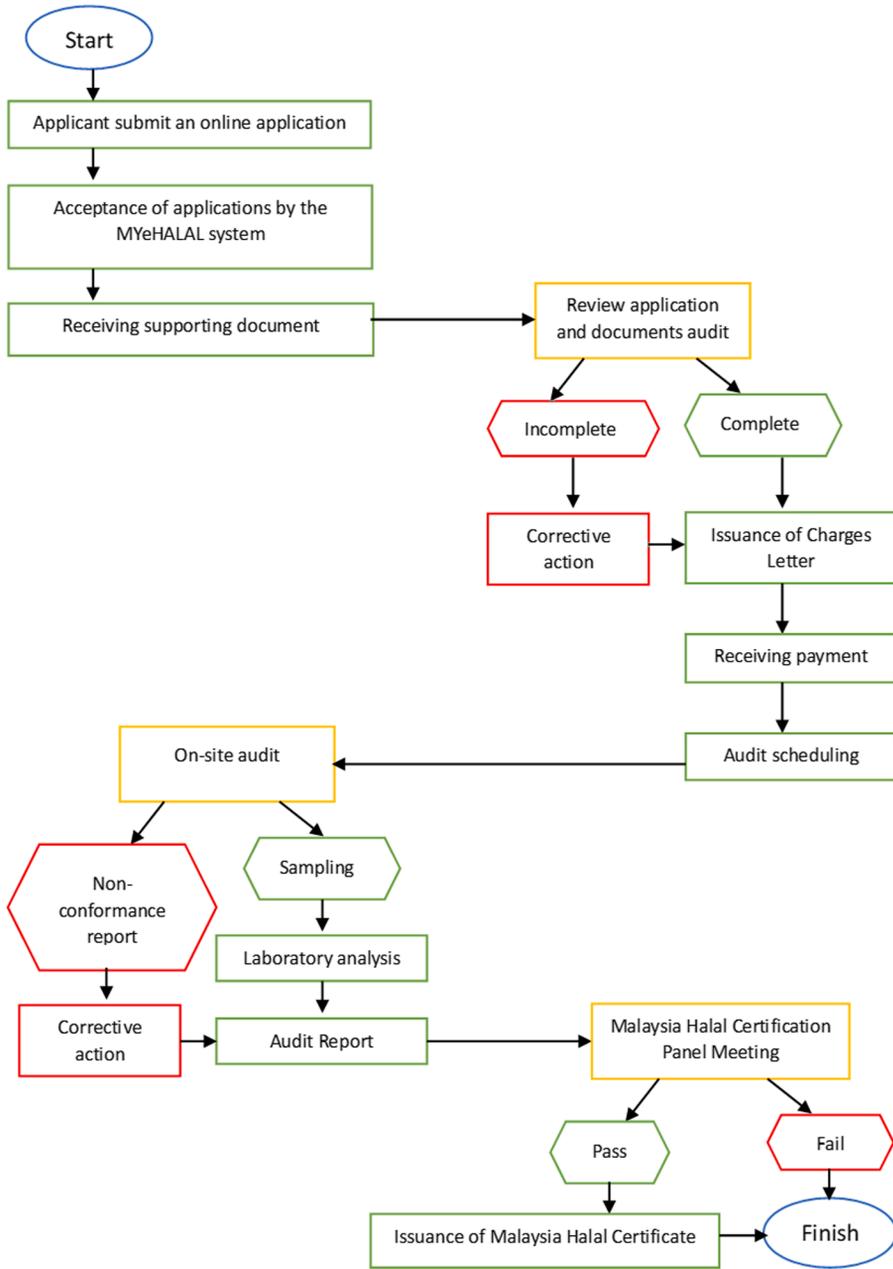


FIGURE 3.3
Malaysia halal certification processes.

certification—particularly when nonhalal ingredients are used postcertification or animals are subjected to improper slaughtering techniques, both of which directly violate the standards set under MS 1500:2019 (Zakaria & Abdullah, 2019).

6. Case studies of loophole exploitation

The shocking revelation of a halal meat cartel scandal in late 2020 highlighted the persistent vulnerabilities within the halal food industry, both domestically and internationally (Mohd Riza et al., 2022). The discovery of 1000 tons of frozen meat falsely labeled with halal logos not only astonished consumers across Malaysia, both Muslim and non-Muslim, but also tarnished the nation's reputation as a leading figure in the global halal market. Despite Malaysian authorities' seizure of these goods, investigations led by JAKIM in collaboration with Australian officials addressed allegations of halal protocol breaches and unethical animal handling practices at the implicated slaughterhouse (Abd Razak & Ramli, 2022). Another significant incident involved the distribution of fish balls bearing an unrecognized halal logo, leading to a factory raid after complaints from local consumers (Asa, 2019).

This increased awareness and insistence on halal-only food consumption have significantly influenced the perception of halal-labeled products among both Muslim and non-Muslim communities (Chong et al., 2021). The credibility of halal food products hinges on the transparency of their production methods and the origin of their ingredients, establishing a foundational trust. The halal logo, ingredient lists, country of origin, packaging details, and manufacturer identification play crucial roles in shaping consumer confidence in halal food items, as evidenced by extensive research (Maifiah et al., 2022). Compromising these elements can lead to consumer apprehension and distrust, particularly among Muslim consumers.

The scandals mentioned above have sown confusion and caution among consumers, particularly within the Muslim community, undermining their trust in the halal certification process. This erosion of confidence, spurred by uncertainties over product authenticity, demands a concerted effort from industry stakeholders to safeguard the integrity of halal standards and certifications. Those involved in the halal food sector must commit to upholding these principles to preserve and enhance consumer trust and confidence in an ever-expanding market.

7. Technological solutions and innovations

With its increasing global footprint, the halal industry faces myriad challenges ranging from maintaining the integrity of halal certification to enhancing consumer confidence. Technological solutions and innovations have emerged as pivotal tools in addressing these challenges, ensuring compliance, and streamlining the certification process. Below are elaborate subtopics highlighting the impact of technology in the halal sector.

7.1 Ensuring compliance through blockchain technology

The adoption of blockchain technology (BCT) in the halal industry represents a transformative approach to ensuring the integrity of halal products from farm to table. Blockchain's immutable ledger system offers a transparent and tamper-proof supply chain record, ensuring that all halal products are

handled according to strict Islamic guidelines. This technology enables all parties within the supply chain, from slaughterhouses to end consumers, to verify the halal status of products in real-time, significantly reducing the risk of contamination and fraud. As a notable emergent technology within Industry 4.0, BCT has garnered extensive focus. Defined as a decentralized database of linked records, accessible publicly or privately among network participants, BCT facilitates transaction recording in a secure environment devoid of trust dependencies, safeguarded by cryptographic methods (Gurtu & Johnny, 2019).

BCT is characterized by its core components: distributed shared ledgers, smart contracts, consensus mechanisms, and cryptographic technologies (Dolgui et al., 2020; Pournader et al., 2020). The distributed ledger enables data storage across network nodes without centralized oversight. Smart contracts automate transactions without third-party intermediaries. Cryptographic technologies, including hashing functions, ensure data integrity and authenticity, with hashing enabling the chaining of blocks into a secure sequence. Consensus mechanisms validate transactions across the network's nodes.

7.1.1 Characteristics of blockchain technology

Below are BCT's attributes, highlighting its distinct advantages over traditional centralized databases in achieving goals, cost efficiency, transparency, and environmental sustainability (Mangla et al., 2021; Martinez et al., 2019; Büyüközkan et al., 2021).

1. **Decentralization:** In blockchain networks, the verification of transaction data does not rely on a central authority or intermediary (Cole et al., 2019). Instead, verification is performed by the nodes within the network. Every participant in the network has a copy of the entire blockchain and can add new data to it. This decentralized structure ensures the system remains secure and robust, eliminating the risk associated with a single point of failure.
2. **Smart Contracts:** Smart contracts are automated protocols on a blockchain that execute themselves when predefined conditions are met. These contracts facilitate the automatic transfer and payment of assets, significantly lowering transaction costs and enhancing convenience and security (Gurtu & Johnny, 2019). By removing the need for intermediaries, smart contracts streamline processes and minimize the risk of human error.
3. **Immutability:** A key feature of blockchain is its immutability. Once transactions and data are recorded on the blockchain, they cannot be altered. This is ensured by the system's timestamp and permission control features (Van Hoek, 2019). Immutability guarantees that the data remains consistent, trustworthy, and resistant to tampering, which is crucial for maintaining system integrity.
4. **Security:** BCT offers high security due to its immutable nature. Once transactions are recorded, they cannot be changed, ensuring that agreements are documented accurately and the provenance of assets is established (Wang et al., 2019). This security makes blockchain a reliable choice for various applications, including financial transactions, supply chain tracking, and digital identity management.
5. **Anonymity:** Blockchain networks connect numerous nodes to maintain the ledger, yet they protect user identities by keeping them anonymous (Dubey et al., 2020). Participants can engage in transactions without disclosing their personal information, safeguarding privacy and reducing identity theft risk.

6. **Transparency/Visibility:** BCT provides exceptional transparency. All input data is recorded, and changes are documented through a consensus mechanism (Cole et al., 2019). This makes all transactions highly transparent and traceable, fostering trust among users. The transparent nature of blockchain is especially valuable in sectors requiring high traceability and accountability, such as supply chain management (SCM) and finance (Dubey et al., 2020).

7.2 Combined supply chain management with artificial intelligence

Supply chain management (SCM) encompasses the coordinated management of information, products, processes, and finances, all of which significantly influence a business's competitive edge—manifested through production costs, market responsiveness, capital requirements, return on investment (ROI), and profitability (Saber et al., 2019; Seuring & Gold, 2012). Nevertheless, today's globally intertwined supply chains present formidable challenges, exacerbated by geopolitical, economic, and technological uncertainties that render these networks complex, volatile, and prone to disruptions (Saber et al., 2019). Integrating sophisticated and emerging technologies is becoming an increasingly adopted strategy to boost SCM efficacy.

Microsoft (2018) illustrates how BCT can revitalize modern supply chains by boosting transparency, traceability, and efficiency. The World Economic Forum (2018) explores blockchain's role as a foundational element for a sustainable future marked by transparent, traceable supply chains. Deloitte (2017) emphasizes the synergy between BCT and the Internet of Things (IoT) in forging a robust system for tracing supply chain activities. Artificial intelligence (AI) is another technological marvel aiding the halal industry. AI-driven systems can automate the monitoring and analysis of complex data related to halal product ingredients, processing methods, and storage conditions. By utilizing machine learning algorithms, these systems can predict potential breaches in halal compliance, thereby preempting violations before they occur. AI also plays a crucial role in enhancing halal auditing processes, making them more efficient and less prone to human error. These insights indicate a growing recognition of the strategic advantages of integrating cutting-edge technologies into SCM practices, prompting organizations to explore these innovations to enhance supply chain operations.

7.3 Blockchain technology and supply chain management

BCT significantly enhances SCM by facilitating cost reductions, speeding up processes, enhancing risk management, increasing flexibility, ensuring sustainability, bolstering reliability, and improving customer relationships. Blockchain-enabled SCM provides real-time product tracking, safeguards against counterfeiting, and bolsters consumer trust (Kshetri, 2018). Blockchain's transparency, visibility, and security help eliminate unethical practices, restore trust in commercial supply chains, and foster a transparent culture (Karakas et al., 2021). BCT promotes a cogoverned supply chain, minimizing intermediary roles and reducing opportunistic behaviors and transaction costs. Prause and Boevsky (2019) highlight smart contracts as transformative BCT applications in SCM, offering the flexibility to incorporate business logic under specified conditions, thus cutting costs and enhancing transparency and trust. Wang et al. (2019) advocate for blockchain's applicability in multistakeholder environments, facilitating transactions without intermediaries and encouraging cooperative behavior among supply chain participants. The potential of blockchain to support the circular economy and sustainability is increasingly recognized, with discussions on its capacity to sync data on carbon

emissions across supply chain levels, thereby improving the integration of environmental considerations in SCM (Biswas et al., 2023; Chaudhuri et al., 2021; Kamble et al., 2021; Kouhizadeh et al., 2021; Manupati et al., 2020).

7.3.1 Demonstrable successes of blockchain technology in supply chain management

The theory of Diffusion of Innovations (DOI) suggests that the primary catalyst for adopting new technology is its distinct advantages over existing solutions (Rogers, 2010). BCT surpasses traditional SCM systems in several key areas, including traceability, transparency, operational costs, authenticity, automation, and sustainability. Because of these benefits, blockchain has been integrated into various stages of the business value chain, encompassing product design, manufacturing, logistics, and customer service postpurchase.

According to the Technology Acceptance Model (TAM), technology adoption is closely linked to its perceived effectiveness in resolving user issues and achieving their objectives (Zhu & Kouhizadeh, 2019). In supply chain systems, blockchain enhances accuracy, reduces costs and time, and increases transparency and efficiency. These improvements enable supply chain managers to fulfill their roles better, thus making blockchain a favored choice across numerous sectors.

Walmart Canada has implemented blockchain to address payment disputes with its 70 third-party freight carriers, which handle over 500,000 shipments yearly (Vitasek et al., 2022). This blockchain system autonomously collects data at every stage, from the initial bid to delivery confirmation and payment approval. The data is updated in real-time and accessible to all relevant parties in the supply chain. This system has rectified significant data mismatches in invoicing and payment processes for freight carriers, reducing reconciliation efforts and preventing severe payment delays. The transparency afforded by Walmart's blockchain system has fostered unprecedented trust between Walmart Canada and its carriers, enhancing supplier relationships, minimizing dispute-related costs, and boosting overall efficiency. However, the system's open access to information, without requiring permissions, poses potential risks to industrial and organizational security standards (Vitasek et al., 2022). Similar security concerns have been noted in other studies (e.g., Baharmand et al., 2021; Zhang & Liu, 2022).

Furthermore, digital retailers increasingly use blockchain to enhance supply-side visibility and combat issues like counterfeit products and food fraud (Xu, He, et al., 2023). An example is Alibaba, which has deployed BCT across its international supply chains to document and track food products. This initiative began in 2018 with the blockchain-based Food Trust Framework, which tracked shipments from Australian healthcare company Blackmores and New Zealand dairy producer Fonterra to China (Zhao, 2018). This blockchain network meticulously records details such as the country of origin, shipping methods, port of departure, port of arrival, and customs procedures (Zhao, 2018). Additionally, BCT helps retailers and manufacturers better understand consumer behavior, thereby helping to stabilize demand fluctuations.

7.4 Sustainability and ethics

Blockchain has demonstrated considerable promise in mitigating environmental and social challenges critically linked to health, safety, and human rights concerns (Saber et al., 2019). For example, manufacturing has capitalized on blockchain's integration with SCM to promote sustainability. According to Manupati et al. (2020), blockchain-enabled strategies have decreased operational costs by

minimizing waste, reducing overproduction, and reducing emissions. Moreover, blockchain assists in monitoring the carbon footprint of products, enabling consumers to make better-informed purchasing choices regarding goods with lower carbon emissions and associated taxes, thereby prompting companies to overhaul their supply chains to cater to these preferences.

Blockchain's impact in remanufacturing sectors has been explored, revealing its capability to log detailed information about each product component, thereby enhancing reproduction decision-making, boosting productivity, and lowering carbon emissions (Xu, Yan, et al., 2023). Furthermore, a game theory model between manufacturers and retailers demonstrated blockchain's effectiveness in reducing environmental degradation (Biswas et al., 2023). However, it is important to note that blockchain's operation can be energy-intensive, potentially increasing emissions and contributing to global warming (Cao & Shen, 2022). Therefore, companies need to balance the environmental costs against the benefits of blockchain adoption.

Blockchain also plays a pivotal role in promoting social sustainability by ensuring fair labor practices and human rights within global supply chains. Integrating blockchain with IoT and big data can automate data collection and recording, preventing data tampering and enhancing traceability to support social sustainability efforts (Quayson et al., 2021). Saberi et al. (2019) pointed out that blockchain enhances supply chain transparency and traceability, offering stronger human rights guarantees and fair labor conditions. Smart contracts, used within blockchain systems, can be programmed to monitor and enforce compliance with regulatory policies, ensuring that products are sourced and produced in an ethical manner. Additionally, the immutable nature of blockchain databases means that any modification of stored data requires consent and verification from authorized entities, making blockchain a robust tool against corruption (Wang et al., 2022). BCT could prevent the misuse of green loans and bolster environmental performance, further highlighting its potential for broader sustainability impacts (Wang et al., 2023).

Fig. 3.4 illustrates the three core technological pillars—BCT, SCM, and AI—that collectively contribute to the sustainability and ethical integrity of the halal industry. Each technology addresses specific challenges within the halal ecosystem:

1. BCT ensures compliance and traceability through decentralization, smart contracts, security, immutability, transparency, and anonymity.
2. SCM oversees the entire lifecycle of halal products, coordinating logistics, suppliers, and verification processes while reducing inefficiencies and fraud.
3. AI enhances auditing, monitoring, and predictive analysis within halal supply chains, making them more responsive and accurate.

The convergence of these technologies supports a halal ecosystem that is not only secure and efficient but also aligned with sustainable and ethical practices, ensuring long-term trust and global market competitiveness.

8. Global variations and challenges

8.1 Overview of existing standards

Multiple halal standards exist worldwide, particularly within the food and beverage (F&B) sector, each developed to suit the unique legal, cultural, and religious contexts of individual countries. These

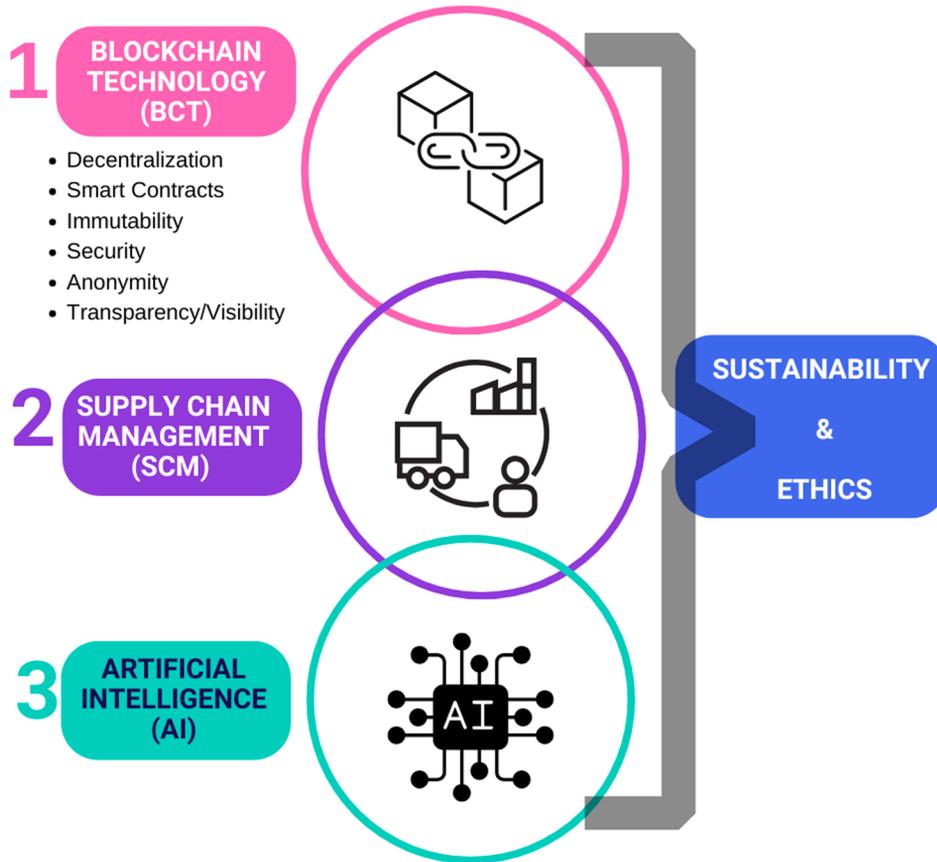


FIGURE 3.4
Integration of technological solutions in the halal industry.

standards establish the requirements for halal food production, handling, slaughtering, packaging, and logistics in accordance with Islamic law. Prominent examples include MS 1500:2019 (Malaysia), MUIS Halal Standard (Singapore), HAS 23000 (Indonesia), Brunei Halal Standard, GSO 2055-1 (Gulf Cooperation Council (GCC) countries including Saudi Arabia, Kuwait, and United Arab Emirates [UAE]), PS 3733 (Pakistan), and the Organization of Islamic Cooperation (OIC)/SMIIC 1:2019 Standard, which seeks to harmonize halal food standards across member states.

In non-Muslim-majority regions such as Europe and North America, these standards often serve as benchmarks for halal certification, with recognition or accreditation from various international halal bodies. The following sections analyze four of the most prominent and globally recognized halal food standards, highlighting their structure, strengths, and areas for improvement.

8.1.1 Malaysia halal standard

The development of Malaysia's halal standards began in 1974 under the Islamic Affairs Division of the Prime Minister's Department, which spearheaded early research and guidance on halal practices. Formal halal certification and auditing processes were introduced in 1994 and 1998, respectively (Halal History, n.d.). Today, these standards are developed by the National Industrial Standardization Committee, chaired by the JAKIM and approved by the Department of Standards Malaysia (DSM). In 2017, Malaysia's halal standards gained international recognition through endorsement by the SMIIC.

Malaysia's halal system encompasses a range of sector-specific standards, including MS 1500: 2019 for food, the MS 2200 series for cosmetics, MS 2424 for pharmaceuticals, and other standards covering logistics, retailing, hospitality, and quality management systems. These collectively ensure that halal-certified products and services meet rigorous quality, safety, and shari'ah compliance requirements, making Malaysia a global leader in halal standardization and certification.

8.1.2 Singapore halal standard

The halal certification system in Singapore is governed by the MUIS, also known as the Islamic Religious Council of Singapore. MUIS operates under the Ministry of Culture, Community, and Youth and has developed a comprehensive set of halal standards and certification frameworks, rather than a single standalone document. These include general guidelines for the handling and processing of halal food, the development and implementation of a Halal Quality Management System (HalMQ), and several certification schemes tailored for different sectors such as food preparation, central kitchens, storage, and logistics (Sugita, 2017).

The MUIS halal standards emphasize hygiene, management control, traceability, and effective segregation practices to ensure both local compliance and alignment with international halal requirements. This system is recognized for its structured and rigorous approach to maintaining the integrity of halal-certified products, and it has positioned Singapore as a trusted hub for halal certification in the region.

8.1.3 Indonesia halal standard

Previously managed by the Assessment Institute for Foods, Drugs, and Cosmetics (LPPOM) of the Indonesian Council of Ulama (MUI), the Indonesia Halal Standard began its development in 1989 and was formalized in 1996. Known as HAS 23000, this standard provides comprehensive guidelines for businesses involved in manufacturing and production, focusing on criteria, general guidelines of the HAS, and policies and procedures for halal certification (Hudaefi & Jaswir, 2019). Established under the Halal Assurance Act (JPH) No. 33 of 2014, the Indonesia Halal Standard includes detailed articles that align with various Indonesian laws and regulations to ensure effective implementation (Hudaefi & Jaswir, 2019). This standard is integral to maintaining the credibility and authenticity of halal products in Indonesia's diverse and populous market.

8.1.4 Halal standard by SMIIC

Based in Istanbul, Türkiye, the SMIIC is an intergovernmental organization focused on standardization. SMIIC aims to establish a universal system for standardization and accreditation in halal certification, enabling the free movement of halal products worldwide based on the OIC/SMIIC standard and related documents (SMIIC, 2013). Although SMIIC is not a certification body, it accredits halal certification bodies (HCBs) globally. The accreditation and conformity assessment processes are

grounded in shari'ah principles and incorporate standards from the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and the Codex standards, ensuring alignment with international norms.

As the sole organization authorized to develop standards for the OIC, SMIIC published its first standard in 2011 with contributions from experts across 39 OIC member states and the International Islamic Fiqh Academy (IIFA). By 2020, SMIIC had published 10 halal-related standards covering various aspects of halal compliance, including slaughtering rules, food processing, machinery, utensils, production lines, storage, display, service, transport, hygiene, sanitation, food safety, validation, verification, identification, traceability, market presentation (packaging and labeling), and legal requirements (SMIIC, 2020; SMIIC and Wace, 2018). Each country implements the SMIIC standards according to its laws, regulations, and needs, which may vary significantly. Adopting these standards involves integrating several international standards, enhancing the robustness and comprehensiveness of the halal certification process.

The global landscape of halal standards is diverse and continually evolving. By understanding and adopting these standards, countries and companies can ensure the integrity and quality of halal products, fostering trust among Muslim consumers worldwide. The efforts to standardize and rigorously enforce halal certification criteria are essential in supporting the growth of the halal market, ensuring compliance with Islamic principles, and meeting the expectations of a rapidly expanding global Muslim population.

8.2 Global leadership and rigorous standards in Malaysian halal certification

The global surge in demand for halal products has led to the emergence of numerous halal-certifying organizations dedicated to protecting consumer rights and ensuring access to authentic halal products and services. These certification bodies—established to meet both local and international needs—often originate from private initiatives, religious councils, or community-based organizations.

Prominent examples from across continents include:

- IFANCA—North America
- Halal Food Council International (HFCI)—South America
- South African National Halaal Authority (SANHA)—Africa
- Australian Federation of Islamic Councils (AFIC)—Oceania
- FIANZ—Oceania
- Halal Certification Europe (HCE)—Europe
- BPJPH—Asia

These bodies collaborate closely with international accreditation organizations and national authorities, such as Malaysia's Department of Islamic Development (JAKIM), to ensure mutual recognition and the harmonization of halal standards globally. This international network reflects the increasing importance of halal integrity in diverse markets and supports the export potential of certified halal products worldwide.

The halal certification requirements of the JAKIM are recognized as some of the most stringent globally. JAKIM is regarded by many as a leader in halal certification, uniquely positioned as a government agency authorized to issue halal certificates and enforce related regulations (Amat, 2006).

Internationally, JAKIM's protocols and guidelines reference the Codex Alimentarius Commission's "General Guidelines for the Use of the Term Halal," established in 1997.

The Malaysian government has continuously refined its national halal standards to maintain its global leadership and ensure comprehensive halal governance. A significant milestone was the introduction of MS 1500:2004, titled "Halal Food—Production, Preparation, Handling and Storage—General Guidelines," which marked the formal standardization of halal practices beyond the fundamental halal-haram dichotomy. This version incorporated essential elements of food hygiene, safety, and Good Manufacturing Practices (GMP). The development process involved multi-stakeholder engagement, including government agencies, nongovernmental organizations (NGOs), academic institutions, and industry representatives. The draft was also circulated internationally for feedback, receiving 17 comments—11 from Islamic organizations and the remainder from institutions in the United States and Europe—all of which were carefully considered in finalizing the standard.

This foundational standard has since undergone further revisions, with the most current being MS 1500:2019 (third revision). The 2019 update enhances clarity and rigor in halal food production, incorporating updated requirements for hygiene, traceability, halal logistics, slaughtering practices, and internal halal control systems. It also aligns more closely with international standards, reaffirming Malaysia's position as a global reference point for halal certification. This evolution reflects Malaysia's ongoing commitment to upholding the integrity, safety, and global competitiveness of halal-certified products.

Malaysia's significant potential to meet global demand for halal food is attributed to its reputation for high-quality halal production standards (Abdul Rahman et al., 2013). A 2005 survey of major importing countries revealed that over 80% of consumers perceive Malaysia as a commendable Islamic nation, with consumer confidence in Malaysian halal products rated higher than those from other Asian and Western nations (Irfan, 2007, p. 36–40). These findings highlight Malaysia's robust framework and rigorous standards in halal certification, positioning it as a global leader in the halal industry. The continuous efforts to enhance and update halal standards and widespread international recognition reinforce Malaysia's pivotal role in the global market.

8.3 Issues and challenges of diverse halal standards

The absence of a uniform halal standard, stemming from the diverse interpretations of Islamic dietary laws by various Islamic schools of thought, presents numerous challenges. For instance, while the Hanafi, the Maliki, and the Hanbali school of Islamic jurisprudence mandate the invocation of the "*tasmiya*" ("*Bismillahi-Allahu Akbar*," meaning "In the name of Allah the greatest") during slaughter, the Shafi'i school does not see it as necessary. This variance extends to different national and sometimes regional standards within the same country, complicating the global halal certification landscape (Al-Mahmood & Fraser, 2023). The lack of a global benchmark leads to increased production costs due to the need to comply with multiple national standards and poses risks when a slaughtering method accepted under one standard is not recognized under another, such as mechanical slaughter and animal stunning.

8.3.1 Diverse halal standards: Implications and challenges

The existence of diverse halal standards across the globe presents both opportunities and challenges for the halal industry. Large- and mid-sized HCBs—typically characterized by their broad operational

scope, international recognition (e.g., by JAKIM or SMIIC), and high certification output across multiple sectors—often adopt multiple standards such as GSO 2055-1:2015, Malaysian Standard MS 1500:2019, and OIC/SMIIC 1:2019 to meet the requirements of various importing countries (Al-Mahmood & Fraser, 2023).

In contrast, smaller HCBs—often with a limited regional focus, fewer staff, and lower annual certification volume—may develop and implement their own certification standards, drawing primarily from independent interpretations of the Qur'an and Hadith. This is particularly evident in the United States, where such HCBs often operate in domestic slaughterhouses and meat processing facilities (Fahmi, 2017). However, these organizations frequently encounter challenges such as counterfeit halal certificates, the misuse of expired halal logos, and a lack of international recognition, all of which complicate certification consistency and undermine consumer trust.

8.3.2 Challenges to establishing a unified halal standard

Despite the perceived benefits, establishing a unified halal standard remains a global challenge. Across various regions, the diversity of halal logos and certification schemes often reflects not just differing interpretations of Islamic law but also strategic branding decisions made by certification bodies. For instance, in countries such as the United States, some HCBs have noted that the wide variety of halal logos is not necessarily due to differing standards but rather a result of each certifier wanting to maintain a distinct brand identity to remain competitive. Meanwhile, smaller HCBs operating in regions such as the Middle East and Southeast Asia have noted that many importing countries require the use of specific halal logos and standards, making harmonization challenging.

Although some stakeholders suggest that a unified halal logo might be feasible—provided all certifiers strictly follow the same standards—such alignment is currently deemed impractical due to variations in national regulations, religious interpretations, and market dynamics. This highlights the complex interplay between religious, regulatory, and commercial interests in the global halal certification landscape.

The absence of a unified halal standard in the United States continues to increase production costs and regulatory complexity for HCBs and exporters. Some standards are perceived as more flexible or less stringent than others, yet there is broad acknowledgment—especially among industry practitioners—of the need for a universally accepted minimum halal standard (Fahmi, 2017).

According to Al-Mahmood and Fraser (2023), insights gathered through interviews with selected representatives from U.S.-based HCBs indicate a growing interest in forming a national halal oversight body or halal hub to coordinate certification, standardization, and compliance efforts. However, respondents in the same study noted that such unification is perceived by many as difficult to achieve due to differences in interpretation, decentralization, and the private nature of halal certification in the United States.

Several HCBs interviewed in the study expressed confidence that international organizations such as the OIC–SMIIC could play a leading role in advocating for a globally unified halal standard. Nevertheless, nearly all respondents—comprising stakeholders from both large and small U.S. certifiers—recognized the significant challenge of establishing a centralized, nationally recognized halal hub in the United States, primarily due to the fragmented and competitive nature of the current certification landscape.

Pursuing a unified halal standard is complex and requires careful consideration of diverse religious interpretations, national regulations, and industry practices (Ratanamaneichat & Rakkarn, 2013).

Achieving this goal would involve extensive collaboration among international bodies, national governments, and halal certification organizations to ensure the standards are comprehensive, universally accepted, and strictly enforced. This effort would streamline the certification process, enhance consumer confidence, and facilitate global trade in halal products.

9. Legal and regulatory framework

The halal food industry is governed by various laws and regulations that differ across jurisdictions. In Malaysia, the legal framework includes the Trade Descriptions Act 2011, which covers specific regulations such as the Trade Descriptions (Certification and Marking of Halal) 2011 and the Trade Descriptions (Definition of Halal) 2011 (Asa, 2017). Additionally, the Food Act 1983, the Animal Act 1953 (Revised 2006), the Consumer Protection Act 1999, and the Customs Act 1967 play significant roles in regulating halal food. Since 1974, the JAKIM and the MAIN have been instrumental in verifying the halal status of food products in Malaysia (Asa & Azmi, 2018).

Internationally, the regulatory landscape varies. Indonesia, for example, has implemented comprehensive halal laws through the Halal Product Assurance Law, mandating halal certification for products entering the Indonesian market. Similarly, the UAE enforces halal compliance through the Emirates Authority for Standardization and Metrology (ESMA), which implements the UAE Halal Certification Scheme. While no unified halal regulation exists in Europe, countries such as France and the United Kingdom have developed guidelines and certification processes to cater to their Muslim populations.

9.1 Gaps in the legal framework

Despite these regulatory frameworks, significant gaps hinder the effective enforcement of halal compliance. One major issue is the lack of standardization across different countries, leading to confusion among consumers and producers about what constitutes halal (Asa, 2019). For instance, slight variations in the interpretation and implementation of halal standards between countries such as Malaysia, Indonesia, and the UAE reflect diverse local contexts, which may pose challenges for harmonizing international trade and ensuring consistent consumer understanding.

Another gap is the limited enforcement power of HCBs. Organizations like JAKIM can certify products in many jurisdictions but lack the authority to prosecute violations (Asa, 2019). Enforcement typically falls to other governmental bodies that may not specialize in halal standards, leading to ineffective regulation and potential misuse of halal labels. Furthermore, inadequate monitoring and auditing of certified entities allow noncompliance to go unnoticed.

9.1.1 Additional context on halal demand and legal evolution

The demand for halal products is rapidly increasing not only in Malaysia but also in many countries worldwide. This growth is closely tied to global demographic shifts, particularly the steady rise in the Muslim population. According to projections by the Pew Research Center (Lipka, 2017), the global Muslim population was expected to reach nearly 3 billion by the year 2060, accounting for approximately 30% of the world's total population. While we are now in 2025, current estimates place the Muslim population at around 2 billion, affirming the continued expansion of the global halal market.

These demographic trends highlight the critical need for robust standards and legal frameworks to ensure that products comply with halal requirements as prescribed by Islamic law, particularly those outlined in the Qur'an (*Al-Baqarah* 2:172–173; *Al-Maidah* 5:3) (Othman, 2014). Additionally, communities around the world are developing a more comprehensive understanding of the halal concept, increasingly recognizing it as a holistic lifestyle that encompasses ethical consumption, cleanliness, and overall well-being (Asa & Azmi, 2018).

Malaysian law has evolved to keep pace in response to the halal industry's expansion. The legal framework governing halal products includes the Trade Descriptions Act 2011 and related regulations (Sahari et al., 2022). Other relevant legislation includes the Food Act 1983, the Animal Act 1953 (Revised 2006), the Consumer Protection Act 1999, and the Customs Act 1967. JAKIM collaborates extensively with various government bodies, such as the Ministry of Domestic Trade and Costs of Living, the DSM, the Department of Veterinary Services, the Ministry of Health, and the Customs Department (Sahari et al., 2022). These entities play significant roles in enforcing halal compliance. Additionally, the Halal Development Corporation Berhad (HDC) works closely with these agencies to foster the growth of the halal industry in Malaysia, aiming to position the nation as a leading international halal hub.

9.1.2 Addressing enforcement issues and prosecution challenges

A critical review of JAKIM's enforcement effectiveness reveals significant limitations. Current legislation only allows JAKIM to withdraw halal certification; it does not grant authority to prosecute violators. Prosecutorial actions are handled by the “Kementerian Perdagangan Dalam Negeri dan Kos Sara Hidup” (KPDN)—Ministry of Domestic Trade and Cost of Living, which collaborates with JAKIM primarily to monitor and verify compliance with halal standards (Ibrahim et al., 2012). JAKIM's role is to identify noncompliance and testify in related legal cases. KPDN has the authority to seize goods and impose penalties on entities such as eateries, food product manufacturers, and slaughterhouses (Sahari et al., 2022). This delineation of responsibilities highlights a notable enforcement gap: JAKIM, while central to halal certification, lacks comprehensive legal powers to enforce these standards independently. For more effective regulation of halal products, it would be prudent for JAKIM to certify and be endowed with broader enforcement powers to address violations directly (Hassan, 2007).

Prosecution is intricately linked with enforcement issues. Currently, enforcement related to halal certification by JAKIM, along with KPDN, tends to blur, as the Ministry of Domestic Trade and Cost of Living handles halal product cases and a broader spectrum of violations. KPDN lacks dedicated halal units, whereas JAKIM has established its own Halal Hub Division of Monitoring and Enforcement (Rahman et al., 2018). This separation often results in enforcement and prosecution inefficiencies due to the involvement of multiple parties.

For JAKIM to take on prosecutorial duties, several prerequisites must be met. Firstly, JAKIM personnel would need appropriate legal qualifications to operate within civil courts, as the jurisdiction for prosecuting halal product violations falls under civil law. Secondly, legislative changes are necessary to empower JAKIM officials with prosecutorial authority. Lastly, it is important to recognize that certain halal-related offenses fall under the jurisdiction of shari'ah law, such as those outlined in Section 42 of the Shari'ah Criminal Offenses (Federal Territories) Act 1997, where the Chief Prosecutor of the states holds prosecutorial powers. Any proposal to extend prosecutorial powers to JAKIM

officials must be thoroughly evaluated from multiple perspectives to ensure legal and practical feasibility (Hassan, 2007).

9.2 Drafting the Halal Malaysia Act

Since 2010, there has been an ongoing discussion about establishing the Halal Malaysia Act. Announced during the 2010 budget presentation, the Malaysian government proposed this act to consolidate and enhance the legal framework surrounding halal certification processes, procedures, and controls. Despite these discussions, the act has yet to be presented in Parliament for enactment into law (Ahmad, 2015).

9.3 Proposals for regulation

To enhance the legal oversight of the halal food industry, several measures can be proposed to address existing gaps and improve regulatory effectiveness:

1. **Global Standardization:** Efforts should be directed toward creating a unified global standard for halal certification. This standardization, endorsed by major Islamic organizations such as the OIC, would harmonize halal certification criteria across different countries. A unified standard would streamline the certification process, reduce confusion among consumers and producers, and facilitate international trade (Aziz, 2023). Standardization would also enhance consumer confidence in halal products by ensuring market consistency and reliability.
2. **Enhanced Enforcement Capabilities:** In Muslim-majority countries with centralized halal governance—such as Malaysia—HCBs like JAKIM could be empowered through legislative reform to possess broader legal authority to enforce compliance and prosecute violations. This includes powers to impose penalties, conduct regular audits, and initiate legal proceedings against noncompliant entities (Akram, 2020). Such legal empowerment would strengthen enforcement mechanisms and improve adherence to halal standards, reducing the misuse of halal labels.

In contrast, in non-Muslim-majority countries, HCBs are often privately operated and function without legal enforcement authority. In these contexts, enforcement capabilities can be improved through:

- Mutual recognition agreements with importing countries that require rigorous standards and transparency.
- Voluntary accreditation systems overseen by national food regulatory agencies or religious councils, which assess and recognize trustworthy HCBs based on adherence to established international standards (e.g., OIC/SMIIC, MS 1500, GSO).
- Industry self-regulation and internal auditing systems, where HCBs adopt strict certification criteria and accountability mechanisms to maintain credibility and build trust with both Muslim consumers and regulatory bodies abroad.

Encouraging collaboration between private HCBs and national food safety authorities or halal accreditation councils can help ensure that halal certification maintains its integrity even in decentralized or secular regulatory environments.

1. **Leveraging Technology:** BCT can significantly enhance transparency and traceability in the halal supply chain. Blockchain provides an immutable record of the entire production process, ensuring that products labeled as halal meet all necessary criteria from farm to table. This technological integration would boost consumer trust by offering verifiable proof of compliance and streamline regulatory oversight by providing real-time access to certification and audit information (Gurtu & Johnny, 2019). Implementing BCT could also reduce the risk of fraud and improve the efficiency of halal certification processes.
2. **Comprehensive Legal Framework:** Establishing a comprehensive legal framework consolidating various aspects of halal regulation under a single authoritative body would enhance efficiency and accountability (Ab Halim et al., 2022). This unified body could oversee certification, enforcement, and consumer education, ensuring a holistic approach to maintaining halal standards. By centralizing halal regulation, the industry can eliminate redundancies, improve coordination among regulatory agencies, and provide clear guidance to producers and consumers (Ab Halim et al., 2022). This framework would also facilitate better resource allocation for monitoring and enforcement activities.
3. **Addressing Resistance and Misconceptions:** One of the more pressing challenges in the global halal movement is the emergence of resistance in certain quarters—often rooted in political or ideological opposition rather than substantive concerns. In some cases, halal certification is falsely perceived as a form of religious imposition or cultural isolation. To counter such narratives, regulatory bodies and halal advocates must invest in proactive public relations strategies, emphasizing the universal values embedded in halal standards—such as hygiene, sustainability, animal welfare, and ethical sourcing.

Moreover, inclusive messaging that frames halal as part of a broader framework of consumer rights and food quality assurance can shift perceptions. Engaging with civil society, consumer rights organizations, and academic institutions in non-Muslim countries provides opportunities to educate the wider public, reduce friction, and promote halal certification as a transparent, accountable, and voluntary practice that respects local laws and values diversity.

Addressing these gaps and implementing these proposals can ensure compliance and foster consumer trust worldwide, enabling the halal food industry to achieve more robust and effective regulation. These measures will enhance halal certification's credibility and support the industry's growth and development in the global market.

10. Role of consumer awareness and education

10.1 Educating consumers

Educating consumers about halal certification ensures they make informed choices that align with their religious, ethical, and health considerations. As the demand for halal products grows globally, raising awareness about what halal certification entails, its benefits, and how consumers can verify the authenticity of halal claims becomes increasingly important. This can be achieved through various strategies targeting different population segments and utilizing various educational methods (Said et al., 2014). Stakeholders can significantly enhance consumer understanding and trust in halal certification by implementing public workshops, collaborations with educational institutions, digital

platforms, informational campaigns on social media, and mobile applications (Erdem et al., 2015). The following points outline these strategies in detail, providing a comprehensive approach to educating consumers about halal certification.

1. **Public Workshops and Seminars:** Public workshops and seminars serve as powerful tools to educate consumers about the intricacies of halal certification (Jannah & Al-Banna, 2021). These events can feature a range of speakers, including religious scholars who can explain the theological basis of halal, industry experts who can discuss practical applications and standards, and health professionals who can highlight the health benefits of consuming halal products (Sudrajat, 2022). These comprehensive sessions allow for direct interaction, where consumers can ask questions and engage in discussions, enhancing their understanding and trust in halal certification.
2. **Collaborations with Educational Institutions:** Integrating halal certification topics into the curricula of schools, universities, and vocational training centers can raise awareness from a young age (Rachman & Sangare, 2023). This strategy ensures that future consumers and professionals in the food industry understand the importance of halal practices (Risza, 2024). Educational programs can include case studies, practical workshops, and guest lectures from industry experts, providing students with a well-rounded understanding of halal certification and its significance in global markets (Ruslan et al., 2018).
3. **Use of Digital Platforms:** Digital platforms such as online courses, webinars, and informational websites can reach a global audience, offering flexible learning opportunities for consumers (Alomari et al., 2020). These platforms can provide detailed information about halal certification processes, standards, and benefits (Jannah & Al-Banna, 2021). Interactive elements such as Q&A sessions, discussion forums, and quizzes can enhance engagement and understanding, making learning more accessible and comprehensive.
4. **Informational Campaigns on Social Media:** Social media platforms are powerful tools for disseminating information quickly and widely (Aminah, 2023). By leveraging platforms like Facebook, Instagram, Twitter, and YouTube, organizations can share short videos, infographics, and articles that explain the halal certification process, its significance, and how to identify halal products (Abd Jalil et al., 2021; Wibowo et al., 2022). Social media campaigns can reach diverse audiences, including younger consumers who are more likely to engage with digital content.
5. **Mobile Applications:** Mobile applications dedicated to halal certification can offer consumers a convenient way to access information about halal products (Petiwala et al., 2021). Features like barcode scanners for instant verification of halal status, directories of certified halal products and restaurants, and notifications about new certifications can enhance consumer confidence and ease of access (Jannah & Al-Banna, 2021). These apps can also provide educational content about halal principles and updates on industry standards.
6. **Magazines, Books, Exhibitions, and Podcasts:** Beyond digital and institutional methods, traditional and creative media also play a valuable role in consumer education. Regular magazines and special issues focused on halal topics can cover diverse angles—from market trends and certification updates to interviews with halal entrepreneurs. Leisure and educational books tailored for children and adults alike can further reinforce halal values. For younger readers, illustrated books and engaging stories can introduce concepts such as halal food, ethical consumption, and purity in a relatable way.

Meanwhile, exhibitions—whether standalone halal expos or integrated into broader events—offer immersive experiences. Consumers can gain firsthand exposure to halal-certified products and services through live cooking demonstrations, interactive booths, and expert talks. Lastly, podcasts are emerging as a popular tool for learning on the go. Weekly or monthly shows featuring scholars, auditors, or halal entrepreneurs allow for a deeper exploration of issues related to certification, consumer challenges, and global best practices—often in an engaging, narrative-driven format.

10.2 Enhancing consumer awareness

Enhancing consumer awareness about halal certification ensures that individuals can make informed choices that align with their values and dietary requirements. As the global market for halal products continues to expand, increasing consumer knowledge through targeted campaigns and initiatives becomes paramount. Effective strategies include nationwide awareness campaigns, designated Halal Certification Week (a series of events, conferences, and seminars focused on halal certification, standards, and the broader halal industry), influence partnerships, community outreach programs, and improved labeling and packaging information. Each method offers unique benefits in spreading crucial information about halal certification processes, the significance of certification, and how to identify halal products. The following points provide a detailed overview of these strategies, campaigns, and initiatives, highlighting their role in raising consumer awareness and fostering a deeper understanding of halal certification.

Nationwide Awareness Campaigns (Adaptable to Minority Context): Nationwide awareness campaigns are large-scale initiatives designed to educate the public about halal certification. They typically use a variety of media platforms—television, radio, print, and digital channels—to reach wide and diverse audiences (Jannah & Al-Banna, 2021). In Muslim-majority countries, such campaigns are often government-led or co-organized with national halal authorities and enjoy strong institutional support.

However, in non-Muslim-majority countries, particularly those with “nonvisible” Muslim minority communities (where Muslim populations are smaller or less publicly represented), private HCBs can still play a vital role. While they may not operate at a nationwide level due to resource or policy limitations, they can:

- Launch targeted regional or city-level campaigns tailored to local Muslim communities.
- Collaborate with local mosques, halal retailers, or Islamic organizations to co-organize awareness events or media engagements.
- Use social media platforms and ethnic radio/newspapers to deliver multilingual, culturally relevant content to specific Muslim audiences.
- Advocate for halal education through schools, universities, or community centers, using simplified materials to explain halal certification.
- Partner with national food safety authorities or multicultural affairs offices, which often support faith-based dietary education.

The key message remains relevant regardless of scale, explaining what halal certification means, why it matters, and how consumers can verify halal status. These grassroots-level campaigns not only educate Muslim consumers but also build interfaith and public understanding of halal as a matter of consumer rights, ethical standards, and food safety.

- a) **Halal Certification Weeks:** Halal Certification Weeks are designated periods during which concentrated efforts are made to raise awareness about halal certification. These weeks can feature promotional events, educational workshops, special offers on halal-certified products, and media coverage (Calder, 2020). The goal is to generate significant public interest and media attention, making halal certification highly visible (Haleem et al., 2020). Retailers, restaurants, and food producers can participate by highlighting their halal-certified products and offering discounts or special deals. Additionally, informational booths and pop-up events in public spaces can provide direct engagement opportunities for consumers.
1. **Influencer Partnerships:** Partnering with influencers, including social media personalities, celebrities, and community leaders, can significantly amplify the message of halal certification awareness (Wilson & Liu, 2010). Influencers have the power to reach large and engaged audiences, making them effective at spreading information. They can share personal stories, endorsements, and educational content about halal certification, making the information more relatable and trustworthy for their followers (Rahim et al., 2021). Influencer campaigns can include sponsored posts, videos, live sessions, and collaborations with HCBs to create content that resonates with a broad audience.
 2. **Community Outreach Programs:** Community outreach programs involve organizing educational events and activities within local communities, particularly in community centers, mosques, and other local gathering places. These programs provide a more personal touch by allowing direct interaction between educators and community members (Mardhiyah et al., 2023). Activities can include workshops, Q & A sessions, informational booths, and distribution of educational materials (Ali et al., 2017). These programs aim to build trust and understanding at the grassroots level, making information about halal certification more accessible and tailored to the specific needs and concerns of the community.
 3. **Labeling and Packaging Information:** Clear and informative labeling on halal-certified products is crucial for educating consumers at purchase (Alfaini et al., 2024). Labels should include the halal certification logo, a brief explanation of what halal certification entails, and the certifying body's information (Labolo et al., 2023). Packaging can also feature QR codes that consumers can scan for more detailed information about the product's halal certification process. This transparency helps consumers make informed decisions and builds trust in the certification process. Additionally, educational campaigns can be run to inform consumers about how to read and understand these labels.

10.3 Impact of consumer pressure

The influence of consumer pressure on industry standards and practices in the halal food sector is significant and multifaceted. As consumers become more informed and vocal about their expectations, their demands can drive substantial changes within the industry. Understanding and analyzing these consumer pressures is crucial for stakeholders aiming to maintain high halal certification and compliance standards (Susanty et al., 2022). Key areas impacted by consumer demands include the role of consumer advocacy groups, the importance of market research and surveys, the implementation of public feedback mechanisms, the necessity for transparent reporting by companies, the benefits of industry collaboration, and the positive impact of corporate social responsibility (CSR) initiatives. The

following points delve into how these factors shape industry practices, ensuring that they align with consumer expectations and uphold the integrity of halal certification.

Below are some of the key points analyzing how consumer demands influence industry standards and practices:

1. **Consumer Advocacy Groups:** Consumer advocacy groups play a crucial role in the halal food industry by lobbying for stricter standards and acting as watchdogs to ensure compliance (Islami, 2023). These groups are often composed of concerned consumers, religious scholars, and industry experts who collectively work to uphold the integrity of halal certification (Susanty et al., 2022). They can influence policy by participating in public consultations, submitting feedback on regulatory proposals, and campaigning for better enforcement of existing standards (Harahap, 2022). Additionally, they provide a platform for consumers to voice their concerns and experiences, fostering a community-driven approach to maintaining halal integrity.
2. **Market Research and Surveys:** Regular market research and surveys are essential for understanding consumer preferences and demands. These surveys can gather data on consumer awareness, attitudes toward halal certification, and purchasing behaviors. The insights gained can guide industry practices and standards, ensuring they align with consumer expectations (Fitria et al., 2019). For example, if research shows a high demand for more stringent halal certification processes, industry stakeholders can respond by implementing higher standards and more rigorous verification procedures.
3. **Public Feedback Mechanisms:** Establishing robust public feedback mechanisms allows consumers to communicate directly with HCBs and food producers (Md Nawi et al., 2023). These mechanisms can include online feedback forms, customer service hotlines, and social media platforms where consumers can report issues or suggest improvements (Zainuddin et al., 2024). Regularly reviewing and responding to this feedback helps identify areas for improvement, address consumer concerns, and enhance the overall transparency and reliability of the halal certification process.
4. **Transparent Reporting by Companies:** Transparency in the halal certification process is critical for building consumer trust. Companies can demonstrate their commitment to high standards by providing detailed reports on their certification processes, including sourcing, production, and auditing procedures. Transparent reporting can also publish annual sustainability and compliance reports highlighting achievements and improvement areas (Nusran et al., 2023). Companies can foster a sense of accountability and integrity by being open about their practices.
5. **Industry Collaboration:** Collaboration among industry stakeholders, including HCBs, food producers, retailers, and consumer groups, is essential for developing best practices and continuously improving halal standards (Deuraseh et al., 2020). Collaborative efforts can lead to the creation of standardized guidelines, shared resources for training and auditing, and joint initiatives to raise awareness and educate consumers (Md Nawi et al., 2023). Such cooperation ensures that all parties are aligned to maintain high halal standards.
6. **CSR Initiatives:** CSR initiatives focused on halal certification can enhance a company's reputation and contribute to the overall development of the halal industry (Giyanti et al., 2021). These initiatives can include funding for halal research, community education programs, and partnerships with certification bodies to support their efforts (Jaiyeoba et al., 2023). Companies

can also engage in ethical sourcing and fair-trade practices, ensuring their supply chains are halal-certified and socially responsible.

11. Future outlook

The halal food industry is poised for substantial growth, driven by the expanding global Muslim population and a growing interest from non-Muslim consumers who view halal products as safer and more ethical. The global halal market, encompassing food, pharmaceuticals, cosmetics, and fashion, is anticipated to experience significant expansion as demand increases. Technological advancements will play a pivotal role in driving this growth. For example, BCT can enhance traceability and transparency in the halal supply chain, enabling consumers to verify the halal status of products from farm to table (Masudin et al., 2022). AI can also optimize supply chain processes, ensuring efficiency and reducing contamination risks. Integrating halal certification with sustainability practices will also become more prominent, aligning with global ethical and environmentally friendly consumption trends (Battour et al., 2022). Companies that adopt sustainable practices alongside halal certification will likely attract a broader consumer base that values religious and environmental ethics.

Several key reforms are essential to address existing loopholes in the halal certification process. Standardizing halal certification criteria across different countries is a significant step, as the lack of a unified standard leads to inconsistencies and confusion among consumers and producers (Islam et al., 2023). A global standard endorsed by major Islamic organizations could streamline the certification process and build greater trust (Islam et al., 2023). Implementing stricter regulations and conducting regular audits are crucial to preventing fraudulent certifications and ensuring that all certified products meet the required standards. Adopting advanced technologies such as blockchain can provide an immutable record of the entire supply chain, ensuring transparency and traceability. A unified global HCB could oversee these standards and reforms, ensuring a consistent and trustworthy certification process worldwide.

Consumer awareness and education are crucial in the halal food industry. Practical strategies to educate consumers, enhance awareness, and leverage consumer pressure can significantly improve industry standards and practices. The future of the halal food industry looks promising, with potential for substantial growth and technological advancements. However, addressing current loopholes through reforms such as standardization, stricter regulations, and enhanced transparency will be essential. As the industry evolves, continuous efforts to educate consumers and uphold high standards of halal compliance will be vital to maintaining trust and ensuring the integrity of halal products. By implementing these measures, the halal food industry can meet the growing demands of consumers and continue to expand its global reach.

AI disclosure

During the preparation of this work, the author(s) used ChatGPT and Grammarly in order to improve the readability and language of the work. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Beyond Halal

Exploring Dietary Preferences, Novel Ingredients and Techniques

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Addresses the fragmented nature of information surrounding sustainable and ethical food production, consumer behavior and preferences, nutrition and dietary choices, new food innovation, and supply chain transparency in halal practices

In a world where dietary choices, sustainability, and supply chain transparency are becoming increasingly intertwined, *Beyond Halal: Exploring Dietary Preferences, Novel Ingredients, and Techniques* sheds light on the ethical and dietary considerations and challenges that arise in the context of halal food practices. Written by leading experts of halal food studies in their respective fields, *Beyond Halal: Exploring Dietary Preferences, Novel Ingredients, and Techniques* not only addresses the aspects of sourcing, production, distribution, and certification, but also examines the applications of nanomaterials in ethical and sustainable food production and explores the use of sustainable aquaculture practices to meet the dietary preferences of halal consumers. This book takes a deep dive into the intersection of molecular gastronomy and health in the context of ethical food production, discusses plant-based innovation in halal cuisine, and examines consumer behavior and preferences in relation to halal practices. It also discusses the application of blockchain technology in enhancing transparency and integrity in the halal supply chain, while focusing on the impact of consumer choices and ethical considerations.

Key features

- Addresses the challenges in ethical food production and halal practices
- Explores the intricacies of the halal food supply chain, while addressing sourcing, production, distribution, and certification
- Investigates the use of sustainable aquaculture practices to meet the dietary preferences of Halal consumers
- Elucidates plant-based innovation in halal cuisine
- Examines consumer behavior and preferences within ethical and halal contexts



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