

Research Article

Fostering Sustainable Partnership in the Halal Sector: A Triple Helix Model for Enhanced Food Security and Graduate Employability

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Abstract.

The global food system faces significant challenges in ensuring food security, food safety, and sustainability, which are vital for public health and economic stability. In Malaysia, the halal food supply chain is under increasing pressure to meet the rising demand for Shariah-compliant practices while also addressing sustainability concerns. However, the current system lacks an integrated framework that brings together universities, industries, and government agencies. Furthermore, there is a notable skills gap among graduates, making it difficult for them to meet industry requirements, thereby limiting their employability. Given these challenges, there is an urgent need for a model that not only enhances food security and safety but also improves the employability of graduates through sustainable and Shariah-compliant practice. This research seeks to address these issues by developing a sustainable Shariah-compliant model that enhances Malaysia's food security and safety. The approach will be grounded in the triple helix model, which fosters collaboration between academia, industry, and government. This model aims to bridge the gap between theoretical knowledge, industrial needs, and government policies. This research uses quantitative research, in the form of surveys among graduates and employers, will explore the existing skill gap and assess metrics related to food safety and security. The expected outcomes of this research are multifaceted. First, it aims to enhance food security by developing a comprehensive model for Shariah-compliant food production that aligns with Malaysia's sustainability and food safety goals. Second, the employability of graduates will be significantly improved through the acquisition of industry-relevant skills, particularly in the halal sector. Third, the research will strengthen collaboration between academia, industry, and government, leading to more effective knowledge transfer, policy-making, and industrial innovation. Finally, the research will promote sustainability within halal practices, encouraging the halal industry to adopt environmentally friendly methods without compromising Shariah compliance.

Keywords: triple helix model, Shariah compliance, food security, food safety

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1. INTRODUCTION

Food security and safety remain critical global challenges, especially in developing nations like Malaysia, where the pressures of growing populations, resource limitations, and climate change exacerbate vulnerabilities in food production systems [1]. As Malaysia aims to secure its food supply, ensuring the availability of safe and nutritious food is further complicated by the need to comply with religious and ethical principles, such as Shariah law. These principles mandate specific ethical, hygienic, and environmental practices in food production, which are integral to maintaining both religious compliance and consumer trust [2].

Moreover, the importance of sustainability in agriculture has gained significant attention, particularly for its role in mitigating environmental degradation and ensuring long-term productivity [3, 4]. However, the concept of integrating Shariah-compliant sustainability into agricultural practices is still an emerging field. This convergence offers an opportunity to simultaneously address food security and safety while adhering to Islamic ethical values.

Additionally, the agribusiness sector faces another challenge—a skills gap. Graduates entering the workforce often lack the competencies required to meet the evolving demands of the industry. This skills mismatch has been widely recognized as a factor contributing to low employability among graduates. A promising solution to this challenge is the Triple Helix model, which emphasizes collaboration between academia, industry, and government to better align educational outcomes with industry needs [5]. The introduction of the article presents the background of research/ scientific writing, the literature review that directs the introduction to the problem formulation. The last paragraph contains the purpose of research/article writing.

2. LITERATURE REVIEW

2.1. Food Security and Safety

Food security, as defined by the Food and Agriculture Organization (FAO), is the assurance that all people have access to sufficient, safe, and nutritious food at all times. In recent years, food security has been increasingly threatened by various factors, such as rapid population growth, climate change, and inefficiencies in food production systems. These challenges are especially pronounced in developing countries, where

limited resources and technological infrastructure gaps further complicate efforts to maintain stable food supplies [1].

In Malaysia, food security is closely tied to the United Nations Sustainable Development Goals (SDGs), notably Goal 2: Zero Hunger, and Goal 12: Responsible Consumption and Production. Malaysia's approach to addressing food security focuses on improving agricultural productivity, adopting climate-resilient farming methods, and enhancing food supply chain efficiency. These initiatives align with Shariah principles, which emphasize sustainability, resource stewardship, and equitable resource distribution.

Climate change presents significant risks to Malaysia's agricultural sector, impacting crop yields and food availability. In response, the government has implemented policies aimed at promoting sustainable agriculture, such as the National Agrofood Policy (NAP) and initiatives encouraging the adoption of smart farming technologies. These measures seek to improve resource efficiency, reduce waste, and increase resilience to climate disruptions, contributing to the achievement of SDG targets.

Additionally, digital traceability and precision farming techniques are becoming essential tools for ensuring food safety and security in Malaysia. These technologies allow real-time monitoring of food production processes, ensuring compliance with Shariah principles and global sustainability standards. By addressing inefficiencies and promoting transparency within the food supply chain, Malaysia can strengthen its food system to meet both domestic and international demands.

Integrating Shariah compliance with SDG-driven strategies for food security offers a holistic framework to tackle Malaysia's challenges. The alignment of ethical, religious, and sustainability principles fosters innovation and collaboration across sectors, ensuring long-term food security while contributing to global sustainability goals.

2.2. Shariah Compliance in Halal Sector

Shariah compliance within the halal sector ensures that all processes, from production to consumption, strictly adhere to Islamic principles. Beyond food production, Shariah compliance encompasses a broader range of products and services, reflecting the holistic nature of Islamic teachings. Halal certification, which is pivotal in Muslim-majority nations like Malaysia, is increasingly recognized globally, driven by the rising demand for ethically and sustainably produced goods [2]. This global trend underscores the

importance of integrating Shariah-compliant principles into various sectors, including pharmaceuticals, cosmetics, and logistics.

Research on Shariah-compliant systems in the halal sector emphasizes their alignment with contemporary ethical, hygienic, and sustainability standards. These principles advocate for the responsible use of resources, humane treatment of animals, waste reduction, and environmental stewardship, aligning seamlessly with global sustainability goals [5]. For example, Shariah principles encourage the avoidance of harm (darar) and emphasize mutual benefit (maslahah), which resonate with modern sustainability frameworks.

Despite these synergies, further research is needed to fully incorporate Shariah-compliant practices into modern, sustainable production and supply chain systems. Studies have begun to explore their potential contributions to enhancing food safety, security, and overall quality assurance in the halal sector [6]. This is particularly pertinent in the context of digital traceability technologies, which can ensure transparency and integrity in halal certification processes. By adopting innovative tools, stakeholders can enhance trust and efficiency in the halal supply chain, meeting both Shariah requirements and consumer expectations.

The evolving dynamics of the halal sector demand continuous scholarly engagement to address emerging challenges and leverage opportunities. As global interest in halal-certified products grows, integrating Shariah compliance with advanced technological and sustainable practices will be crucial for ensuring both adherence to Islamic principles and alignment with global market trends. Recent studies emphasize the need for a multidisciplinary approach to understand and optimize the interplay between Shariah compliance, technological innovation, and sustainability [7, 8].

2.3. The Triple Helix Model: Academia-Industry-Government Collaboration

The Triple Helix model of collaboration between academia, industry, and government is an essential framework for fostering innovation and economic development [9]. In the context of agribusiness, the model encourages the development of sustainable and efficient food production systems through joint research and innovation efforts. By leveraging the expertise of academia, industry, and government, this model can address key challenges in food security, sustainability, and employability [9, 10, 11]. Recent research emphasizes the importance of this collaborative approach in enhancing technological

advancements and fostering the development of new food safety protocols [12, 7]. The model also supports the development of innovative solutions to global food challenges through sustainable agribusiness practices.

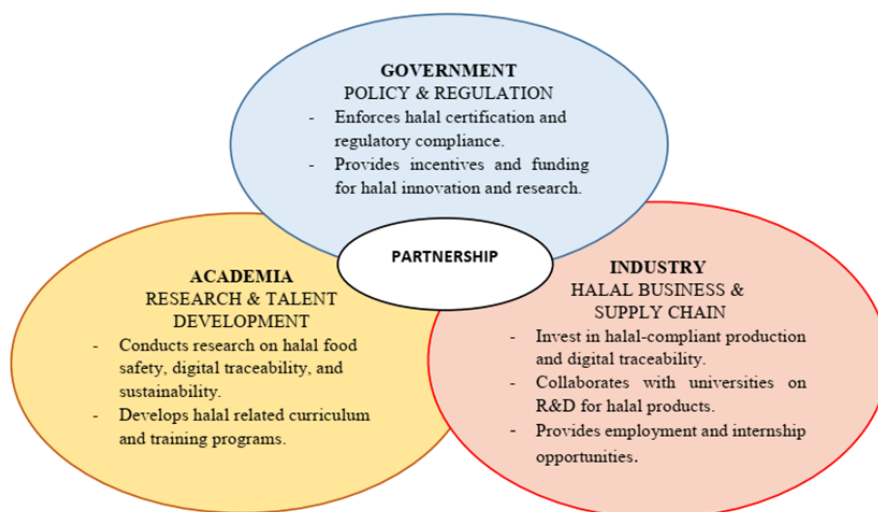


Figure 1: A Triple Helix Conceptual Framework Model for Enhanced Food Security and Graduate Employability.

The model in Figure 1 is recognized for fostering the development of agricultural technologies, such as precision farming and digital traceability systems, which play a significant role in enhancing food security and sustainability [13]. Furthermore, the model supports the creation of policies that balance economic growth with environmental sustainability, aiding the shift toward more responsible agribusiness practices. This collaborative framework also helps bridge the gap between research and its practical application, especially in developing countries, where slow technology adoption can be a barrier. By involving all three sectors, the Triple Helix model accelerates the implementation of innovative solutions that address local food security issues while aligning with broader global sustainability goals [14].

Through joint efforts, universities can share cutting-edge research, industries provide infrastructure and commercialization pathways, and governments create policies and funding mechanisms to support innovation [12]. This synergy leads to the development of practical solutions that enhance the sustainability, resilience, and efficiency of the global food system.

In conclusion, the Triple Helix model in Figure 1 is a powerful tool for fostering innovation and collaboration in agribusiness, supporting the development of sustainable food production systems, and addressing global food security challenges. As this model

continues to evolve, it will be essential in meeting future food security demands while promoting environmental stewardship and social equity.

2.4. Graduate Employability and Skills Development

Graduate employability is increasingly critical in the context of changing industry demands. In agriculture and agribusiness, there is a recognized need for specialized skills in sustainability, food safety, and digitalization [15]. Recent studies emphasize the importance of aligning curricula with industry needs, ensuring that graduates are equipped with practical, industry-relevant skills alongside academic knowledge [16]. The Triple Helix model offers a solution to these challenges by fostering collaboration between educational institutions and industry [17]. By engaging students in internships, research projects, and innovation initiatives, this model enhances graduate employability and provides valuable opportunities for students to gain real-world experience [11, 17].

3. RESEARCH QUESTIONS AND RESEARCH OBJECTIVES

3.1. Research Questions

Three primary research questions and corresponding objectives to address these pressing issues comprehensively. The first research question explores: What are the current challenges in implementing Shariah-compliant practices in Malaysia's food production systems? Shariah-compliant food production aligns with the ethical and religious values of Malaysia's predominantly Muslim population. However, the implementation of such practices faces several challenges, including inconsistent regulatory enforcement, gaps in certification processes, and limited awareness among stakeholders. Investigating these issues will shed light on the barriers hindering the adoption of Shariah-compliant standards and offer insights into potential solutions.

The second research question examines: What are the key factors influencing graduate employability in the halal sector, and how can sustainability and compliance frameworks improve these rates? The halal sector in Malaysia holds significant potential for job creation, yet many graduates struggle to secure relevant employment. Factors such as mismatches between academic training and industry requirements, a lack of practical skills, and insufficient exposure to sustainability practices often contribute to

this gap. By identifying these key factors, the study seeks to recommend ways in which sustainability and compliance frameworks can enhance graduate employability.

The third research question focuses on: What are the roles of academia, industry, and government in promoting both ethical food production and graduate employability? Collaboration between these three entities—commonly referred to as the Triple Helix model—is essential to fostering an ecosystem that supports both ethical practices and workforce development. Academia plays a pivotal role in research and talent cultivation, industry drives innovation and practical application, and government provides regulatory and financial support. This research aims to unravel how these stakeholders can work synergistically to achieve shared goals. The corresponding research objective is: To examine the roles of academia, industry, and government in promoting ethical food production and enhancing graduate employability through collaborative frameworks like the Triple Helix model.

3.2. Research Objectives

The objectives of this study are multifaceted, focusing on critical aspects of Malaysia's food production systems and halal sector. Firstly, the research seeks to investigate the current challenges faced in implementing Shariah-compliant practices within Malaysia's food production systems. This exploration aims to shed light on the obstacles that hinder adherence to Islamic principles in food production and identify potential solutions to address these issues.

Secondly, the study aims to identify the key factors influencing graduate employability in the halal sector. It will examine how integrating sustainability practices and compliance frameworks can enhance employability rates, preparing graduates for the demands of a rapidly evolving industry.

Third, the research intends to examine the roles of academia, industry, and government in promoting ethical food production and improving graduate employability. By leveraging collaborative frameworks like the Triple Helix model, the study aims to highlight strategies for fostering partnerships that align with ethical, sustainable, and employment-focused objectives. These goals collectively contribute to addressing pressing challenges and advancing the development of Malaysia's agribusiness and food production sectors.

TABLE 1: Interconnections between SDGs, Food Security, Safety, and Employability in Malaysia. (Source Malaysia’s Voluntary National Review (VNR) (2021) Malaysia’s SDG Roadmap Phase I (2016-2020).

Sustainable Development Goals	Description	Relevance to Malaysia
SDG 2: Zero Hunger	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.	Malaysia is committed to enhancing food security by increasing the Self-Sufficiency Level (SSL) of essential commodities, such as aiming for 80% SSL in rice and 100% in fresh milk by 2030.
SDG 8: Decent Work and Economic Growth	Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.	Efforts are directed towards improving employability in the agribusiness sector, focusing on integrating sustainability practices and compliance frameworks to enhance job opportunities.
SDG 12: Responsible Consumption and Production	Ensure sustainable consumption and production patterns.	Malaysia is advancing sustainable food production systems to ensure food safety and environmental sustainability.
SDG 17: Partnerships for the Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development.	Collaborative frameworks like the Triple Helix model, involving academia, industry, and government, are being promoted to enhance ethical food production and graduate employability.

4. METHODOLOGY

This quantitative study will used questionnaire for the purpose of investigating the current challenges in implementing Shariah-compliant practices within Malaysia’s food production systems, to identify the key factors influencing graduate employability in the halal sector and explore how sustainability and compliance frameworks can improve employability rates and to examine the roles of academia, industry, and government in promoting ethical food production and enhancing graduate employability through collaborative frameworks like the Triple Helix model. The population for this study comprised the northern region of Malaysia peninsular among broiler. Sample composed of 100 firms was randomly drawn from broiler industry. The questionnaires were distributed each to boiler producer business. The questionnaire was developed after an extensive review of the literature related to food security and safety, shariah compliant, and sustainability. A five-point Likert scale was used for the items that measured the financial accessibility constraints and government regulations; the scales range from 1 which is indicating “strongly disagree” and 5 which is denoting “strongly agree.” The

data collected using the questionnaire among the broiler in north region peninsular Malaysia. The data collected will be analyzed using descriptive statistics and inferential statistics.

Descriptive statistics such as mean, standard deviation, and frequency distributions will be used to describe the sample characteristics. Besides that, descriptive statistics such as mean, standard deviation, and frequency distributions will be used to summarize and describe the data collected. This will help in understanding the central tendency, variability, and distribution of the data. Inferential statistics such as correlation and regression analysis will be used to test the research hypotheses. The research design and approach for this study will enable us to identify the key factors influencing graduate employability in the agribusiness sector and explore how sustainability and compliance frameworks can improve employability rates. Moreover, correlation analysis will be used to examine the roles of academia, industry, and government in promoting ethical food production and enhancing graduate employability through collaborative frameworks like the Triple Helix model. This analysis will help in determining the strength and direction of the relationship between the variables. Furthermore it will give more valuable information once the data will be analysed.

5. CONCLUSION

In summary, the implementation of Shariah-compliant practices in Malaysia's halal food industry faces several significant challenges. Inconsistent regulatory enforcement, gaps in certification processes, and limited awareness among stakeholders hinder the uniform adoption of halal standards. If this challenges can be solved it can contribute to achieving SDG 2: Zero Hunger, which emphasizes food security and improved nutrition. Malaysia's halal food industry, already valued globally, plays a critical role in ensuring the production of safe, high-quality, and ethically sourced food [18]. Besides that, graduate employability within Malaysia's halal sector is influenced by several factors. A notable mismatch between academic curricula and industry requirements, a deficiency in practical skills, and insufficient exposure to sustainability practices contribute to the challenges graduates face in securing relevant employment. A focus on equipping graduates with industry-relevant skills, particularly in compliance, quality assurance, and ethical production, will increase their employability and ensure a steady supply of qualified professionals for the halal industry [17].

Furthermore, the Triple Helix model, which emphasizes collaboration among academia, industry, and government, plays a crucial role in promoting ethical food production and enhancing graduate employability. Academia should focus on aligning educational programs with industry needs, incorporating practical skills and sustainability practices. Industry needs to collaborate with educational institutions to provide practical training and articulate required competencies. Government must ensure consistent enforcement of halal regulations and support initiatives that promote industry-academia collaboration. By addressing these areas, Malaysia can develop a robust halal food production system, enhance food security, and improve the employability of graduates in the halal sector.

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