Impact of Ramadan on Halal Food Marketing Strategies in the Chinese Market: A Data Analytics Approach

Chaowapark Srikasem[1], Pradorn Sureephong[2], Ahmad Yahya Dawod[3], Nopasit Chakpitak[4] and Somsak Chanaim[5]

Abstract

This study investigates the integration of halal food into Chinese multinational culture amid the Coronavirus epidemic. Applying a thorough data analytics procedure, the research focuses on the evolving e-commerce landscape within China. The adaptation under scrutiny includes a wide range of sociocultural transformations, including linguistic proficiency, social norms, dietary preferences, and e-commerce consumption habits from various cultural domains. A data-driven marketing strategy's analytical structure, supported by an updated Segmentation, Targeting, and Positioning (STP) model, carefully examines product differentiation criteria. Furthermore, the investigation includes the implementation of a prediction model that uses complex algorithms to estimate market trends and consumer preferences. The term "halal" comes from Arabic and refers to food that is considered permissible for consumption excluding porcine products, carrion, blood, and alcohol. Halal cuisine, which adheres to Islamic dietary regulations, is critical to Muslims' religious devotion around the globe. Halal dietary habits are integrated into Chinese cuisine through major e-commerce platforms. This study utilizes a data-analytics marketing model to analyze transactional data from Taobao.com and Tmall.com, aiming to understand purchasing patterns of halal food products in China. The analysis highlights significant seasonal fluctuations, particularly during major festivals such as Ramadan, Chinese New Year, and Eid, which heavily influence sales.

Keywords: *China E-Commerce, Data-Analytics, Halal Food Market, Halal E-Commerce, Predictive Analysis*

INTRODUCTION

China's halal food market experiences substantial growth due to its large Muslim population and rising demand for quality halal products, further propelled by the Belt and Road Initiative (BRI) promoting trade and cultural exchanges with Muslim-majority nations. The BRI facilitates halal food supply chain integration, augmenting import/export of halal-certified products and establishing China as a significant contributor to the global halal food market. The COVID-19 pandemic showcased the halal industry's resilience, offering growth prospects and a crucial opportunity for its enhancement, benefiting both the Muslim community and involved nations. (Hidayat et al., 2022; Rafiki et al., 2021). China's $5.4 trillion digital economy, minimally affected by COVID-19, and the Belt and Road Initiative (BRI), announced by President Xi Jinping in 2013 to enhance cooperation with over 70 countries, remain central to China's economic strategy. (Figure 1) (Bruni, 2019). The significant partnerships and bilateral agreements between China and Muslim countries underscore the strategic importance of these connections.

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[1] International College of Digital Innovation Chiang Mai University Chiang Mai, Thailand. Email: chaowapark_s@cmu.ac.th, (corresponding author)

[2] College of Arts, Media and Technology Chiang Mai University Chiang Mai, Thailand. E-mail: pradorn.s@cmu.ac.th

[3] International College of Digital Innovation Chiang Mai University Chiang Mai, Thailand.

[4] International College of Digital Innovation Chiang Mai University Chiang Mai, Thailand.

[5] International College of Digital Innovation Chiang Mai University Chiang Mai, Thailand.
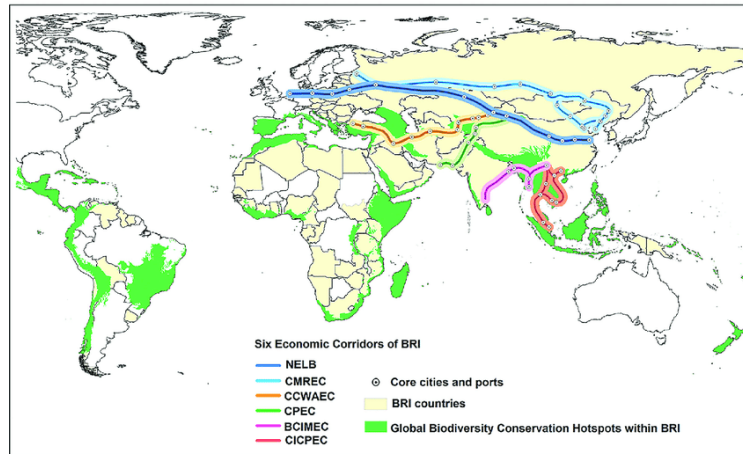
Figure 1. Oceanic and land routes of BRI and SREB China with Asia, Europe, and Africa. (Bruni, 2019)

Maintaining strong relations with Islamic countries is vital for the success of China's Belt and Road Initiative, given Islam's prevalence along the Silk Roads. China's 23 million Muslims, especially the Hui, act as a cultural bridge, facilitating cooperation in Islamic finance and halal food production while expanding cultural exchanges to overcome misunderstandings and enhance collaboration. (Li, 2018). The Halal food sector is projected to reach a value of 1.38 trillion USD by 2024, with a 3.5% growth rate from 2019 to 2024, and the overall Islamic economy is expected to hit 2.4 trillion USD by 2024 (Masood & Rahim, 2021). The Belt and Road Initiative (BRI) promotes large-scale infrastructure, international trade, and digital transformation, significantly benefiting the global halal food market. By aligning the interests of China's 1.44 billion people with the world's 1.9 billion Muslims, the BRI fosters substantial growth in the halal food sector.

Food consumption is influenced by religious beliefs, with Islam and Judaism prohibiting pork, Buddhism and Hinduism often forbidding beef, and Muslims adhering to Islamic dietary laws by consuming only halal food as prescribed in the Qur'an. (Ali et al., 2017). Halal, meaning acceptable and lawful, includes qualities like cleanliness and safety, and is crucial for the growing Muslim population committed to halal consumption globally. The global halal food market, valued at $715 billion in 2018, is projected to grow annually by 12.7% until 2027, driven by the economic influence and modern consumption trends of Muslims (Insights, 2019; Li, 2018; Selmier, 2018). In Southeast Asia, countries like Malaysia, with a 65% Muslim population, and others like Singapore and Thailand, are increasingly producing halal foods due to rising demand. Even in countries where Muslims are a minority, such as Thailand, Korea, and Japan, halal consumption is growing, ensuring compliance with dietary laws and creating economic opportunities. (Gonul & Rogenhofer, 2018).

China's constitution recognizes it as a unitary multinational state with 56 ethnic groups, including 113 million minorities like Hui Muslims, who have faced regulatory challenges. Although Muslims constitute only 1.8% of China's population, they are a significant minority, comparable in number to those in many Muslim-majority countries (Waheed et al., 2017). China's strong economy attracts international business and students, boosting the Muslim community and halal food sector, with religiosity significantly influencing halal food choices and offering countries a competitive advantage in the growing global market (Brose, 2018).

Halal food markets along the Belt and Road Initiative (BRI) route offer significant growth potential by linking Islamic countries in Asia and enhancing trade between China and Thailand. By 2030, key Muslim markets in Asia are projected to reach 1 billion people, and leveraging Chinese e-commerce platforms will be crucial for Thailand to capitalize on these opportunities, with research focusing on enhancing trade knowledge for Thai halal food producers and exporters (Awuson-David et al., 2021; Hakim et al., 2020). Our study explores the Belt and Road Initiative's impact on digital e-commerce and logistics with Islamic countries, revealing strong halal food consumption during festive seasons, aiding Thai producers in anticipating demand via data-driven predictions before entering the Chinese market**.**

LITERATURE REVIEW

Studying halal foods within Islamic culture is crucial for discerning their permissibility according to Shariah Law. This understanding of what is permissible (halal) and what is not (haram) is fundamental to Muslim consumers' lifestyles, setting them apart from others. Additionally, both contemporary and traditional marketing strategies are rooted in data-analysis approaches.

Halal Food and Islamic Teachings

Halal, derived from the Quranic term, signifies what is permitted or lawful, contrasting with Haram, which denotes what is forbidden. In Islam, all matters of Halal and Haram, including disputes, are to be resolved by referring to the Quran and Sunnah. While the concept of Halal applies universally to human activities, its application to food is specifically outlined in the Quran and Sunnah, necessitating a deep understanding for modern developments like Halal supply chain management. Halal supply chain management focuses on preventing contact with forbidden substances, managing contamination risks, and aligning with Muslim consumers' perceptions, with product and market characteristics playing pivotal roles in this process.

Halal Food in Thailand: Economy Booster

In 2019, Thailand became the 11th largest halal exporter, generating $1.13 billion and 2.44% of the global market, and the leading producer in Southeast Asia with a net worth of $6 billion. Halal food exports, comprising 20% of Thailand's total exports, have grown 19% over five years, driven by standardization efforts from organizations like CICOT and HSC. A uniform national halal definition is crucial for market expansion, particularly towards China, and tourism, contributing 31.7% to GDP, further boosts Thailand's appeal to Muslim visitors from neighboring and distant countries. (Insights, 2019; Jeaheng et al., 2019). Hence, a significantly contributed, concerning its global growth, yet a valuable potential is unexplored.

Table 1. Overview of the market for Thai halal food trade in high potential area.

Rank	Country	Population (million)	GDP (2023)	Halal Food Industry Strengths	Potential of Market Target	Reference
1	Indonesia	276.4	$1.389 trillion	Largest Muslim population, significant halal food production and export	No	(Masruroh, 2020)
2	Malaysia	32.7	$373.4 billion	Major global halal hub, strong government support and certification systems	No	(Ahmad-Fauzi & Md Saad, 2024)
3	Turkey	85.3	$905.5 billion	Large halal food market, key player in halal meat production	No	(Muchtar et al., 2024)
4	Saudi Arabia	35.8	$933.4 billion	Significant halal food consumption, investment in halal food production	Moderate	(Soonsan & Jumani, 2024)
5	United Arab Emirates	9.9	$501.4 billion	Major re-exporter of halal products, strategic location	Moderate	(Soonsan & Jumani, 2024)
6	Pakistan	242.9	$347.7 billion	Growing halal food sector, large agricultural base	Moderate	(Sungnoi & Soonthonsmai, 2024)
7	Egypt	104.1	$387.4 billion	Significant halal food production and export potential	Moderate	(Utomo & Sari, 2022)
8	China	1,425.7 (26.4)	$19.374 trillion	Large Muslim population in specific regions, emerging halal food production but insufficient to fulfill the needs of customer.	Excellent	(Hong et al., 2019)

Keeping an eye on the benefits of being an alliance of BRI and Silk Road's initiative, Thailand Halal Food can also be exported to China, since the Chinese government is still struggling to manage the supply and demand for Muslim communities in China.

Theories of Marketing Strategy

This study will centre on optimizing Philip Kotler's data-driven Marketing 5.0 as a foundational element, with additional methodologies considered for future research (Figure 2) (Adinugraha et al., 2021). The primary focus of Marketing 5.0, emphasized here, is leveraging data throughout the marketing process, from research and strategic planning to online execution. Concurrently, the study will examine not only transactions on China's e-commerce platforms but also the broader Chinese market and global Muslim consumers in the future.
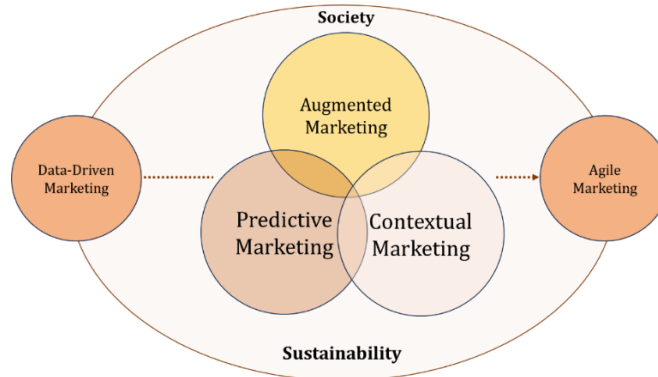
Figure 2. the 5 components of Marketing 5.0 by Phillip Kotler. (Adinugraha et al., 2021)

Strategies for marketing are critical to business success, especially in today's competitive e-commerce market. Companies in the halal food market in China can improve their segmentation, targeting, and positioning strategies by adopting concepts from Phillip Kotler's Marketing 5.0 and the conventional STP model (Figure 3). These frameworks offer a structured method for studying consumer behavior, market dynamics, and competitive positioning.

Figure 3. The STP model for the marketing plan.

Segmentation categorizes the Chinese halal food market by factors like religious affiliation and shopping behavior, while targeting selects the most appealing segments to optimize resource allocation, market share, and sales potential. (Camilleri, 2020). Understanding Muslim consumers' specific demands, like the importance of the "Halal Logo," allows businesses to gain credibility and appeal by marketing their products as Halal-certified and trustworthy. (Ahmad et al., 2019). Data-driven marketing tools provide insights into consumer behavior and trends for informed decision-making, while modern approaches like content marketing, influencer collaborations, and personalized experiences enhance engagement and brand advocacy through e-commerce and social networking. (Rünzel et al., 2021; Sha et al., 2021; Xu et al., 2018).

 Overall, the combination of marketing strategies, data-driven technologies, and strategic positioning will greatly help halal food enterprises in China's e-commerce sector. Businesses that understand customer requirements, target the proper segments and successfully position their products can gain a competitive advantage and drive growth in this dynamic and growing market.

METHODOLOGY

This research aims to use a data-driven methodology and predictive modeling to analyze Ramadan's impact on halal food transactions, marketing strategies, and trade dynamics in China, offering evidence-based advice to optimize marketing efforts and capitalize on opportunities during Ramadan.
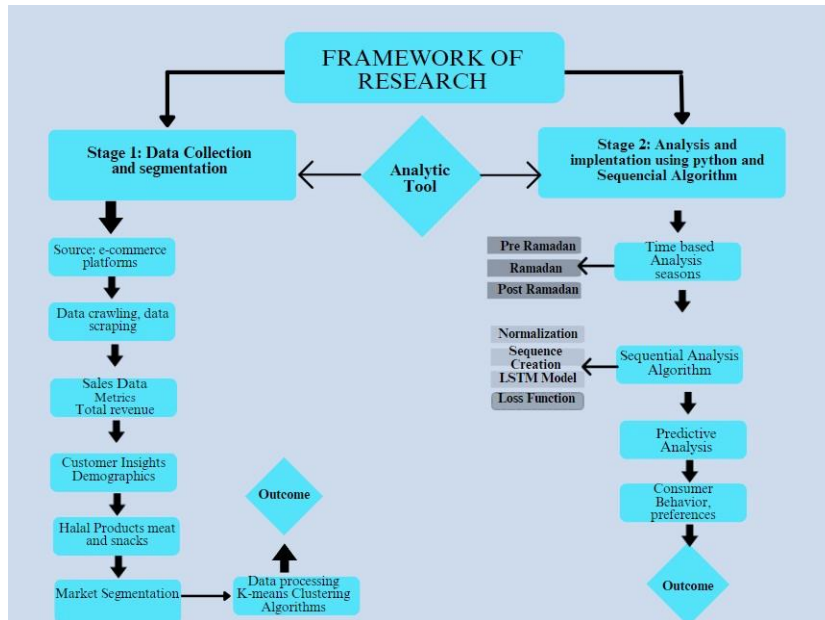

Figure 4. Framework of Research for Halal Food Marketing Strategies

Data Collection and Segmentation

Data Collection

To understand halal food market dynamics during Ramadan, data from Taobao, Tmall, and official trade statistics will be collected, focusing on sales, transactions, and import/export data across pre-Ramadan, Ramadan, and post-Ramadan periods using crawling and scraping techniques with strict quality control.

Market Segmentation

After data collection, segmentation analysis with group analysis and Python's K-means clustering will identify unique market categories, enabling customized marketing strategies, while predictive analytics using historical sales data and Sequential Analysis forecasts 'Total Sales Per Unit' for halal food products from 2024-2030. (Janićijević et al., 2020).

$$\bar{X} = \frac{1}{N} \sum_{(i=1)}^{N}, X\_i \qquad\qquad (1)$$

Here, $\bar{X}$ denotes the cluster centroid, N is the number of data points in the cluster, and X_i represents the features of each data point within the cluster. This clustering enables us to discern distinct behavioral patterns and sales dynamics within segments of the halal food market.

Analysis and Implementation

In the second stage, we analyze the impact of Ramadan on the Chinese halal food sector and implement strategies to leverage this insight. Using Python's sequential analysis algorithm, we enhance our analysis to develop effective marketing strategies.

Time-Based Analysis

The methodology for analyzing halal food sales during Ramadan uses Python libraries like pandas, Matplotlib, and stats models for processing data, visualizing trends, and applying time series analysis to understand consumer behavior. Sequential analysis algorithms refine forecasting models in real-time, aiding in adaptive inventory and supply chain management, thus optimizing operations and marketing strategies for increased profitability.

Predictive Analytics

Predictive analytics with Python libraries like scikit-learn and TensorFlow improves forecasting models using historical data to predict future halal food purchase trends during Ramadan. Sequential analysis algorithms refine these models in real-time, enabling proactive adjustments in inventory and supply chain management to increase profitability.

Consumer Behavior Analysis

The research methodology uses Python for sequential analysis to understand consumer behavior during Ramadan, starting with collecting and preprocessing purchase data. Sequential analysis techniques identify patterns and trends, with statistical methods calculating metrics like purchase frequency and average basket size, illustrated through visualizations. Insights reveal peak shopping times and popular product categories, informing business recommendations for adjusting marketing strategies, product offerings, and inventory management to better meet customer needs during Ramadan.

Competitive Analysis

Our study leverages Python and sequential analysis to comprehensively analyze marketing activities, pricing strategies, and distribution channels in the halal food market during Ramadan, identifying trends and strategic opportunities for optimized marketing and strategic positioning.
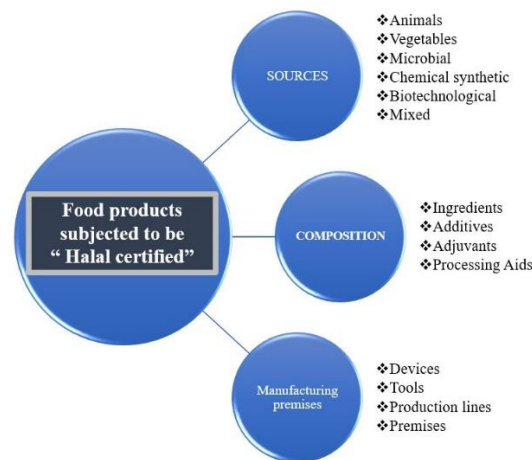
Figure 5. Food products subjected to be halal certified

LSTM/sequential Algorithm

In the second stage of understanding LSTM/sequential algorithms, you'll learn the equations governing LSTM cells' information flow, involving sigmoid and hyperbolic tangent functions, essential for effectively processing sequential data like text or time series.

Normalization

Normalized _value = (value − min)/(max − min)   (2)

Where (min) and (max) are the minimum and maximum values in the dataset.

Sequence Creation

Given a time series {x_1 , x_2, ... x_T}, sequences of length seq_length is created:

X = {(x_i , x_i + 1, …, x_i + seq_length − 1)│i = 1, …, T − seq_length } (3)

Y = {x_(i + seq_length| i = 1, …, T − seq_length }) (4)

LSTM Model

The LSTM model consists of two LSTM layers with Dropout for regularization:

h_t = LSTM (x_(t,) ht − 1) (5)

Where **ht** is the hidden state at the time **t** and **xt** is the input at a time **t.**

Loss Function

The model uses Mean Squared Error (MSE) as the loss function:

$$MSE = \frac{1}{n}\sum_{i=}^{n} 1\ (y_i - \hat{y}i)\ 2$$ (6)

In the analysis and implementation stage, key functions like normalization and sequence construction, along with LSTM models and Mean Squared Error loss, enhanced time-based analysis, predictive analytics, and consumer behavior understanding for informed decision-making.

RESULTS

Through a data-analytics marketing model analyzing transactional data from Taobao.com and Tmall.com, we aim to understand halal food purchasing patterns in China, focusing on categories, seasonality, pricing, and real-time demand prediction, revealing significant fluctuations in seasoning sales during major festivals and a preference for chicken and meat in ready-to-eat formats, informing product development strategies to meet local and international consumer demands.
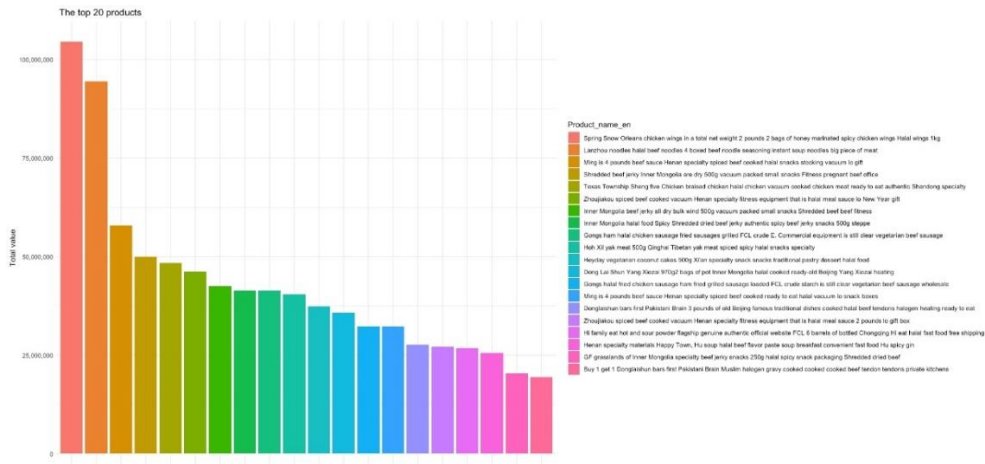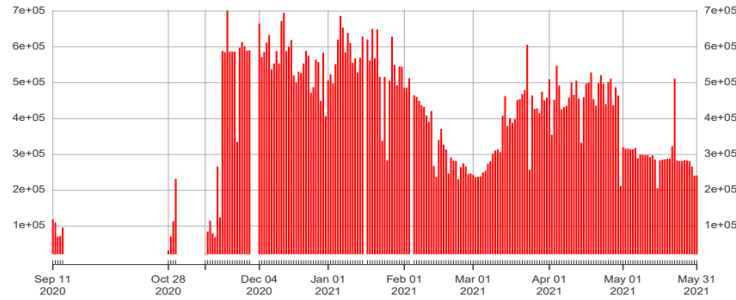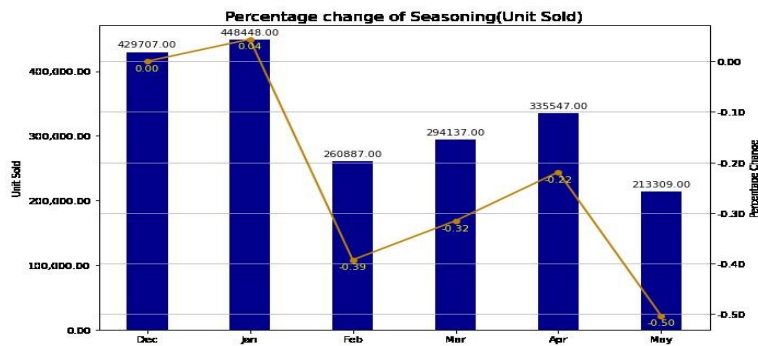
Figure 6

Figure 6. Contribution of the Holy Month of Ramadan towards the best-selling products.

The sales patterns of three major ingredients crucial in preparing ready-to-serve halal food in China were studied, focusing on the number of items sold and revenue generated over time. Seasoning, vital for flavor and aroma in global cuisine, particularly crucial in halal food, was chosen as one of the sample sets. (Figure 7).

Figure 7. Sales of seasoning during the festive span in China

Results revealed that the majority of sales come during the first two events spanning December to January, followed by a decrease in sales of almost 39%. Later it increased till the end of April which spanned the Holy Month of Ramadan. This fluctuation is due to the fasting hours of the Muslim community but still provides a decent sales pattern because of home cooking to release the fast (Figure 8).

Figure 8. Percentage sales of units of seasoning in the festive span

Chicken is another key contributor and one of the best raw ingredients for Halal food (Figure 9). Looking at the data set, the sales of chicken touched the horizons during the month of April or the Ramadan period (Pakiding, 2024).
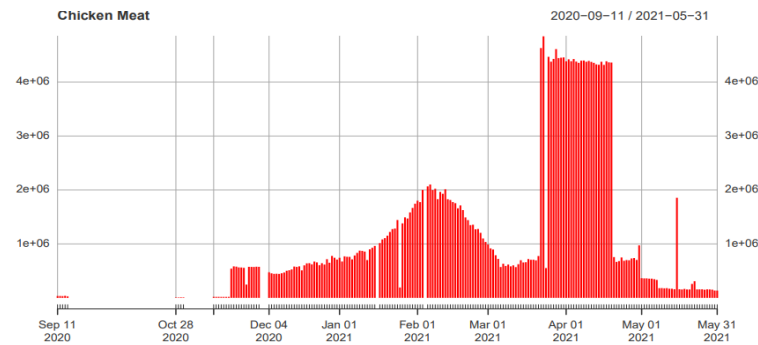
Figure 9. Sales of Chicken Meat during the festive period in China

This is again due to the fasting month because huge gatherings have been observed in Mosques to release the fasts. Results demonstrate the importance of chicken meat in every food (Figure 10).
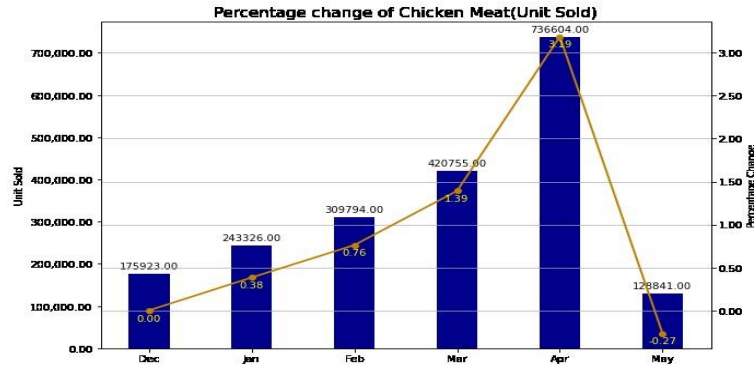
Figure 10. Percentage sales of units of raw chicken meat in the festive span

Unlikely, beef meat has not gotten the high sales values as compared to chicken. The decrease in sales can be explained by the fact that during the Holy Month of Ramadan, people prefer to eat light proteins such as chicken and fish (Suhartanto et al., 2020) Figure 11.
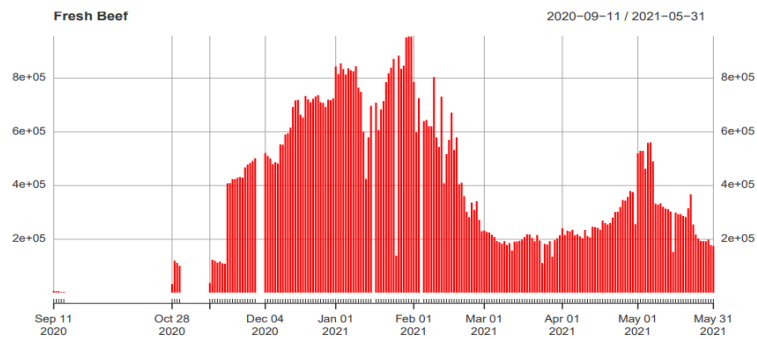

Figure 11. Sales of fresh beef during the festive season in China.

While in general during the Chinese New Year festival, the highest sales have been recorded in terms of units sold out (Figure 12).
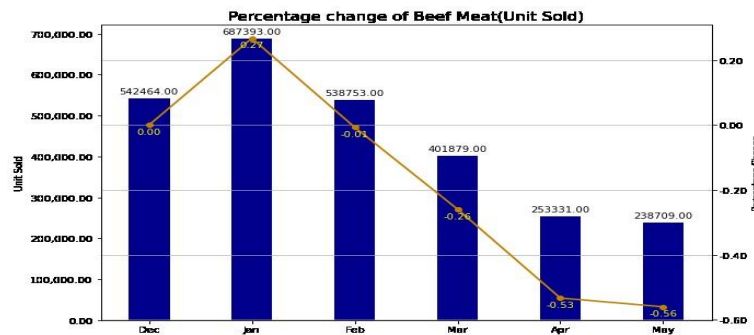

Figure 12. Percentage sales of units of raw beef meat in festive span.

Research indicates that processed, fresh, and dried halal food products command the highest prices and peak consumption during festive seasons like Ramadan and New Year, presenting opportunities for strategic inventory management and investment on Chinese e-commerce platforms (Mukherjee, 2014) (Figure 13).
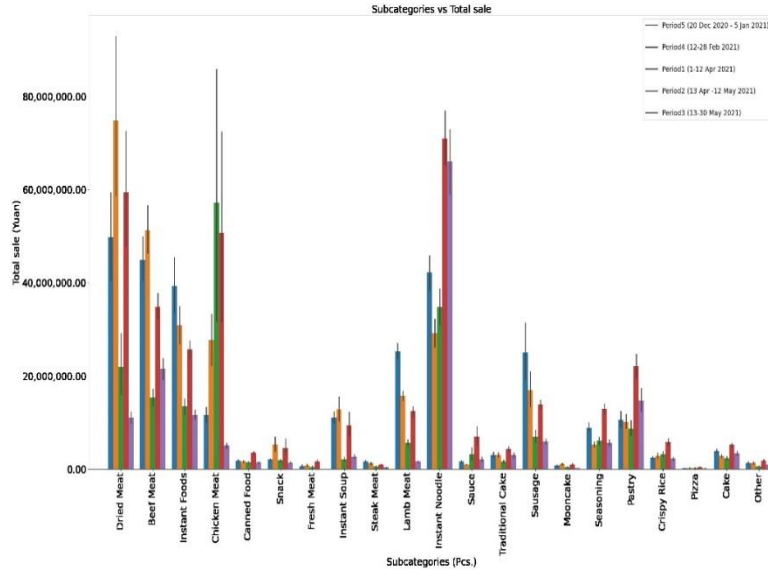
Figure 13. Comparison of sales of sub-categories in CNY during the festive span.

Ramadan, Chinese New Year, and International New Year drive the highest halal food sales, necessitating tailored product customization for Chinese Muslim online customers to ensure timely, season-specific, and localized offerings in a data-driven marketing strategy. (Waheed et al., 2017). This customer-centric approach, grounded in data-driven insights, will serve as the cornerstone for strategic development by adhering to the STP (Segmentation, Targeting, Positioning) model of marketing (Figure 14).
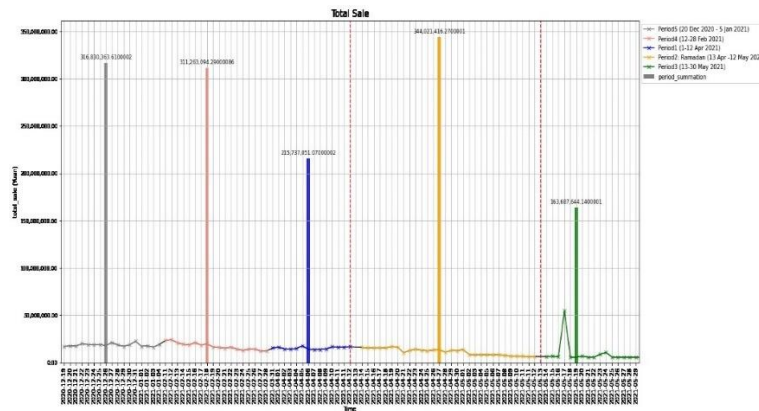

Figure 14. Comparison and contribution of festive span in total sales of halal food.

The findings (Figure 15) indicate that during Ramadan, halal product total sales close-up peak in the pre-Ramadan period, before the month begins, but a notable decline in daily sales during Ramadan itself has been recorded.
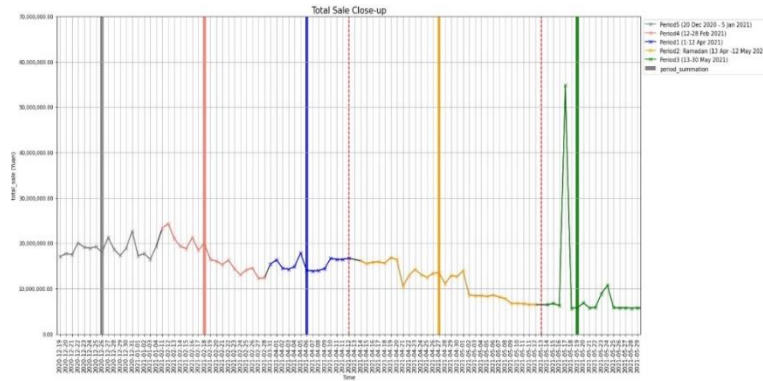
Figure 15. Comparison of pre-Ramadan and post-Ramadan sales close-up with other festivals.

Predictive analytics using K-means clustering and LSTM models forecast future halal food sales trends from 2024 to 2030, providing insights into "Total Sales Per Unit" across three market clusters.

Analysis of Predicted Results

In our predictive analytics framework, the clusters identified as Cluster 0, Cluster 2, and Cluster 1 represent different market segments characterized by unique buying behaviors, price sensitivity, or product preference patterns (Table 2). These clusters are not merely representative of individual products but rather groups of products or consumers that exhibit similar attributes or behaviors. (Janićijević et al., 2020)

Table 2: Annual Predicted Sales Per Unit for Clusters 0, 2, and 1 from 2024 to 2030

Year	Cluster 2 (Million Yuan)	Cluster 1 (Million Yuan)	Cluster 0 (Million Yuan)
2024	3,200,000	250,000	100,000
2025	2,650,000	255,000	100,000
2026	2,490,000	260,000	100,000
2027	2,480,000	261,000	100,000
2028	2,475,000	261,000	100,000
2029	2,470,000	261,000	100,000
2030	2,469,500	261,000	100,000

Clusters in Predictive Modeling

The K-means algorithm has proven a useful tool to identify homogeneous groups within our consumer database and is well reported by (Ogunleye et al., 2023). Partitioning a dataset into clusters based on similarities enables personalized marketing, with the algorithm iteratively updating centroids to minimize the sum of squared distances, optimizing clustering accuracy.

Visual Representation of Results:

The accompanying figure (Figure 13) visually depicts sales trajectories for each cluster over the forecast period, using distinct colors to highlight varying sales volumes, with data scaled using Min-Max scaling for uniformity and accuracy in the K-means model.
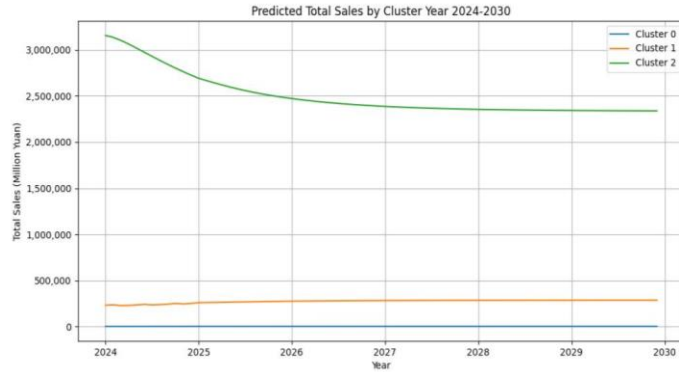
Figure 13. Annual sales forecasts for three market clusters from 2024 to 2030, differentiated by color: Cluster 0 (blue), Cluster 2 (green), and Cluster 1 (orange).

LSTM/Sequential Analysis

After clustering, we used an LSTM/sequential model to predict total halal food sales in the Chinese market during festive periods, showing a gradual rise until 2027 followed by steady growth until 2030, reflecting positive consumer behavior trends (Figure 14, (Bogere, 2023).
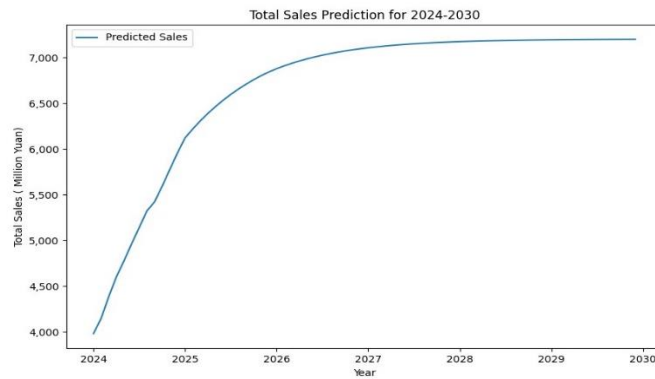
Figure 14. Overall sales forecast by LSTM/Sequential Model

The analysis shows significant export potential for Thai halal food products, with Figure 15 indicating festive periods as ideal for sampling and forecasting sales growth, using the STP model for targeted marketing and assured investments. (Raval et al., 2023).
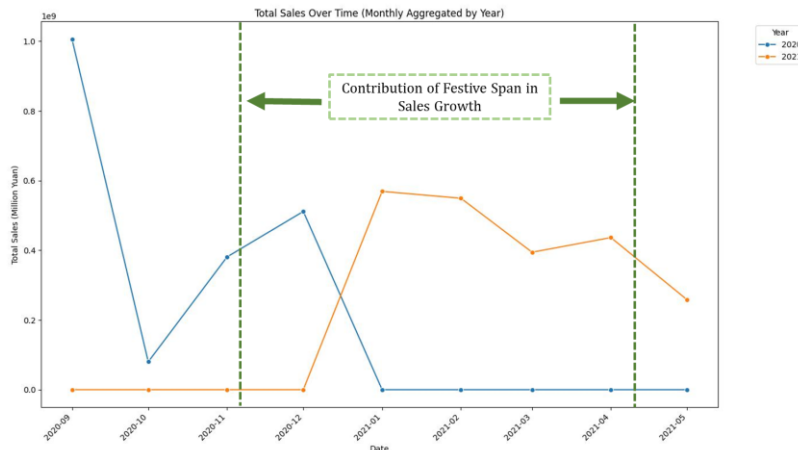
Figure 15. Contribution of the festive period to the growth of sales of Hala food in China

DISCUSSION

The K-means algorithm identified three consumer groups based on price and sales volume (Table 2): Cluster 0 with low price sensitivity or premium product preference, Cluster 1 with high price sensitivity favoring promotional offers, and Cluster 2 with intermediate sensitivity requiring nuanced marketing. These clusters, derived from analyzing comprehensive datasets, help tailor marketing and inventory management strategies.

The predicted sales (Figure 13) provide crucial insights for strategic planning, resource allocation, and tailored marketing campaigns, helping businesses prepare for demand fluctuations and improve market positioning during key periods like Ramadan. Cluster 0 shows lower, stable sales, Cluster 2 indicates high initial demand and steady sales, and Cluster 1 suggests significant growth, guiding investment and marketing strategies. (John et al., 2023).

The consistent predictions across years highlight the robustness of our predictive models in capturing complex market dynamics, essential for long-term planning and investment in the halal food industry. Our analysis integrates k-means clustering and LSTM/Sequential models to enhance prediction accuracy and market segmentation. K-means clustering categorizes data into distinct groups based on sales data similarities, allowing tailored predictive models for different market segments. The LSTM/Sequential model then models the relationship between sales and influential factors over time within each cluster, mirroring methodologies like those in (Fauzi et al., 2022) for competitive pricing and demand forecasting.

Summarized Conclusions and Recommendations

The study highlights the significance of festive periods in addressing the Halal food gap in China, emphasizing a customer-centric approach to target the growing Muslim community. This approach supports the Chinese government's efforts to meet Halal food demand, revealing that both ingredients and ready-to-serve foods significantly impact China's GDP growth. The festive span (December to May) is optimal for targeting the Chinese market through e-commerce, especially in conjunction with BRI and Silk Road initiatives. Data crawling and time series analysis have provided insights into seasonal spending patterns, essential for managing large datasets and facilitating sales predictions. The study underscores the value of data-driven marketing strategies for navigating the competitive Chinese market. Additionally, leveraging social media and sentiment analysis can offer insights into customer perceptions, helping businesses understand sentiment, identify improvement areas, and respond to trends in real-time. Despite challenges like data volume and sentiment interpretation, advanced tools in machine learning and natural language processing can enhance decision-making for Halal food products.

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