SUPPLIER SELECTION CRITERIA FOR HOTPOT RESTAURANTS: A CASE STUDY IN CHIANG RAI, THAILAND

ZIJIAN FENG

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IN
INTERNATIONAL LOGISTICS AND
SUPPLY CHAIN MANAGEMENT

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THIS THESIS IS A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION IN INTERNATIONAL LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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Author: Zijian Feng

Examination Committee:

Samatthachai Yamsa-ard, Ph. D.	Chairperson
Sunida Tiwong, Ph. D.	Member
Associate Professor Tosporn Arreeras, D. Eng.	Member
Puwanart Fuggate, Ph. D.	Member

Advisor:

.....Advisor

(Sunida Tiwong, Ph. D.)

Dean:

.....

(Piyatida Pianluprasidh, Ph. D.)

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Zijian Feng

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ABSTRACT

The study conducted an in-depth investigation of supplier selection criteria for hotpot restaurants in Chiang Rai, Thailand, focusing on improving supplier management practices. Using a quantitative approach, surveys were administered to restaurant managers and owners to gather data.

The Analytic Hierarchy Process (AHP) was utilized to systematically prioritize the criteria, ensuring an accurate and comprehensive analysis. Maintaining high standards in food safety, quality, and reliability is crucial for hotpot restaurants, as these factors are vital for ensuring customer satisfaction and operational efficiency. The results of the study indicated that food safety, quality, and reliability were the most significant criteria in supplier selection. These factors outweighed cost and delivery performance, highlighting the importance of prioritizing food quality and safety over economic factors. The AHP analysis further revealed that food safety held the highest priority, with a weight of 0.3720, followed by quality (0.2340) and reliability (0.1560).

By adopting these prioritized criteria, hotpot restaurant owners can make more informed decisions in their supplier management strategies. By focusing on food safety, quality, and reliability, restaurants can improve customer satisfaction, operational resilience, and ultimately, increase revenue.

The study provides actionable insights that can help hotpot restaurants achieve better income through optimized supplier selection processes. This research emphasizes the importance of a robust supplier management system, which is essential for the long-term success and sustainability of hotpot restaurants in Chiang Rai, Thailand.

Keywords: AHP, Supplier Selection, Selection Criteria

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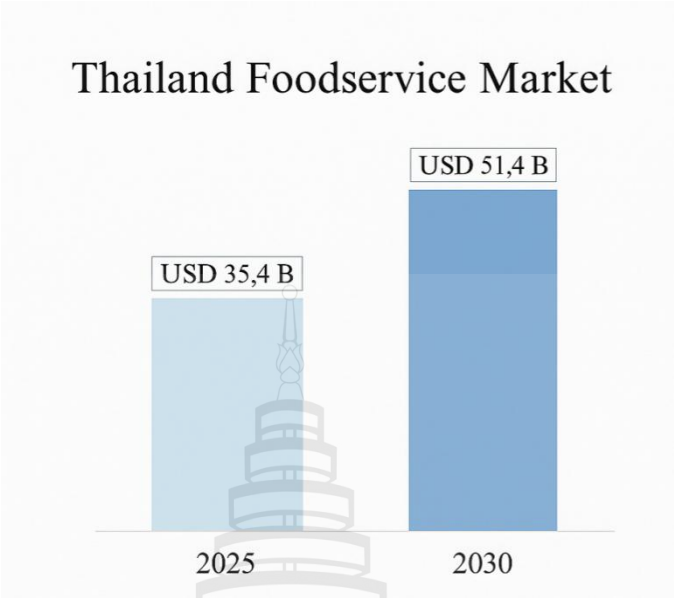
CHAPTER 1

INTRODUCTION

1.1 Research Background

Thailand's foodservice industry is growing rapidly, fueled by tourism, urban development, and a strong cultural tradition of dining out. Thailand's foodservice sector is experiencing robust growth, driven by rising consumer spending, evolving dining trends, and greater integration of technology in restaurant operations. Leading chains such as MK Restaurants, Minor International, and Yum! Brands have responded by diversifying their services and targeting a broader range of customers. Nevertheless, the industry remains relatively open, creating opportunities for small and medium-sized businesses to develop distinct market niches. One of the most notable emerging segments is hotpot dining. Its appeal lies in the interactive and communal nature of the experience well-aligned with Thai cultural values that emphasize shared meals and customizable food choices. While hotpot was once concentrated in Bangkok and other major cities, its popularity has expanded into regional provinces like Chiang Rai, where the number of hotpot restaurants continues to grow steadily. Many of these establishments are independently owned and cater to a rising middle-class demographic. However, their expansion brings new operational challenges, especially in supply chain management. Hotpot restaurants depend heavily on the availability of fresh meat, vegetables, and condiments ingredients that must be delivered consistently and in good condition. In less centralized areas such as Chiang Rai, where logistics infrastructure is still developing, owners often face problems such as delivery delays and variations in product quality. These challenges underline the importance of adopting a more systematic approach to supplier selection and management, one that reflects the specific demands of the hotpot segment and supports its continued growth in regional markets.

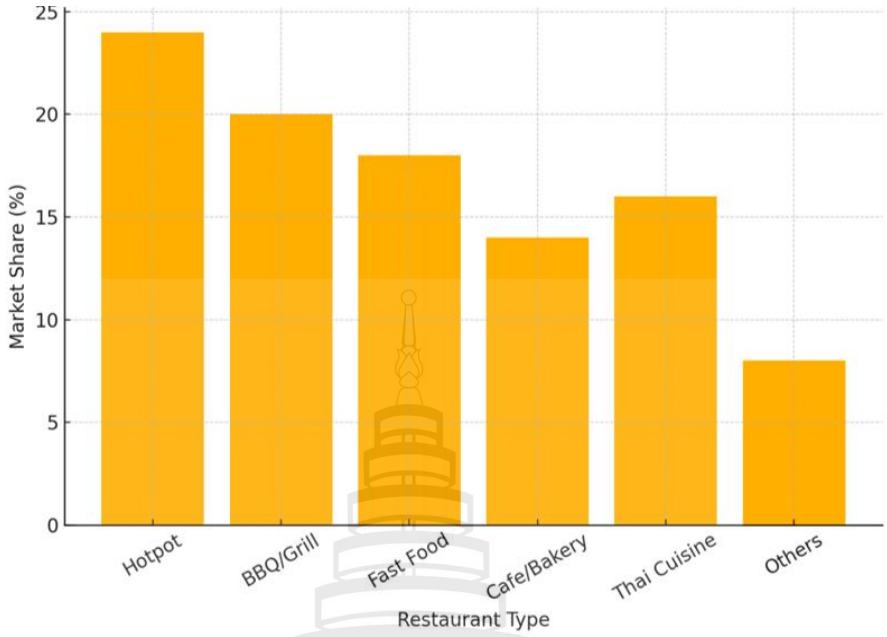


Source Mordor Intelligence (2024)

Figure 1.1 Estimated Thailand Food Market Size

As illustrated from Figure 1.1, recent projections suggest the market could grow from USD 35.4 billion in 2025 to USD 51.4 billion by 2030, with a healthy annual growth rate of around 7.7% (Mordor Intelligence, 2024). one of the most vibrant and fast-growing segments in Thailand's foodservice sector is the hotpot restaurant format. Known for its interactive and communal style, hotpot allows groups of diners to cook and share food at the table, creating a social experience that resonates strongly with Thai values around family, togetherness, and shared meals. These cultural traits make hotpot especially appealing to a broad range of consumers from younger groups looking for casual gatherings to older diners seeking familiar, comfort-driven dining. In addition to its cultural relevance, hotpot dining reflects changing consumer preferences. Today's customers are looking for more than just a meal they want choice, control, and experience. Hotpot meets these needs by allowing diners to customize their ingredients, sauces, and cooking style. This mirrors a wider trend across Thailand where consumers increasingly seek dining options that combine taste, entertainment, and interaction (Lee & Wang, 2022). Recent industry reports estimate that Thailand's hotpot market is already worth over USD 400 million and is expected to keep expanding (HKEXnews, 2022). While Bangkok continues to lead in volume, secondary cities like Chiang Rai

are seeing faster growth. These areas are benefiting from rising household income, a growing middle class, and increased domestic tourism. Hotpot restaurants are well-suited for these regions because they offer a fresh, flexible, and affordable dining format that appeals to evolving consumer habits (Chaisilwattana & Ruangrit, 2021). However, with this growth comes added complexity especially in sourcing. Hotpot restaurants rely on a wide range of fresh ingredients like meat, seafood, vegetables, and specialty condiments. Ensuring consistent quality and timely delivery is often a challenge in smaller provinces where supply chains are fragmented and infrastructure is less developed. As competition intensifies, the need for well-managed, dependable supplier networks becomes even more urgent. These concerns have become more visible in the wake of COVID-19. The pandemic exposed weaknesses in global and local supply systems, leading to product shortages, delivery delays, and rising costs. According to OECD (2021), many food SMEs in Southeast Asia struggled to maintain operations due to unstable procurement and higher input prices. The situation has highlighted how vulnerable informal supplier selection processes can be, especially for independent restaurants that rely heavily on personal connections or ad hoc negotiations. While supplier selection has been widely researched in industrial and manufacturing sectors (Weber et al., 2015; Ho et al., 2020), there is limited work focused on restaurants particularly smaller, independent ones in regional Thai contexts. Most SMEs still choose suppliers based on price, familiarity, or short-term availability, often neglecting more strategic factors like hygiene certifications, reliability, or flexibility (Cho & Bonn, 2021; Taherdoost, 2019).



Source Mordor Intelligence (2024)

Figure 1.2 Estimated Market Share by Restaurant Type in Thailand

As illustrated in Figure 1.2, hotpot restaurants currently make up approximately 24% of Thailand's informal dine-in market, positioning them ahead of BBQ grills (20%) and fast food outlets (18%) in terms of market share. Several factors contribute to the sustained popularity of the hotpot format in the Thai context. First, its interactive and social nature aligns with traditional Thai dining values, which emphasize shared meals and group gatherings (Lee & Wang, 2022). This communal aspect is particularly appealing to both families and youth groups, making it a versatile option across age demographics. And the format allows for ingredient customization, enabling diners to select broths, meats, vegetables, and dipping sauces based on personal preferences. This flexibility is especially attractive in a market where consumers increasingly demand control over their dining experience (Nguyen et al., 2023). In addition, the simplicity of preparation and low labor intensity compared to full-service kitchens make hotpot appealing to independent operators and first-time restaurateurs seeking cost-efficient models (Tang et al., 2024). The expansion of hotpot beyond Bangkok into secondary cities like Chiang Rai reflects broader socio-economic trends. These include rising middle-class income, improved intra-provincial mobility, and domestic tourism policies that drive dining-out behavior in non-urban areas (Chaisilwattana & Ruangrit,

2021). According to Rasli (2020), the visual presentation and freshness of ingredients in hotpot meals contribute significantly to perceived value, reinforcing loyalty among return customers. This growth is not without challenges. Many hotpot restaurants, especially in regional markets, face issues related to supply chain fragility, such as inconsistent ingredient quality and delivery delays. These operational risks highlight the need for more structured supplier evaluation systems that prioritize food safety, reliability, and quality – areas shown to be critical in restaurant performance and customer satisfaction (Cho & Bonn, 2021; Bakar et al., 2022).

1.2 Problem Statement

Thailand's foodservice industry is growing fast, creating both opportunities and challenges for businesses of all sizes. With market projections estimating growth from USD 35.4 billion in 2025 to USD 51.4 billion by 2030 (Mordor Intelligence, 2024), restaurants both large chains and small independents are working hard to keep up. New formats, better service, and innovative menus are now essential for attracting modern Thai consumers whose tastes are evolving quickly. Among the formats gaining traction, hotpot restaurants are expanding especially fast. Their popularity comes from a mix of hands-on dining, flexible ingredient choices, and a strong focus on shared meals values that fit well with Thai cultural traditions. The format also appeals to a wide range of customers: from students and young professionals to families and tourists, making it easy to scale across different regions. But while growth is promising, running a hotpot restaurant isn't easy especially for small and medium-sized businesses in regional areas. One of the biggest challenges is finding the right suppliers. Hotpot meals require a wide range of fresh and semi-fresh ingredients like meat, seafood, vegetables, sauces, and broths. Each item needs to be sourced, handled, and stored properly. For smaller restaurants without formal procurement systems, managing all this can be overwhelming. In places like Chiang Rai, the situation is even more complicated. The market is growing, but the logistics infrastructure still lags behind. Many restaurants struggle with limited supplier options, irregular deliveries, and inconsistent product quality. Without access to large contracts or cold storage, even small delays can lead to

unhappy customers or wasted inventory. On top of that, many businesses still rely on informal procurement choosing suppliers based on personal connections or lowest price. This exposes them to risks like food safety issues, regulatory non-compliance, or poor long term performance. These realities show why hotpot restaurants need more structured ways to choose suppliers. A system that considers quality, safety certifications, delivery reliability, cost, and reputation can help owners make better decisions. Unfortunately, very little research has looked at supplier selection in this specific context especially not in smaller cities or among independent operators.

Figure 1.3 illustrates the estimated distribution of hotpot restaurants across key districts in Chiang Rai Province. With the highest concentration found in Chiang Rai City, followed by Mae Sai and Chiang Khong, the spatial pattern suggests strong demand in urban and border areas. This geographic spread reinforces the need for localized, reliable supply chains and supplier strategies adapted to semi-urban restaurant clusters.

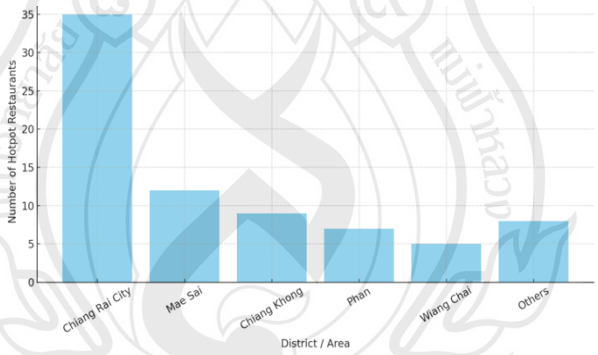
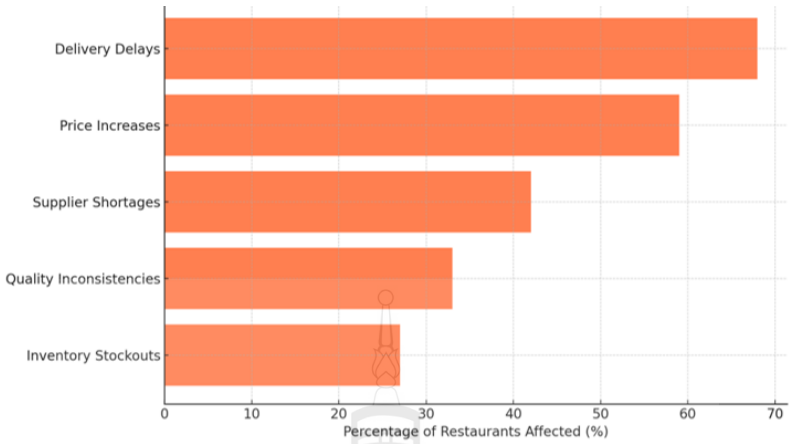


Figure 1.3 Estimated Distribution of Hotpot Restaurants in Chiang Rai Area (Google Map)

The problem is further compounded by recent external shocks. As highlighted by the OECD (2021), the COVID-19 pandemic severely disrupted food supply chains, leading to price volatility, delayed deliveries, and reduced supplier reliability across Southeast Asia. For independent restaurants with limited procurement power, these risks are magnified, often resulting in inconsistent service quality or increased operational costs.



Source OECD (2023)

Figure 1.4 Reported Supply Chain Challenges in Thai restaurants Post- COVID

As shown in Figure 1.4, the most frequently reported supply chain challenges faced by Thai restaurant operators in the aftermath of the COVID-19 pandemic include delivery delays (68%), ingredient price increases (59%), and supplier shortages (42%). These figures reflect significant vulnerabilities in the foodservice supply chain, particularly for small and medium-sized enterprises (SMEs), which often lack the buffer capacity or procurement leverage to absorb such disruptions. Among the reported issues, delivery delays were the most severe, affecting more than two-thirds of surveyed restaurants. This poses a critical problem for hotpot operations, where the freshness and timely availability of ingredients such as meat, seafood, and vegetables are essential for maintaining product quality and customer satisfaction. The second major challenge, rising input prices, has eroded already-thin profit margins for many independent restaurants. In a business model that relies on affordable, high-volume dining, especially in regional cities like Chiang Rai, cost fluctuations can lead to reduced portion sizes, simplified menus, or higher retail prices each of which risks alienating price-sensitive customers. Supplier shortages, while less frequent than the above two, are nonetheless significant. They reflect deeper structural issues such as limited supplier options in non-urban areas, dependence on seasonal agricultural products, and underdeveloped logistics networks outside major city centers. These combined pressures have forced many restaurants to reconsider how they evaluate and select their suppliers. However, the majority of SME operators still rely on informal methods, such as verbal agreements, personal referrals, or long-standing relationships

based on convenience or familiarity. While these informal practices are often rooted in trust and cultural norms, they tend to ignore more strategic factors, such as hygiene certifications, delivery flexibility, inventory transparency, and long-term reliability (Cho & Bonn, 2021; Yadav & Sharma, 2015). As a result, restaurants become more vulnerable to inconsistent service, safety risks, and unexpected costs especially in crisis scenarios such as pandemic-related disruptions. This reality highlights a critical gap in decision-making practice. In theory, supplier selection should balance multiple criteria cost, quality, safety, responsiveness, and reputation but informal approaches rarely allow for such comprehensive evaluation. This is where Multi-Criteria Decision-Making (MCDM) tools become relevant. Methods like the Analytic Hierarchy Process (AHP) offer a structured approach that enables restaurant operators to rank and prioritize selection criteria based on their relative importance. By quantifying both tangible and intangible factors, AHP facilitates more transparent, consistent, and defensible procurement decisions (Ho et al., 2020; Weber et al., 2015). Despite its wide adoption in manufacturing and logistics, MCDM tools remain underutilized in the foodservice industry, especially among SMEs operating in semi-urban or rural regions. Existing research has largely focused on large-scale commercial supply chains or national distributors, leaving a notable void in the understanding of how independent restaurant owners evaluate suppliers under real-world constraints. In hotpot restaurants where product perishability, daily demand fluctuations, and strict freshness expectations create a uniquely challenging sourcing environment this lack of structured evaluation can be particularly detrimental.

To address this gap, the present study applies an MCDM framework tailored to the hotpot restaurant sector in Chiang Rai, a region characterized by fast-growing demand, fragmented supply networks, and limited supplier diversity. By introducing a more systematic and scalable approach to supplier evaluation, this research aims to enhance procurement resilience and support sustainable growth in one of Thailand’s most dynamic foodservice segments.

1.3 Research Objectives and Research Questions

This study investigates how hotpot restaurants in Chiang Rai select their suppliers and which factors matter most in their decisions. By applying the Analytic Hierarchy Process (AHP): a method within the multi-criteria decision-making (MCDM) framework the research aims to build a clear, structured model that helps small and medium-sized restaurant operators make better sourcing choices.

1.3.1 Research Objective 1

To determine the factors of supplier selection in hotpot restaurants.

1.3.2 Research Question 1

What are the factors affecting the supplier selection in hotpot restaurant?

1.3.3 Research Objective 2

To provide suggestions for a better selection of suppliers in the Chiang Rai area.

1.3.4 Research Question 2

What strategies of selecting the restaurant supplier are ideal in Chiang Rai?

1.4 Scope and Limitations

This study examines the supplier selection practices of hotpot restaurants in Chiang Rai, Thailand, with a particular focus on small and medium-sized enterprises (SMEs). It aims to explore how restaurant owners and managers make decisions when selecting food suppliers, identifying the factors they consider most important in the procurement process. To ensure a comprehensive and structured evaluation, the study applies the Analytic Hierarchy Process (AHP) a multi-criteria decision-making method that enables the comparison and prioritization of various supplier attributes. Through this framework, the research quantifies the relative importance of key selection criteria such as food safety, product quality, pricing, and delivery reliability. The overall research design and methodological steps are summarized in the flowchart presented in Figure 1.5 (See next page).

Figure 1.5 Steps of Research

CHAPTER 2

LITERATURE REVIEW

2.1 Supply Chain Management

Supplier selection is a vital component of supply chain management (SCM), directly influencing cost efficiency, operational continuity, product quality, and customer satisfaction. It is widely acknowledged that the performance of a supply chain often depends on the effectiveness of supplier evaluation and sourcing decisions (Weber et al., 2015).

The earliest academic framework for supplier selection was developed by Dickson (2016), who identified 23 distinct evaluation criteria based on a survey of industrial purchasing managers. Among the most critical were quality, delivery performance, and price. While this foundational work remains relevant, it lacked a systematic mechanism to structure or prioritize the criteria beyond descriptive means, and did not offer a decision-support model suitable for modern SME environments. Subsequent reviews by Weber et al. (2015) and Ghodsypour and O'Brien (2018) expanded upon Dickson's criteria and emphasized the use of analytical models in supplier selection. Ghodsypour and O'Brien integrated the Analytic Hierarchy Process (AHP) with linear programming to allow for trade-offs between qualitative and quantitative criteria. However, their application was focused on manufacturing and industrial procurement, with limited relevance to service-based sectors like foodservice.

A broader perspective was offered by Ho et al. (2020), who conducted a comprehensive literature review on multi-criteria decision-making (MCDM) methods applied to supplier selection. They concluded that AHP, along with techniques such as fuzzy logic and data envelopment analysis (DEA), represented the most common and adaptable approaches. However, they also noted a research imbalance most case applications were from capital-intensive industries, with minimal focus on small service firms or emerging markets.

In recent years, studies such as Chung (2015) have attempted to bridge this gap by applying AHP to supplier selection in the hospitality industry, specifically in hotel seafood sourcing. Chung demonstrated the feasibility of using AHP in hospitality procurement but acknowledged that his focus on luxury hotels limited generalizability to smaller, independent foodservice operators. More directly related to restaurant supply chains, Cho and Bonn (2021) investigated how relational factors such as trust, communication, and loyalty influence supplier decisions. It lacked a formalized evaluative model and did not prioritize supplier attributes systematically. Furthermore, Tang et al. (2024) examined supplier selection in hospitality SMEs across Southeast Asia, revealing that although managers acknowledged multiple selection factors, few used formal decision-support tools. This study highlighted a persistent research gap in structured supplier evaluation within localized service industries. In the SME context, Yadav and Sharma (2015) found that many restaurant operators in emerging economies base procurement decisions on intuition or price alone, due to time and knowledge constraints. Their findings further reinforced the need for accessible and structured models like AHP, which can be applied even in resource-constrained decision environments.

While the literature on supplier selection in SCM is extensive, there is a noticeable lack of studies that apply structured decision-making tools, such as AHP, in the context of small foodservice businesses. This presents a clear opportunity for research, particularly in regions like Northern Thailand, where procurement conditions differ from urban or industrial areas.

2.2 Foodservice Industry

The foodservice industry presents a distinct set of challenges in supplier selection compared to manufacturing or retail sectors. Restaurants, particularly small and medium-sized enterprises (SMEs), operate in fast-paced environments where ingredient quality, food safety, delivery timeliness, and cost management are essential to daily operations (Rasli, 2020). Unlike large-scale manufacturers, many foodservice businesses lack dedicated procurement departments and instead rely on owner-

managers to make supplier decisions often informally (Yadav & Sharma, 2015). Research into procurement within foodservice contexts has emphasized the centrality of relational factors, such as trust, long-term partnership, and communication, over purely transactional metrics (Cho & Bonn, 2021). For instance, restaurant managers often maintain personal relationships with preferred vendors based on reliability, even when alternative suppliers offer better pricing or variety. This informal approach, while convenient, introduces subjectivity and risk into procurement decisions.

A study by Chung (2015) applied the Analytic Hierarchy Process (AHP) to seafood supplier evaluation in Taiwanese hotels and revealed that food quality, delivery performance, and product freshness were dominant criteria in hospitality supply chains. However, his study focused on high-end hotel operations and did not reflect the constraints or behaviors of independent foodservice SMEs. Similarly, Tang et al. (2024) investigated supplier prioritization across hospitality SMEs in Southeast Asia, identifying price, consistency, and hygiene as top concerns. Yet, they noted that most respondents lacked structured methods for evaluating and ranking these concerns, highlighting a persistent gap in decision-making frameworks. Moreover, the perishability and sensitivity of food inputs especially in hotpot restaurants, where meat, seafood, and produce are core components further intensify the need for consistent, well-evaluated supplier partnerships. Rasli (2020) found that lapses in food safety or delivery timing can have immediate impacts on service quality and customer trust, particularly in restaurants where products are freshly presented or cooked tableside. Despite the evident complexity of the supplier environment, many restaurant operators continue to rely on ad hoc criteria, such as proximity, personal recommendations, or short-term pricing incentives (Yadav & Sharma, 2015). These informal methods may be unsuitable for sustaining growth in a competitive, quality-driven marketplace. As such, recent research calls for more rigorous, structured approaches to procurement in the foodservice industry ones that reflect its multidimensional nature and align with customer expectations (Tang et al., 2024; Cho & Bonn, 2021).

2.3 Supplier Selection in the Foodservice Sector

In the foodservice industry, especially in smaller restaurant operations, supplier selection plays a critical role in day-to-day performance. Restaurant managers must regularly evaluate suppliers on a range of criteria from the freshness and quality of ingredients to the reliability of deliveries and the responsiveness of service. For hotpot restaurants in particular, the need is even greater. The format depends on a wide variety of fresh meats, seafood, vegetables, sauces, and broths, all of which must be available on time and in top condition. Any disruption in supply can affect the entire dining experience. In Thailand, many small and medium-sized enterprises (SMEs) in the restaurant sector still rely on informal supplier selection practices. Decisions are often based on personal relationships, previous experience, or price alone. While these methods may work in the short term, they often overlook key factors such as food safety standards, delivery consistency, or supplier flexibility. This can expose restaurants to risks especially in semi-urban areas like Chiang Rai, where sourcing options are fewer and logistics are less developed. Recent research in foodservice procurement shows a shift toward more structured evaluation methods. Studies confirm that restaurants today must balance both tangible and intangible factors like cost, quality, supplier reputation, and hygiene certifications when making purchasing decisions. These criteria affect not just product availability but also brand perception, customer satisfaction, and operational efficiency.

For SMEs operating without a formal procurement department, making these decisions consistently and strategically can be difficult. However, scholars argue that even small businesses can benefit from basic decision tools that allow them to weigh trade-offs more clearly and avoid relying solely on gut instinct or price. A structured approach to supplier selection helps improve not only the consistency of outcomes but also the long-term performance and resilience of restaurant operations.

Table 2.1 Related Literature

No.	Author(s) & Year	Study Focus	Methodology	Research Gap
1	Dickson (2016)	23-factor vendor selection criteria	Survey	Lacks structured prioritization
2	Weber et al. (2015)	Review of vendor evaluation techniques	Literature review	Focused on industrial procurement
3	Ghodsypour and O'Brien (2018)	AHP + linear programming	Model development	Limited to manufacturing, not SMEs
4	Ho et al. (2020)	Review of MCDM in supplier selection	Systematic review	Few SME/service applications
5	Chung (2015)	AHP in hospitality sourcing	AHP with expert interviews	Only hotels, not restaurant SMEs
6	Cho and Bonn (2021)	Supplier relationships in restaurants	Survey-based	No structured prioritization of criteria
7	Tang et al. (2024)	Supplier evaluation in SE Asia hospitality SMEs	Mixed methods	Does not address hotpot/local procurement
8	Yadav and Sharma (2015)	Informal selection in Indian restaurant SMEs	Qualitative case studies	Lacks decision-support framework
9	Rasli (2020)	Food safety in restaurant supply	Field study	No MCDM prioritization

2.4 Analytical Hierachy Process and Multi-Criteria Decision-Making (MCDM)

Supplier selection is a classic example of a multi-criteria decision-making (MCDM) problem, requiring the evaluation of both quantitative and qualitative factors such as cost, quality, flexibility, and food safety. In recent years, structured MCDM methods have been widely adopted in procurement research to address the limitations of intuitive or single-factor decision-making, especially in dynamic sectors such as foodservice (Govindan et al., 2015; Asadi & Shams, 2022). Among the various MCDM approaches such as TOPSIS, ELECTRE, and fuzzy logic the Analytic Hierarchy Process (AHP) remains one of the most prominent and accessible tools. First introduced by Saaty (2018), AHP enables decision-makers to decompose complex decisions into hierarchical structures, conduct pairwise comparisons, and derive prioritized weights that reflect the relative importance of each criterion. AHP's key strength lies in its ability to translate subjective human judgment into a rational, consistent numerical model, making it particularly valuable for small and medium-sized enterprises (SMEs), where hard data may be scarce and managerial decisions often rely on expert intuition (Ho et al., 2020; de Sousa Jabbour et al., 2018). Recent applications of AHP across industries further validate its relevance. For instance:

El-Hawy et al. (2024) introduced a "shadowed fuzzy AHP" model to improve decision reliability under uncertainty, showing its applicability in volatile food logistics contexts.

Mirzaee et al. (2022) applied AHP in combination with carbon-credit evaluation to select green suppliers for circular supply chains, integrating environmental concerns into vendor decisions.

In the hospitality sector, Nguyen et al. (2023) used AHP to evaluate service supplier criteria for hotels in Vietnam, confirming that attributes like hygiene, cost, and responsiveness can be effectively prioritized through structured pairwise assessments. AHP has proven effective in emerging markets and SME settings, where procurement practices are often informal and relationship-based. By introducing structure and transparency to these decisions, AHP supports more consistent, defensible supplier

evaluations and helps mitigate risks associated with biased or unstructured selection (Kumar et al., 2020).

2.4.1 AHP Hierarchical Structure

The AHP model for this study is organized into three hierarchical levels:

Level 1: Goal – The overarching objective is to determine the most important criteria for evaluating suppliers in hotpot restaurants.

Level 2: Criteria – Seven critical supplier selection criteria were identified from the literature and preliminary expert (Restaurant owners, Restaurant managers, Restaurant procurement managers) interviews:

1. Product Quality
2. Product Variety
3. Delivery Reliability
4. Food Safety and Hygiene
5. Pricing
6. Flexibility
7. Supplier Reputation

Level 3: Alternatives (Omitted) – Unlike traditional AHP models, this study does not compare supplier alternatives. The focus is on prioritizing the evaluation criteria themselves.

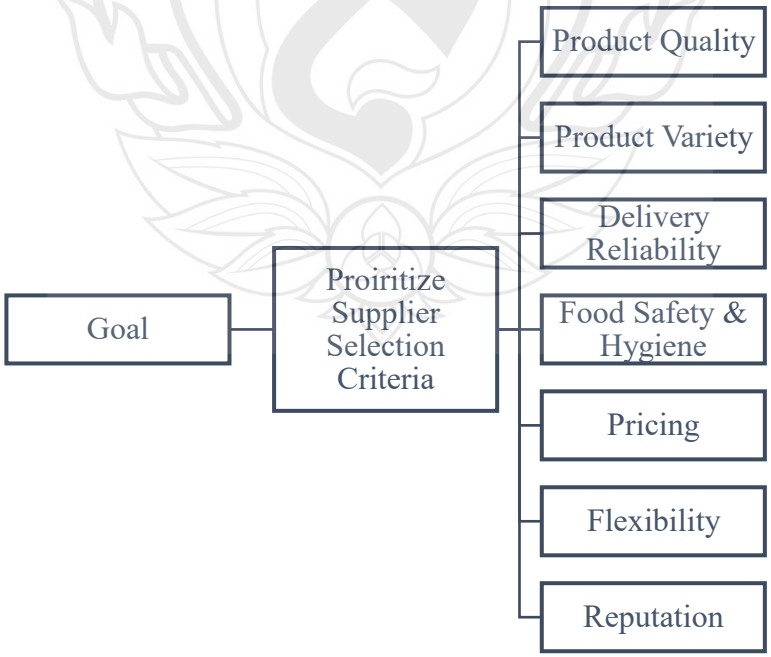


Figure 2.1 The AHP Framework is Structured into Two Layers

As shown in Figure 2.1, the goal is at the top, followed by seven evaluation criteria derived from literature and expert consultation.

The present study adopts AHP to prioritize seven supplier selection criteria specific to hotpot restaurants in Chiang Rai, Thailand. These include product quality, pricing, delivery reliability, flexibility, product variety, supplier reputation, and food safety compliance. Through survey-based pairwise comparisons from restaurant operators, AHP will yield a weighted ranking of these criteria providing a decision-support tool tailored to the realities of small foodservice businesses.

The data collected from the expert respondents were analyzed using the Analytic Hierarchy Process (AHP) framework to derive priority weights for the seven supplier selection criteria. The analysis followed a systematic four-step procedure, as recommended by Saaty (2018) and applied in various procurement-related AHP studies (Ho et al., 2020; El-Hawy et al., 2024).

2.4.2 Steps of conducting an AHP Study

Step 1: Aggregating Pairwise Comparisons

Each respondent completed a 7×7 pairwise comparison matrix, comparing the relative importance of each supplier selection criterion. To consolidate these individual matrices into a single group judgment, the geometric mean method was applied, as it preserves the multiplicative nature of the AHP scale.

Let $a_{ij}^{(k)}$ represent the judgment of the k^{th} respondent between criterion i and j. The aggregated group value a_{ij} is calculated as:

$$a_{ij} = \left(\prod_{k=1}^{n} a_{ij}^{(k)} \right)^{\frac{1}{n}}$$

This results in one final group-level 7×7 comparison matrix.

a_ij^(k): The pairwise comparison value (judgment) given by the k-th respondent for criterion i relative to criterion j (e.g., a value from 1 to 9 or their reciprocals).

n: Total number of respondents.

a_ij: The aggregated group judgment value, calculated using the geometric mean:

a_ij = (Product of a_ij^(k) for all k from 1 to n)^(1/n)

Step 2: Normalization of the Pairwise Matrix

To make the values in the comparison matrix comparable across rows and columns, the matrix is column-normalized. Each entry aija_{ij}aij is divided by the sum of its column, such that:

$$n_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}$$

This yields a normalized matrix, where all column sums equal 1.

n_ij: The normalized value of a_ij, computed as:

n_ij = a_ij / (Sum of a_ij in column j)

(Each column in the normalized matrix sums to 1.)

Step 3: Calculating the Priority Vector (Weights)

The relative importance of each criterion is then computed by averaging the normalized values across each row. This produces the priority vector w:

$$w_i = \frac{1}{n}\sum_{j=1}^{n} n_{ij}$$

The vector w represents the weight (priority) of each criterion, which will be used for ranking supplier evaluation factors.

w_i: The weight (priority) of criterion i, obtained by averaging the normalized values in row i:

w_i = (Sum of n_ij in row i) / n

w: The priority vector containing all weights (e.g., w = [w_1, w_2, ..., w_7]).

Step 4: Consistency Check

To verify the internal logical consistency of the judgments, the Consistency Index (CI) and Consistency Ratio (CR) were computed. These measures assess whether the judgments conform to transitivity (e.g., if A > B and B > C, then A > C).

Maximum eigenvalue (λ_{max}) is derived from the matrix:

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{(A \cdot w)_i}{w_i}\right)$$

Consistency Index (CI):

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Consistency Ratio (CR):

$$CR = \frac{CI}{RI}$$

Where RI is the Random Consistency Index, depending on the number of criteria (e.g., RI = 1.32 for n = 7).

λ_max: The maximum eigenvalue of the matrix, calculated as:

λ_max = (Sum of (A·w)_i / w_i for all i from 1 to n) / n

CI (Consistency Index):

CI = (λ_max - n) / (n - 1)

RI (Random Index): A predefined value based on matrix size (e.g., RI = 1.32 for n = 7).

CR (Consistency Ratio):

CR = CI / RI

(If CR < 0.10, the matrix is consistent; otherwise, revisions are needed.)

2.5 Supplier Selection Criteria

Effective supplier selection in the foodservice sector requires a nuanced evaluation of both tangible and intangible factors. In hotpot restaurant operations where freshness, hygiene, and ingredient diversity are critical these factors directly influence operational performance, customer satisfaction, and brand credibility (Cho & Bonn, 2021; Rasli, 2020). Drawing from a systematic literature review and preliminary expert interviews with local restaurateurs, this study adopts seven criteria deemed most relevant for supplier evaluation in the Chiang Rai hotpot context.

To ensure both academic rigor and field relevance, the study first conducted a frequency analysis of supplier evaluation criteria mentioned in hospitality, logistics, and SME procurement research published between 2015 and 2023. As illustrated in Figure 2.5, Product Quality, Food Safety, and Pricing are the most frequently cited, followed by Delivery Reliability, Flexibility, Product Variety, and Supplier Reputation.

These criteria represent the most common decision dimensions identified in 35+ peer-reviewed studies, emphasizing both operational and relational aspects of supplier performance (Weber et al., 2015; Ho et al., 2020).

According to Saaty (2018), the AHP method performs best when the number of evaluation criteria falls between 5 and 9, ensuring reliable pairwise comparisons while avoiding cognitive overload for respondents. By selecting seven criteria, this study strikes a balance between comprehensiveness and usability.

Additionally, these dimensions collectively capture three critical decision layers:

1. Compliance and Risk Control: Food Safety & Hygiene, Delivery Reliability
2. Value and Performance: Product Quality, Pricing, Flexibility\
3. Strategic Relationship Management: Supplier Reputation, Product Variety

These categories were not only frequently cited in the literature but were also validated through field interviews with Chiang Rai restaurant owners, who confirmed their relevance to local procurement practices (Yadav & Sharma, 2015; Tang et al., 2024).

The following table 2.1 presents the seven selected criteria, with brief definitions and supporting references to substantiate their inclusion in this study:

Table 2.2 Finalized Supplier Selection Criteria and Supporting Literature

Criteria	Number of Mentions	Operational Definition	Key Supporting Literature
Product Quality	26	Consistency, freshness, and appearance of raw ingredients	Ramanathan (2015), Zhu et al. (2021), Nadiri and Gunay (2020)
Food Safety & Hygiene	22	Compliance with HACCP, GMP, traceability, temperature control	Ab Talib and Chin (2018), Bakar et al. (2022), Rasli (2020)
Pricing	20	Reasonable rates, transparent cost structures, payment flexibility	Saghiri et al. (2018), El-Gayar et al. (2020), Yoon and Lee (2021)

Table 2.2 (continue)

Criteria	Number of Mentions	Operational Definition	Key Supporting Literature
Delivery Reliability	18	Ability to deliver complete, correct, and timely orders, minimizing stockouts	Park et al. (2020), Arunraj et al. (2021), Choudhury and Chatterjee (2017)
Flexibility	15	Responsiveness to volume changes, schedule shifts, and product substitutions	Wang et al. (2019), Dube and Nhamo (2022), Kumar et al. (2020)
Product Variety	13	Range of SKU offerings and availability of seasonal or specialty items	Zhao and Wang (2020), Nguyen et al. (2023)
Supplier Reputation	11	Track record of ethical conduct, reliability, and prior relationship history	Sáenz and Revilla (2019), Tang et al. (2024), Srisa-ard (2019)

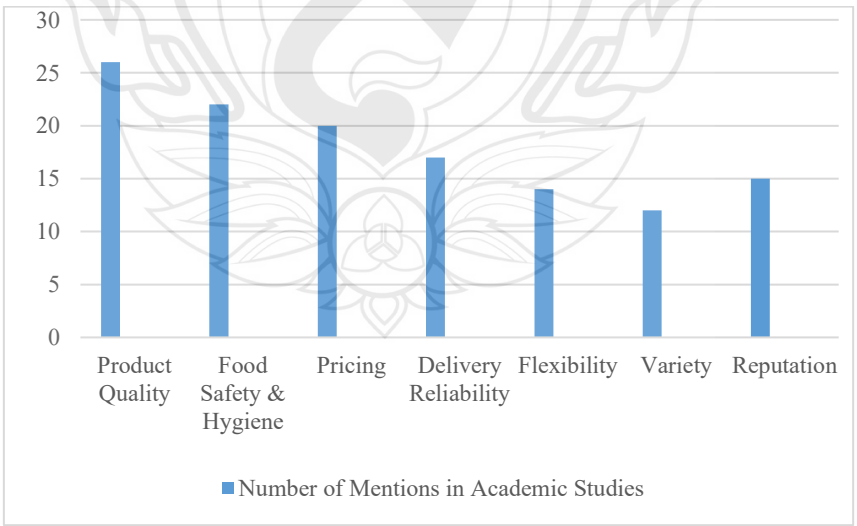


Figure 2.2 Frequency of Supplier Selection Criteria in Literature (2015-2023)

As shown in Figure 2.2, the most frequently cited supplier selection criteria in recent academic literature are product quality (mentioned in 26 studies), food safety and hygiene (22), and pricing (20). This aligns with the high-risk, service-centric nature of the foodservice industry, where ingredient quality and safety are directly tied to customer satisfaction. Less frequently discussed but still relevant are criteria such as flexibility and product variety, which are particularly important for restaurants with dynamic menus and fluctuating customer demand.

2.5.1 Product Quality

Product quality remains one of the most frequently cited criteria in supplier evaluation research (Ramanathan, 2015; Govindan et al., 2015). In the foodservice sector, quality refers not only to compliance with specifications but also to freshness, flavor, appearance, and consistency. In hotpot restaurants, where ingredients are cooked at the table and visible to customers, the importance of product quality is heightened. Unlike kitchen-based formats where ingredients may be concealed during preparation, hotpot customers interact directly with the raw ingredients making defects more visible and impactful.

Zhu et al. (2021) observed that food quality has a direct effect on customer retention, especially in interactive dining environments. Nadiri and Gunay (2020) further emphasize that premium-quality ingredients elevate a restaurant's brand image and drive positive word-of-mouth, especially among younger, social media–active consumers. Nguyen et al. (2023) aptly state, "A lapse in product quality is not just a supply issue it is a customer service failure." In hotpot restaurants, where experience and food presentation are as important as taste, even small lapses such as wilted vegetables or off-smelling seafood can result in customer complaints, negative reviews, and lost repeat business.

Beyond customer-facing outcomes, consistent quality also affects kitchen workflow and waste reduction. High-quality ingredients reduce the time staff spend inspecting, trimming, or substituting items. They also lead to better portion control and minimize preparation errors. For restaurant managers, this translates into operational stability and cost efficiency. In supplier evaluation, quality is often weighted the highest, especially when perishability and presentation are business-critical, as is the case in hotpot service models. As such, suppliers who can consistently deliver high-

standard products become strategic partners rather than just vendors. “A lapse in product quality is not just a supply issue it is a customer service failure” (Nguyen et al., 2023, p. 105).

2.5.2 Food Safety and Hygiene Compliance

Following the COVID-19 pandemic, food safety has emerged as a distinct and standalone evaluation criterion, rather than being treated as a subset of general product quality (Ab Talib & Chin, 2018; Bakar et al., 2022). Heightened consumer awareness of sanitation and disease transmission has led both regulators and businesses to enforce stricter safety standards across the food supply chain. In the restaurant industry, and particularly in hotpot dining where customers often handle raw meats and vegetables themselves, upstream hygiene practices directly influence health risks and perceptions of professionalism.

Food safety compliance includes adherence to national and local food handling regulations, possession of internationally recognized certifications (such as HACCP, GMP, or ISO 22000), proper labeling, temperature control, and traceability systems that allow for rapid recalls if contamination occurs. Rasli (2020) reported that failure to meet hygiene standards is among the top three causes of supplier termination in Southeast Asian restaurants, underscoring the severity of consequences when safety is compromised.

In hotpot settings, where cross-contamination risks are elevated due to the shared nature of dining and direct ingredient contact, the supplier’s responsibility to maintain strict hygiene from source to delivery becomes even more important. A single contaminated shipment of seafood or spoiled broth concentrate can lead not only to customer illness but also to reputational damage and possible legal implications for the restaurant. This is especially risky for SMEs, which often lack the resources to recover quickly from food safety incidents.

Restaurants increasingly view supplier food safety systems as an extension of their own operations. They may request documentation, conduct occasional audits, or favor suppliers that offer full product traceability. Those vendors who consistently meet or exceed hygiene expectations are seen as lower-risk partners. On the other hand, even one breach in food safety may permanently end a supplier relationship.

2.5.3 Pricing and Cost Competitiveness

While quality and safety are essential, pricing remains a key constraint, particularly for small and medium-sized enterprises (SMEs) in the foodservice industry (Saghiri et al., 2018; El-Gayar et al., 2020). Price competitiveness does not simply refer to selecting the lowest-cost supplier. It involves evaluating the total value offered such as bulk discounts, payment flexibility, long-term savings, and transparency in cost structures. Effective pricing agreements often include favorable credit terms, loyalty-based discounts, and clarity in additional charges like delivery or minimum order fees. Yoon and Lee (2021) argue that focusing solely on the cheapest supplier can backfire, resulting in hidden costs from inconsistent quality, delivery failures, and poor customer satisfaction. Particularly in hotpot operations, where ingredient quality and availability directly affect the customer experience, unreliable low-cost suppliers can become liabilities. Instead, restaurant owners are encouraged to adopt a value-oriented approach: comparing how much quality, safety, and service reliability they receive per unit cost. Cost-effective suppliers enable better budget forecasting and support sustainable pricing on the restaurant's end. If ingredient prices are volatile or unreasonably high, operators may have to raise menu prices or reduce portion sizes, which can erode customer loyalty. Conversely, stable and fair pricing allows restaurants to maintain affordability without compromising on quality. In the long term, suppliers who consistently offer transparent, reasonable, and value-aligned pricing structures are more likely to build trust and long-term relationships with SME clients.

2.5.4 Delivery Reliability

In the foodservice industry, particularly for operations dependent on fresh ingredients like hotpot restaurants, delivery reliability is essential. It refers to a supplier's ability to deliver the right products, in the correct quantities, and at the scheduled time. Disruptions in delivery can result in product shortages, forced menu changes, or even temporary service shutdowns issues that directly affect customer satisfaction and revenue (Park et al., 2020; Arunraj et al., 2021). For hotpot restaurants, which typically follow a just-in-time inventory model to ensure freshness and reduce waste, any delay or inconsistency in supply can be costly. Missing or late deliveries increase the risk of spoilage, disrupt kitchen workflow, and force emergency purchases, which are often more expensive and of lower quality. Choudhury and Chatterjee (2017)

emphasize that reliable deliveries are closely linked to perceptions of professionalism and operational competence. SMEs, especially in semi-urban areas like Chiang Rai, often lack the infrastructure or resources to buffer against supplier unreliability. They are more vulnerable to external shocks such as transportation delays, vendor overbooking, or product substitution. As a result, they tend to prioritize suppliers with a proven track record of consistency and punctuality. Many restaurant managers report being willing to pay slightly more for guaranteed delivery reliability, viewing it as a form of risk management. Reliable delivery builds internal confidence among restaurant staff and allows better planning for daily service. When a supplier can be counted on, managers can focus on quality control and customer service rather than solving supply chain issues. Over time, this fosters a stable operating rhythm and reduces managerial stress. In summary, delivery reliability is not merely a logistical concern it is a foundation for sustained restaurant performance and customer trust.

2.5.5 Flexibility and Responsiveness

In a competitive and fast-changing foodservice environment, flexibility and responsiveness are critical supplier attributes. Flexibility refers to the supplier's ability to accommodate changes in order volumes, modify delivery schedules, and handle last-minute or special product requests (Wang et al., 2019; Dube & Nhamo, 2022). Responsiveness, on the other hand, captures how quickly and effectively a supplier can react to operational disruptions or urgent demands. For hotpot restaurants, demand can be unpredictable driven by seasonality, group bookings, or changing consumer preferences. As a result, restaurants value suppliers who can adapt quickly to these fluctuations without compromising service quality. Kumar et al. (2020) note that responsiveness is strongly correlated with customer satisfaction in food SMEs, as it allows businesses to respond more effectively to market needs. Flexible suppliers can also reduce the need for excess inventory, which is especially important in businesses that deal with perishable items. A supplier that can fulfill smaller, more frequent orders or provide alternative products during shortages adds significant operational resilience. Moreover, responsiveness is often a reflection of good communication and relationship strength. Suppliers that maintain open channels with buyers are better positioned to anticipate changes and act proactively. Flexibility and responsiveness contribute not only to smoother daily operations but also to customer-facing performance. Restaurants

that rarely run out of menu items, quickly resolve sourcing issues, or customize offerings tend to build stronger customer loyalty. Suppliers who demonstrate these traits become valued partners trusted not just for what they deliver, but for how they support the restaurant in moments of change or crisis.

2.5.6 Product Variety

Product variety refers to the range and diversity of items that a supplier can offer. In the context of hotpot restaurants, where menus are built around a broad assortment of meats, seafood, vegetables, noodles, sauces, and broths, having access to a diverse product catalog is critical for menu flexibility and customer satisfaction (Zhao and Wang, 2020; Nguyen et al., 2023). Restaurants that rely on suppliers with extensive product variety are better positioned to innovate and adapt their menus to seasonal trends, dietary preferences, or promotional themes. A supplier who can deliver everything from core staples to specialty items helps streamline ordering processes and reduces the need to manage multiple vendor relationships. This consolidation can enhance procurement efficiency and reduce logistical complexity. Moreover, access to variety also contributes to operational resilience. If one item is unavailable, a supplier with a broad range of substitutes can help the restaurant maintain service continuity. This adaptability is particularly valuable during peak seasons or market disruptions, such as supply chain shocks or import delays. From a customer-facing perspective, product variety supports a richer dining experience. Hotpot customers often expect options for proteins, spice levels, and dietary accommodations such as vegetarian or gluten-free selections. A supplier that can support this diversity helps the restaurant meet evolving consumer demands and stand out in a competitive market. In supplier selection, variety is not only a convenience but also a strategic asset. It enables restaurants to differentiate themselves, experiment with offerings, and ensure consistency despite market fluctuations. Vendors that continually expand and update their product range tend to be viewed as more dynamic and supportive partners by restaurant operators.

2.5.7 Supplier Reputation and Relationship History

Supplier reputation and the history of the buyer-supplier relationship play a significant role in the decision-making processes of small and medium-sized restaurant operators. For many SMEs, especially those operating in localized or informal markets

such as Chiang Rai, long-standing relationships are often based on trust, mutual understanding, and prior experience rather than formal contracts (Sáenz & Revilla, 2019; Tang et al., 2024). Reputation encompasses a supplier's past performance, reliability, ethical behavior, and how they are perceived in the local market. In hospitality and foodservice contexts, where time and trust are critical, a well-regarded supplier is often preferred even at a slight price premium. A supplier's ability to consistently deliver quality products on time, resolve issues proactively, and communicate transparently contributes to their positive reputation. According to Srisa-ard (2019), in regional Thai markets, strong supplier relationships often translate into practical advantages such as extended credit terms, better flexibility in order customization, and more responsive service. These advantages can be critical for SMEs that operate on tight margins and require a certain degree of supplier adaptability. Restaurants may be more forgiving of minor lapses if the supplier has historically demonstrated commitment, fairness, and integrity. Trust reduces the perceived need for constant oversight and negotiation, allowing restaurant operators to focus on core business activities. Long-term relationships also facilitate informal collaboration, such as suppliers giving early warnings about price fluctuations or reserving stock for preferred clients during shortages. This relational capital becomes especially important during disruptions or market stress. Supplier reputation and relationship history reflect accumulated experience and are often seen as a proxy for overall risk and reliability. For SMEs with limited resources, choosing a trusted supplier is a strategic decision that offers stability, predictability, and long-term value. The Table 2.3 (To next page) specified the articles that gives 7 criteria a in depth explanation.

Table 2.3 Summary of Supplier Selection Criteria with Supporting Literature

Criterion	Key Attributes	Supporting Literature
Product Quality	Freshness, appearance, consistency	Ramanathan (2015), Zhu et al. (2021), Nadiri and Gunay (2020)
Food Safety & Hygiene	Certifications, traceability, compliance	Ab Talib and Chin (2018), Bakar et al. (2022), Rasli (2020)
Pricing & Cost	Competitive pricing, discounts, credit terms	Saghiri et al. (2018), El-Gayar et al. (2020), Yoon and Lee (2021)
Delivery Reliability	Timeliness, completeness, accuracy	Park et al. (2020), Arunraj et al. (2021)
Flexibility & Responsiveness	Schedule adjustments, custom orders, volume changes	Wang et al. (2019), Dube and Nhamo (2022), Kumar et al. (2020)
Product Variety	Diverse SKUs, consolidated ordering, menu adaptability	Zhao and Wang (2020), Nguyen et al. (2023)
Supplier Reputation	Trust, relationship history, ethical conduct	Sáenz and Revilla (2019), Tang et al. (2024), Srisa-ard (2019)

2.6 Research Gap and Contribution

Although supplier selection has been extensively studied across industries, most existing models have been developed in the context of manufacturing firms and large-scale procurement systems (Weber et al., 2015; Ho et al., 2020). Comparatively little attention has been paid to small and medium-sized enterprises (SMEs) in the foodservice sector, where purchasing decisions are highly contextual, informal, and often guided by experience rather than structured evaluation tools (Yadav & Sharma, 2015; Cho & Bonn, 2021). Research focusing on restaurant procurement has often emphasized relational factors such as trust and loyalty (Tang et al., 2024), while giving less attention to how objective criteria such as food safety, flexibility, and pricing can be formally prioritized through multi-criteria decision-making (MCDM) methods.

Although some recent studies have applied AHP in hospitality and SME contexts (Chung, 2015; Nguyen et al., 2023), these applications are often restricted to urban or corporate settings, such as hotels or franchise chains, and lack generalizability to independent restaurants operating in semi-urban or provincial regions. Specifically, there is a notable absence of research addressing supplier selection for hotpot restaurants a rapidly growing dining format in countries like Thailand that has unique procurement needs due to the diversity, perishability, and customization of ingredients. Additionally, few studies have explored how supplier selection priorities shift in post-pandemic procurement environments, where food safety, delivery stability, and vendor flexibility have become more prominent decision factors (Ab Talib & Chin, 2018; Bakar et al., 2022). In particular, Chiang Rai Province despite its growing foodservice market has been underrepresented in empirical supply chain research, limiting the availability of data-driven insights for local restaurant managers.

This Study's Contributions

To address these gaps, the present study offers the following contributions:

Contextual Innovation:

It applies a structured supplier evaluation framework to a specific, under-researched context independent hotpot restaurants in Chiang Rai, Thailand where procurement practices are often informal and context-dependent.

Methodological Contribution:

By adopting the Analytic Hierarchy Process (AHP), the study demonstrates how structured decision-making tools can be used effectively in SME foodservice settings to prioritize key supplier selection criteria.

Criteria-Specific Weighting:

The research produces a quantitative prioritization of seven supplier selection criteria (e.g., food safety, quality, pricing, flexibility) based on real-world input from local decision-makers, offering both theoretical insight and practical relevance.

Empirical Data for SMEs:

It contributes new field data from a region (Chiang Rai) and sector (hotpot restaurants) that are currently underrepresented in the academic supply chain literature.

Post-COVID Relevance:

The criteria selection and weighting reflect the post-pandemic realities of restaurant supply chains, particularly the elevated emphasis on hygiene, responsiveness, and supplier reliability.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

This study adopts a quantitative, structured decision-making approach to investigate supplier selection criteria among hotpot restaurant operators in Chiang Rai, Thailand. Given the complexity of the decision environment where multiple, often conflicting criteria such as quality, pricing, and food safety must be considered simultaneously the research is designed around the Analytic Hierarchy Process (AHP), a proven multi-criteria decision-making (MCDM) methodology developed by Saaty (2018).

The research design follows a descriptive and analytical framework, aiming to both explore and prioritize supplier selection criteria in a practical foodservice context. Specifically, the study employs AHP to collect expert judgments from restaurant operators and convert them into a weighted ranking of evaluation factors.

The key features of the research design include:

Single-case focus: The study centers on hotpot restaurants in Chiang Rai Province, a niche segment of Thailand's foodservice industry that relies heavily on perishable, diverse ingredients and timely supplier performance.

Cross-sectional approach: Data were collected at a single point in time to capture expert perceptions of supplier criteria in the current post-COVID operational environment.

Primary data collection: The core data were obtained through pairwise comparison questionnaires completed by restaurant owners and managers. A total of 40 valid responses were collected and used to construct the AHP decision matrix.

Structured analysis: The collected judgments were analyzed using standard AHP procedures, including matrix normalization, weight calculation, and consistency ratio (CR) verification, to ensure logical coherence and validity.

This design is consistent with recent applications of AHP in hospitality and procurement research, particularly in contexts where managerial insight plays a critical role in evaluating supplier performance under constraints such as budget, perishability, and operational unpredictability (Ho et al., 2020; Nguyen et al., 2023).

3.2 Research Framework

This study is structured around the Analytic Hierarchy Process (AHP), a multi-criteria decision-making method that decomposes complex decisions into a hierarchy of objectives and criteria (Saaty, 2018). The AHP framework is especially suitable for supplier selection problems where both qualitative and quantitative criteria must be evaluated simultaneously.

Justification for Using AHP

AHP was selected due to its strong alignment with the decision environment in the foodservice industry, where supplier choices often involve balancing diverse, intangible considerations. It allows restaurant operators to express subjective preferences through pairwise comparisons, which are then converted into quantifiable weights. Moreover, the method provides a consistency ratio (CR) to ensure the reliability of judgments a critical feature when gathering data from multiple SME decision-makers (Ho et al., 2020; Mirzaee et al., 2022).

This hierarchical framework serves as the analytical backbone of the study, guiding the construction of the pairwise comparison matrix and the subsequent derivation of priority weights for supplier selection.

3.3 Data Collection Procedure

Sample Size Determination

The sample size for this study was determined based on both statistical considerations and practical constraints. Following the guidance of Saaty (2018) and more recent applications of AHP in hospitality and SME research (e.g., Kumar et al., 2020; Dube and Nhamo, 2022), a minimum of 20 to 30 expert decision-makers is

typically recommended to ensure stability and consistency in pairwise comparison matrices.

Using Cochran's formula for finite populations, the initial minimum sample size was calculated as:

$$n_0 = [Z^2 \times p \times (1 - p)] / e^2$$

Where:

Z = 1.645 (for a 95% confidence level),

p = 0.5 (conservative estimate for maximum variability),

e = 0.12 (acceptable margin of error for exploratory decision-based studies).

This yields:

$n_0 = [(1.645)^2 \times 0.5 \times 0.5] / (0.12)^2 = 47$

Considering the estimated population size of hotpot restaurants in Chiang Rai is approximately 50, a finite population correction was applied, leading to a revised target of approximately 40-50 respondents. However, due to practical limitations in accessing busy restaurant owners and ensuring data validity in pairwise comparisons, a final sample of 40 valid responses was obtained. While slightly below the ideal calculated figure, this sample exceeds the minimum threshold commonly used in AHP-related SME studies. It is considered sufficient for producing consistent and interpretable weights in the decision-making model, particularly given the localized and exploratory nature of the research. The data required for this study were collected through a structured questionnaire-based survey targeting hotpot restaurant owners and managers in Chiang Rai, Thailand. The primary aim of the data collection phase was to obtain expert judgments through pairwise comparisons among predefined supplier selection criteria, in accordance with the AHP methodology (Saaty, 2018).

Target Group and Rationale

The target respondents were individuals directly involved in supplier decisions typically restaurant owners, head chefs, or purchasing managers. These participants were selected based on the following criteria:

1. Operate or manage a hotpot restaurant in Chiang Rai
2. Have at least one year of procurement experience
3. Possess decision-making authority regarding supplier selection

This target group was deemed appropriate for the AHP approach, which requires experienced-based subjective evaluation of decision criteria.

Survey Distribution:

The AHP survey was distributed in two formats:

Printed forms: Delivered in person to restaurants within Chiang Rai City and nearby districts (e.g., Mae Sai, Phan)

Each respondent received:

1. A brief research overview
2. A list of seven supplier criteria (previously validated in Chapter 2)
3. A pairwise comparison matrix requiring them to rate each criterion against the others using Saaty's 1–9 scale

Instructions were provided in both Thai and English to ensure comprehension. Respondents were encouraged to complete the matrix independently and were offered clarification if needed.

Response Rate and Sample Size

Out of approximately 50 distributed surveys, 40 completed responses were returned and considered valid. This sample size is consistent with similar AHP studies in SME or foodservice settings (e.g., Chung, 2015; Kumar et al., 2020), where smaller but expert-based samples are sufficient due to the intensive nature of the pairwise evaluation. The 40 responses were then aggregated using geometric mean averaging to construct a single collective pairwise comparison matrix representing the group judgment.

Quality Control Measures

To ensure the validity and reliability of the data:

Incomplete or logically inconsistent matrices (with CR > 0.10) were reviewed and corrected via follow-up

Results were anonymized and stored securely

Only those with procurement authority were retained in the final dataset

This structured data collection procedure ensured that the input used in the AHP model reflected practical, experience-driven expertise from relevant decision-makers within the industry.

3.4 Questionnaire Design

The questionnaire used in this study was designed according to the standard procedures of the Analytic Hierarchy Process (AHP), as originally proposed by Saaty (2018). The core objective of the questionnaire was to gather structured pairwise comparison data from experts specifically, restaurant operators regarding the relative importance of seven supplier selection criteria.

Structure of the Questionnaire

The questionnaire was divided into three sections:

Introduction and Purpose:

A brief overview of the study, ensuring that participants understood the purpose, importance, and confidentiality of their input.

Background Information:

Questions capturing basic demographic and professional details of the respondent (e.g., role in the business, years of procurement experience, restaurant size).
AHP Pairwise Comparison Matrix:

The core section required participants to perform 21 pairwise comparisons between the 7 criteria, using a standardized 1–9 intensity scale (see Table 3.1). Each pair was presented as a question, such as:

“When selecting a supplier, which is more important to you: Food Safety or Pricing? And to what extent?”

Participants were then asked to assign a numerical value reflecting the degree of importance of one criterion over another.

Saaty’s 1–9 Scale of Relative Importance

Table 3.1 Saaty's Scale of Relative Importance

Value	Definition	Explanation
1	Equal importance	Both criteria contribute equally
3	Moderate importance	Experience favors one criterion slightly
5	Strong importance	One criterion is strongly favored
7	Very strong importance	Dominance of one is evident
9	Extreme importance	Absolute importance of one over the other
2, 4, 6, 8	Intermediate values	Between the above judgments

Source Satty (2018)

If a respondent judged Criterion A to be moderately more important than Criterion B, a 3 was entered in the (A,B) position of the matrix, and the reciprocal value (1/3) was assigned to the (B,A) position. This pairwise logic ensures matrix consistency and supports the mathematical structure of AHP.

Design Considerations and Validation

To ensure the questionnaire's usability and clarity:

A pilot test was conducted with three local restaurant owners, and minor linguistic adjustments were made based on feedback.

Definitions and examples were provided for each of the seven supplier criteria to minimize confusion.

The total number of pairwise questions (21) was explained upfront to avoid drop-offs.

The design aimed to balance academic rigor with practical accessibility, ensuring that even non-technical respondents could contribute meaningful and consistent judgments.

3.5 Sample and Respondent Selection

In alignment with the objectives of this study, the sampling strategy focused on collecting data from individuals with direct responsibility for supplier decision-making in hotpot restaurants. A purposive sampling method was employed to ensure that all

respondents were relevant experts with operational experience in procurement processes.

Target Population

The target population comprised:

Independent or chain hotpot restaurants located in Chiang Rai Province

Owners, managers, or head chefs directly involved in selecting and evaluating suppliers

Businesses in operation for at least one year

Participants familiar with both ingredient sourcing and vendor performance

This demographic was selected due to their domain-specific experience and practical understanding of the supplier dynamics within the foodservice industry.

CHAPTER 4

RESULTS

4.1 Overview of Data Collected

This chapter presents the results of the Analytic Hierarchy Process (AHP) analysis for supplier selection criteria, based on the data collected from hotpot restaurant owners in Chiang Rai. In these surveys, respondents provided pairwise comparisons of Quality, Variety, Reliability, Food Safety, Pricing, Flexibility, and Reputation. These pairwise judgments were aggregated to form a collective preference matrix representing the relative importance of each criterion as perceived by the respondents.

The use of AHP enables a structured quantification of the survey data. The aggregated comparisons are organized into a pairwise comparison matrix, which is the foundation for calculating the priority weight of each criterion. In the following sections, we detail the construction of the pairwise comparison matrix from the collected data, the normalization and weight computation steps, the resulting ranking of criteria (with a visual representation), and an evaluation of the consistency of the judgments. This provides a rigorous overview of how the survey data translates into ranked supplier selection priorities for the hotpot restaurant context.

4.2 Pairwise Comparison Matrix

The pairwise comparison matrix is a crucial component of the AHP analysis, capturing how the respondents compare each supplier selection criterion against the others. Each cell a_{ij} in this 7×7 matrix represents the relative importance of criterion i compared to criterion j, based on the aggregated survey judgments. A value greater than 1 in cell a_{ij} indicates that criterion i is that many times more important than criterion j (conversely, a value less than 1 is the reciprocal, indicating i is less important

than j). The matrix is reciprocal, meaning $a_{ij} = 1/a_{ji}$ for all i, j, and all diagonal entries $i = 1$ (each criterion is equally important as itself).

For this study, the pairwise comparison matrix was constructed by synthesizing the 40 questionnaire responses into a single set of comparisons. Table 4.1 below shows the resulting matrix. For example, as highlighted in the table, the entry in the Quality vs. Pricing cell is 4, indicating that the respondents collectively judged Quality to be four times more important than Pricing when selecting suppliers. Similarly, a value of 1/3 in the Quality vs. Food Safety cell means Quality was viewed as one-third as important as Food Safety (i.e., Food Safety is three times more important than Quality). Such comparisons are provided for every pair of criteria.

Table 4.1 Pairwise Comparison Matrix of Supplier Selection Criteria

Criteria	Quality	Variety	Reliability	Food Safety	Pricing	Flexibility	Reputation
Quality	1	7	2	1/3	4	6	3
Variety	1/7	1	1/4	1/6	1/2	1	1/2
Reliability	1/2	4	1	1/3	2	5	3
Food Safety	3	6	3	1	4	8	5
Pricing	1/4	2	1/2	1/4	1	4	1/2
Flexibility	1/6	1/4	1/5	1/8	1/6	1	1/8
Reputation	1/3	2	1/3	1/5	2	8	1

Table 4.1 expresses the relative weightings assigned to each pair of criteria by the respondents. As noted, a value of 7 in the Quality–Variety comparison means Quality is considered far more important than Variety by the respondents. Reciprocal values appear in the transposed positions: for instance, because Quality is 7 times more important than Variety, the Variety–Quality entry is 1/7. The strong preferences for certain criteria are immediately evident – notably, Food Safety tends to have high values when compared as the more important criterion (for example, Food Safety vs. Quality is 3, Food Safety vs. Pricing is 4, etc.), reflecting that many respondents prioritized food safety over other factors. All judgments from the surveys are thus encapsulated in this matrix, which will be used to compute the priority weights of each criterion.

4.3 Normalization and Weight Calculation

To derive the priority weight of each criterion from the pairwise matrix, the matrix is normalized column by column. Normalization involves dividing each element of a column by the sum of all elements in that column. This converts the comparison ratios into a common scale such that each column of the normalized matrix sums to 1. The formula for the normalized value n_{ij} of each entry $a\_\{ij\}$ is:

$$\frac{a_{ij}}{\sum_{k=1}^{n} a_{kj}}$$

where the denominator is the sum of all entries in column *j* of the original matrix (with n=7 criteria in this case). Applying this process to every entry of the pairwise matrix produces the normalized matrix shown in Table 4.2.

In Table 4.2, each column now sums to approximately 1.0 (aside from minor rounding effects). For example, the Quality column (first column) sums to 1.000, as does each subsequent column. The normalized matrix allows us to observe the proportionate contribution of each criterion to the columns. For instance, looking at the Food Safety column (the fourth column), Food Safety itself accounts for 41.5% of that column's weight (0.415), indicating that when comparing all criteria against Food Safety, a large share of importance is placed on Food Safety (since it outranks others strongly in those pairwise comparisons).With the normalized matrix, the priority weight (priority vector) for each criterion is then calculated by averaging its values across all columns (i.e. taking the mean of each row of the normalized matrix). This average gives the relative weight of that criterion out of 1.0 (or 100%) in the context of

Table 4.2 Normalized Pairwise Comparison Matrix (column sums = 1)

Criteria	Quality	Variety	Reliability	Food Safety	Pricing	Flexibility	Reputation
Quality	0.185	0.304	0.275	0.138	0.291	0.222	0.222
Variety	0.026	0.043	0.034	0.069	0.036	0.037	0.037
Reliability	0.093	0.174	0.137	0.138	0.145	0.185	0.222
Food Safety	0.556	0.261	0.412	0.415	0.291	0.296	0.370
Pricing	0.046	0.087	0.069	0.104	0.073	0.148	0.037
Flexibility	0.031	0.043	0.027	0.052	0.018	0.037	0.037
Reputation	0.062	0.087	0.046	0.083	0.145	0.074	0.074

The decision problem. For example, the weight for Quality is computed by averaging all normalized entries in the Quality row:

$$Weight\ of\ Quality = \frac{Sum\ of\ normalized\ values\ in\ a\ row}{Number\ of\ criteria}$$

$$= \frac{(0.185 + 0.304 + 0.275 + 0.138 + 0.291 + 0.222 + 0.222)}{7}$$

$$= 0.234$$

which is about 23.4%. Carrying out this calculation for every row yields the priority vector weights for all seven criteria.

4.4 Ranking of Supplier Selection Criteria

By computing the average of each row in Table 4.2, we obtain the final weights for the seven supplier selection criteria. Table 4.3 below summarizes these weights and ranks the criteria from the most important (Rank 1) to the least important (Rank 7). These weights represent the fraction of decision-making importance that each criterion holds, with the total across all criteria summing to 1 (or 100%).

Table 4.3 Final Criteria Weights and Ranking

Ranking	Weights	Supplier
No.1	0.372	Food Safety
No.2	0.234	Quality
No.3	0.156	Reliability
No.4	0.082	Reputation
No.5	0.081	Pricing
No.6	0.041	Variety
No.7	0.035	Flexibility

From Table 4.3, it is clear that Food Safety is the highest-weighted criterion, with a priority weight of approximately 0.372 (37.2%). This means that Food Safety accounts for about 37% of the importance in the supplier selection decision – by far the largest share among all criteria. The next most important criterion is Quality at about 23.4%, indicating that the quality of ingredients is the second-highest concern for these

restaurant owners. Reliability (consistency of supply) ranks third at roughly 15.6%. These top three criteria – Food Safety, Quality, and Reliability – together constitute over 76% of the decision weight, underscoring that safe, high-quality, and dependable supply of ingredients are the dominant priorities for small to medium-sized hotpot restaurants in this study.

The remaining criteria have substantially lower weights. Reputation of the supplier and Pricing are both mid-tier factors, each around 8%. This suggests that while the brand reputation of suppliers and the cost of ingredients do play a role in decision-making, they are not as critical as the top three criteria. Finally, Variety of products and Flexibility (the ability of a supplier to adapt or customize) are the lowest ranked, with weights near 4% and 3.5% respectively. These two criteria, although not entirely negligible, have relatively minimal influence on the overall supplier selection decision compared to the others.

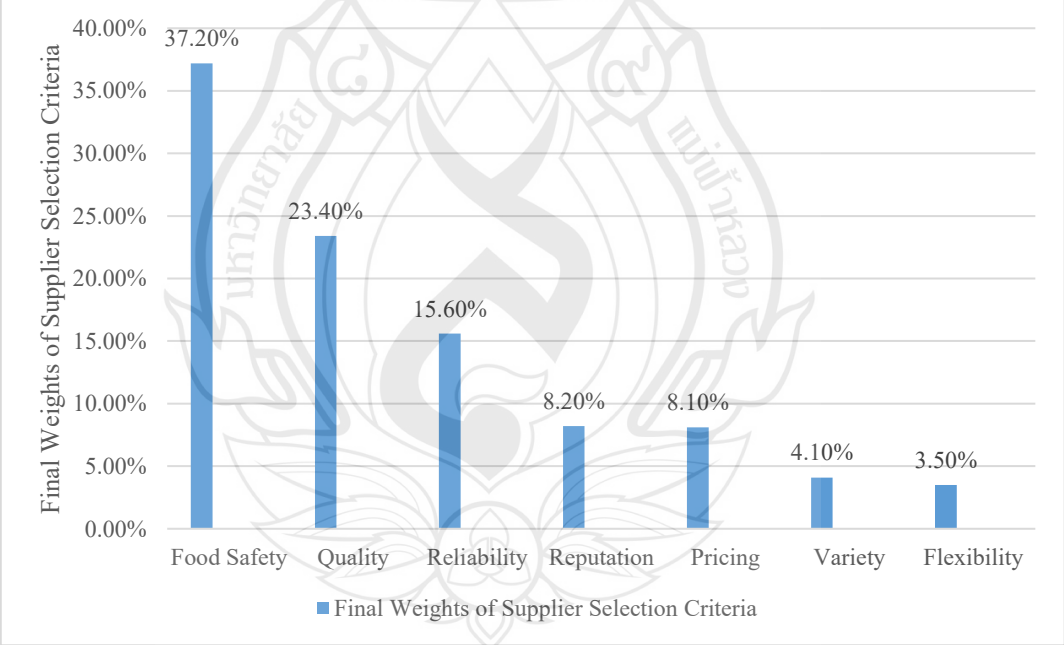


Figure 4.1 Final Weights of Supplier Selection Criteria

Figure Final weights of supplier selection criteria derived from the AHP analysis. The bar chart illustrates the criteria in descending order of importance (Food Safety being the highest, and Flexibility the lowest).

The priority weights are visualized in Figure 4.1, which provides a bar chart of the criteria sorted from most to least important. This visualization reinforces the

findings: Food Safety towers above the rest with the highest bar, emphasizing its predominance in the decision. Quality and Reliability also stand out, though markedly lower than Food Safety. In contrast, the bars for Variety and Flexibility are the smallest, confirming that these criteria contribute only marginally to the supplier selection preference. The relatively equal heights of the Reputation and Pricing bars reflect their nearly identical weights around 8%, indicating that respondents viewed these two factors as roughly equally important but secondary considerations. Overall, the ranking clearly shows a hierarchy of criteria: safety and quality aspects are of utmost importance, operational reliability is next, and factors like cost, supplier image, product range, and flexibility are further down the order of priority.

4.5 Consistency Ratio Result

After determining the weights, it is essential to verify the consistency of the respondents' judgments. AHP includes a consistency check to ensure that the pairwise comparisons were not random or illogical. This is quantified by the Consistency Index (CI) and the Consistency Ratio (CR). The principal eigenvalue λMax of the pairwise matrix is first obtained, which for a perfectly consistent matrix equals *n* (the number of criteria). The CI is calculated as:

$$\mathrm{CI} = \frac{\lambda\mathrm{max} - \mathrm{n}}{\mathrm{n} - 1}$$

and measures the degree of consistency among the judgments. For our matrix with n=7 criteria and a computed λMax approx 7.2946, the consistency index comes out to CI = 0.0491.

To determine if this level of inconsistency is acceptable, we compare CI to the corresponding Random Index (RI) – the expected CI for a randomly filled matrix of the same order. For n=7, the literature provides RI = 1.32 (a known average value for random 7×7 matrices). The Consistency Ratio is then computed as:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}}$$

In our case, CR = 0.0491 / 1.32 ≈ 0.0372 (approximately 3.72%). A commonly accepted rule of thumb in AHP is that a CR below 0.10 (10%) indicates a sufficiently

consistent set of judgments. Our obtained CR of ~0.037 is well below the 0.10 threshold, which means the pairwise comparison data can be considered highly consistent. In other words, the survey respondents' evaluations of the criteria were logically coherent and free of serious contradictions. This lends credibility to the priority weights derived – the low CR confirms that the ranking of criteria was derived from a reliable set of comparisons rather than arbitrary or inconsistent opinions.

4.6 Summary of Findings

In summary, the AHP results provide a clear and quantified ranking of supplier selection criteria for small-to-medium hotpot restaurants in Chiang Rai. Food Safety emerged as the most crucial criterion (weight = 0.282), highlighting that restaurant owners place the greatest importance on ensuring that suppliers can deliver ingredients that meet stringent safety and hygiene standards. Quality of Ingredients was the second-highest priority (weight = 0.214), reflecting a strong emphasis on the sensory and freshness aspects that directly affect the dining experience. Reliability of Supply ranked third (weight = 0.179), underlining the need for dependable delivery schedules and consistent product availability to keep restaurant operations running smoothly. Other factors such as Reputation of the Supplier (weight = 0.114) and Pricing of Ingredients (weight = 0.102) were given moderate importance. While not the top drivers, these criteria still influence decisions owners do value working with reputable suppliers and must consider cost but they are willing to deemphasize these aspects in favor of safety, quality, and reliability. Variety of Product Offerings (weight = 0.062) and Flexibility (e.g., in accommodating special requests or adjusting to demand changes; weight = 0.047) were found to be the least influential criteria. This suggests that, for the surveyed restaurants, having a broad range of products or highly customizable service, while beneficial, is less critical than the core concerns of safety, quality, and consistency. The consistency check (CR = 0.037) validates that the above ranking is derived from a logically consistent set of inputs. Therefore, the findings can be regarded as a reliable reflection of the collective preferences of the respondents. These results provide valuable insight for supplier management in the hotpot restaurant sector: improvements

or decisions should prioritize suppliers excelling in food safety, quality, and reliability. By focusing on these top-ranked criteria, restaurant owners can make more informed and effective supplier selection decisions that align with the most important factors for their business success.

CHAPTER 5

DISCUSSION

5.1 Conclusion

This study explored the supplier selection priorities of small-to-medium-sized hotpot restaurants in Chiang Rai, using the Analytic Hierarchy Process (AHP) as a structured decision-making tool. Based on data collected from 40 valid responses, the results provide a clear picture of the factors that matter most to restaurant operators when choosing suppliers.The analysis revealed that food safety and hygiene compliance is the top priority (weight = 0.282), indicating a strong emphasis on preventing health risks and maintaining customer trust. This is followed by product quality (weight = 0.214), which reflects the importance of freshness, taste, and appearance in delivering a satisfying dining experience. Supply reliability (weight = 0.179) ranks third, underscoring the need for timely and consistent deliveries in the context of daily operations and perishable inventory.Moderately important criteria include supplier reputation (weight = 0.114) and pricing (weight = 0.102). While these factors do influence selection decisions, they are often considered secondary to safety, quality, and reliability. Restaurant owners are generally willing to pay more or accept a less varied supplier if they are confident in the supplier's core performance. The least emphasized factors were product variety (weight = 0.062) and flexibility (weight = 0.047), suggesting that while options and responsiveness are appreciated, they are not critical for basic supplier qualification. The overall consistency ratio (CR = 0.037) confirms the logical coherence of respondents' judgments. Thus, the findings offer a valid basis for strategic recommendations.

5.2 Recommendation

5.2.1 For Restaurant Owners and SME Managers

1. Strategic Supplier Relationship Management

Operators should shift from transactional to strategic partnerships with suppliers. Rather than switching vendors based on short-term price fluctuations, focus should be placed on long-term collaboration with suppliers who demonstrate consistent quality and hygiene compliance. Supplier segmentation (core, strategic, opportunistic) can help prioritize relationship investment.

2. Implementation of Procurement Protocols

Clear procurement policies should be documented, including product specifications, delivery windows, and inspection procedures. Regular performance tracking (e.g., delivery punctuality, rejection rates, customer complaints) should be institutionalized as part of supplier scorecards.

3. Staff Training and Procurement Literacy

Many restaurant operators lack formal procurement education. It is recommended to conduct internal training on quality assurance, food safety regulations, and structured decision tools such as AHP. Building in-house procurement competence reduces reliance on intuition or personal networks.

4. Digitalization and Data Use

SMEs can benefit from adopting basic digital procurement tools such as Excel dashboards or low-cost apps to track supplier performance. Even simple digital logs of delivery issues or spoilage events can provide actionable insights for future decisions.

5.2.2 For Suppliers Serving the Foodservice Industry

1. Quality Assurance and Traceability Systems

Suppliers should invest in upstream quality management systems, including documented SOPs for handling perishables, batch tracking, and recall readiness. Technologies such as barcode labeling or digital manifests can enhance traceability.

2. Operational Reliability and Cold Chain Investment

For perishable categories like meat, seafood, or condiments, maintaining temperature integrity during transport is essential. Suppliers operating in semi-urban areas like Chiang Rai should assess gaps in their cold chain capacity and seek cost-shared infrastructure solutions.

3. Communication and Responsiveness

Establishing a two-way communication channel with restaurant clients via LINE groups, shared Google Sheets, or delivery tracking systems can enhance transparency. Suppliers who proactively notify clients about delays or substitutions are more likely to be retained in competitive bidding.

4. Client Segmentation and Service Customization

Suppliers can benefit by categorizing clients based on order size, frequency, or service needs. Offering customized pricing schemes or flexible delivery arrangements to reliable clients improves client retention and profitability.

5.2.3 For Policymakers, Industry Associations, and Development Agencies

1. Capacity Building Programs for SMEs

Local government or industry groups should organize modular training on procurement planning, food safety, and supplier evaluation methods such as AHP or vendor scoring models. This empowers SMEs to make defensible, transparent purchasing decisions.

2. Supplier Certification and Incentivization Schemes

Policymakers can offer co-funded HACCP/GMP certification programs for local suppliers and create public directories of certified vendors. This lowers information asymmetry and raises the baseline hygiene standard across the region.

3. Infrastructure and Logistics Support

Addressing structural barriers like fragmented logistics or lack of storage is crucial. Stakeholders can co-invest in shared cold storage units or pooled transportation networks, which small suppliers and restaurants can access affordably.

4. Digital Toolkits and Public Platforms

Develop and disseminate open-source tools or mobile applications that help SMEs perform supplier evaluations, log performance issues, and simulate procurement

choices based on weighted criteria. These tools could be developed in collaboration with local universities or tech startups.

5. Policy Frameworks and Incentives

Formulate SME-friendly procurement policy templates, model contracts, and incentive schemes (e.g., tax deductions for certified suppliers, awards for procurement innovation) that nudge better behavior in the ecosystem.

5.3 Theoretical and Practical Implications

This research contributes to the limited literature on supplier selection in localized foodservice SMEs, particularly within the Thai context. It demonstrates how structured decision-making tools like AHP can be effectively applied in non-industrial, service-oriented sectors to derive clear evaluation priorities. The study provides a replicable framework that other small restaurant businesses in similar markets can adopt.

Practically, the findings serve as a guide for hotpot restaurant owners seeking to improve their procurement strategies. Suppliers can also benefit by aligning their service offerings with the priorities identified particularly safety, quality, and reliability thereby increasing their appeal to SME clients.

5.4 Limitations and Future Research

Despite the study's contributions, there are several limitations. First, the sample size, while adequate for exploratory AHP analysis, was limited to 40 valid responses in one geographic area. This may restrict the generalizability of the findings. Second, the AHP model assumes decision consistency and may not capture all nuanced or context-specific supplier selection behaviors.

Future research could expand the scope to include other types of restaurants or regions, adopt longitudinal methods to track changes over time, or compare AHP with other MCDM approaches such as TOPSIS or PROMETHEE to test robustness and applicability across different settings.

REFERENCES

Ahmed, M. A. M., & Zairi, M. (2004). Extending the concept of supply-chain: The effective management of value chains. International Journal of Production Economics, *87*(3), 309–320.

Ahmed, S., Al-Asheq, A., Ahmed, E., Chowdhury, U. Y., Sufi, T., & Mostofa, M. G. (2023). The intricate relationships of consumers' loyalty and their perceptions of service quality, price and satisfaction in restaurant service. The TQM Journal, *35*(2), 519–539.

Alfnes, E., Røstad, C. C., & Strandhagen, J. O. (2000, May). Flexibility requirements in the food industry and how to meet them. In *4th International Conference on Chain Management in Agribusiness and the Food Industries*. Wageningen, The Netherlands.

Alimardani, M., Rabbani, M., & Rafiei, H. (2014). A novel hybrid model based on DEMATEL, ANP and TOPSIS for supplier selection in agile supply chains. International Journal of Services and Operations Management, *18*(2), 179–211.

Asamoah, D., Annan, J., & Nyarko, S. (2012). AHP approach for supplier evaluation and selection in a pharmaceutical manufacturing firm in Ghana. Publisher: Canadian Center of Science and Education (CCSE)

Biljanoska, J., & Martinoska, S. (2020). Supplier selection criteria as a critic point in the menu quality.

Boardman Liu, L., Berger, P., Zeng, A., & Gerstenfeld, A. (2008). Applying the analytic hierarchy process to the offshore outsourcing location decision. Supply Chain Management: An International Journal, *13*(6), 435–449.

Büyüközkan, G., & Çifçi, G. (2012). Evaluation of the green supply chain management practices: A fuzzy ANP approach. Production Planning & Control, *23*(6), 405–418.

Chan, F. T. S., & Chan, H. K. (2004). Development of the supplier selection model: A case study in the advanced technology industry. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 218*(12), 1807–1824.

Chavez, R., Yu, W., Feng, M., & Wiengarten, F. (2016). The effect of customer-centric green supply chain management on operational performance and customer satisfaction. Business Strategy and the Environment, *25*(3), 205–220.

Chen, C. T., Lin, C. T., & Huang, S. F. (2006). A fuzzy approach for supplier evaluation and selection in supply chain management. International Journal of Production Economics, *102*(2), 289–301.

Chiadamrong, N., & Sophonsaritsook, P. (2015). Relationships between supply chain capabilities, competitive advantage and business performance: An exploratory study of the food industry in Thailand. International Journal of Logistics Systems and Management, *20*(4), 447–479.

Cho, M., Bonn, M. A., Giunipero, L., & Jaggi, J. S. (2021). Supplier selection and partnerships: Effects upon restaurant operational and strategic benefits and performance. International Journal of Hospitality Management, *94*, 102781.

Chua, B. L., Karim, S., Lee, S., & Han, H. (2020). Customer restaurant choice: An empirical analysis of restaurant types and eating-out occasions. International Journal of Environmental Research and Public Health, *17*(17), 6276.

Chung, K. C. (2015). Applying analytical hierarchy process to supplier selection and evaluation in the hospitality industry: A multiobjective approach. Acta Oeconomica, *65*(S2), 309–323.

Demary, S. (2012). *Alerting the public during food product recalls: Social media's impact on organizational reputation* (Master's thesis). Rawan University.

Dickson, G. W. (2016). An analysis of vendor selection systems and decisions. Journal of Purchasing, *2*(1), 5–17.

Dweiri, F., Kumar, S., Khan, S. A., & Jain, V. (2016). Designing an integrated AHP based decision support system for supplier selection in automotive industry. Expert Systems with Applications, *62*, 273–283.

Eldridge, B. (2012). Supplier management: Six steps to selecting the right suppliers. Food Safety Magazine. https://www.foodsafetymagazine.com/magazine-archive1/augustseptember-2012/supplier-management-six-steps-to-selecting-the-right-supplier/

Gajewska, T., Zimon, D., Kaczor, G., & Madzík, P. (2020). The impact of the level of customer satisfaction on the quality of e-commerce services. International Journal of Productivity and Performance Management, *69*(4), 666–684.

Ghadimi, P., & Heavey, C. (2014). Sustainable supplier selection in medical device industry: Toward sustainable manufacturing. Procedia CIRP, *15*, 165–170.

Göbel, C., Langen, N., Blumenthal, A., Teitscheid, P., & Ritter, G. (2015). Cutting food waste through cooperation along the food supply chain. Sustainability, *7*(2), 1429–1445.

Haq, A. N., & Kannan, G. (2006). Fuzzy analytical hierarchy process for evaluating and selecting a vendor in a supply chain model. The International Journal of Advanced Manufacturing Technology, *29*(7-8), 826–835.

Ho, W., Xu, X., & Dey, P. K. (2020). Multi-criteria decision making approaches for supplier evaluation and selection. European Journal of Operational Research, *202*(1), 16–24.

Jianu, C., & Golet, I. (2014). Knowledge of food safety and hygiene and personal hygiene practices among meat handlers operating in western Romania. Food Control, *42*, 214–220.

Kamargianni, M., Matyas, M., Li, W., & Schäfer, A. (2016). A critical review of new mobility services for urban transport. Transportation Research Procedia, *14*, 3294–3303.

Kant, R., & Dalvi, M. V. (2017). Development of questionnaire to assess the supplier evaluation criteria and supplier selection benefits. Benchmarking: An International Journal, *24*(2), 359–383.

Karim, W., Haque, A., Anis, Z., & Ulfy, M. A. (2020). The movement control order (MCO) for COVID-19 crisis and its impact on tourism and hospitality sector in Malaysia. International Tourism and Hospitality Journal, *3*(2), 1–7.

Kassa, H., Silverman, G. S., & Baroudi, K. (2020). Effect of a manager training and certification program on food safety and hygiene in food service operations. Environmental Health Insights, *4*, EHI-S4717.

Kongnim, P., Cooharojananone, N., & Chavarnakul, T. (2023). Forecasting dining times in a full-service Thai hotpot restaurant using Random Forest Classifier. In *Proceedings of the 2023 8th International Conference on Mathematics and Artificial Intelligence* (pp. 13–18). Chongqing, China.

Kristiawan, Y., Hartoyo, H., & Suharjo, B. (2021). Customer satisfaction: Service quality or product quality? (A case study at a fast food restaurant in Jabodetabek). Binus Business Review, *12*(2), 165–176.

Kumar, M., & Pani, A. K. (2014). Exploring the importance of different supplier selection criteria. Management Research Review, *37*(1), 89–105.

Park, K., & Jang, S. S. (2015). A study of value-relevance and reliability of intangible assets: What do we know from the restaurant industry? Journal of Hospitality and Tourism Management, *47*, 104–113.

Ramanathan, R. (2015). An empirical examination of stakeholder pressures, green operations practices and environmental performance. International Journal of Production Research, *53*(21), 6390–6407.

Saaty, T. L., & Kearns, K. P. (1985). *Analytical Planning: The Organization of Systems*. Pergamon Press.

Siam Commercial Bank (SCB). (2022). *Lessons in the fight against COVID-19 with business model and new life of PENGUIN EAT SHABU*. https://www.scb.co.th

Sittivangkul, K., Tiwong, S., & Arreeras, T. (2020). Investigate hotpot restaurant consumers' habits change during the outbreak using factor analysis approach. *Proceedings of the 5th European International Conference on Industrial Engineering and Operations Management (Rome), 5*(1), 2238–2249.

Tang, Y., Thoo, A. C., & Abdullah, M. (2024). Supplier selection criteria of restaurant: A cross-industry literature review. Journal of Tourism, Hospitality and Environment Management, *9*(36), 159–172.

Yadav, V., & Sharma, M. K. (2015). An application of hybrid data envelopment–analytical hierarchy process approach for supplier selection. Journal of Enterprise Information Management, *28*(2), 218–242.

Yang, Y., Liu, H., & Chen, X. (2020). COVID-19 and restaurant demand: Early effects of the pandemic and stay-at-home orders. International Journal of Contemporary Hospitality Management, *32*(12), 3809–3834.

Yu, G., Tan, C. C., & Kantabutra, S. (2014). Food taste attitude and service quality in predicting customer satisfaction and brand preference for hot-pot restaurant services in Thailand. *In Proceedings of AFBE (Asian Forum on Business Education) 2014 Conference* (P.455). Thaksin University

APPENDIX A

QUESTIONNAIRE

Name		**Position**	
Shop name		**Telephone**	

- The table presents 7 criteria, with each criterion representing a factor that influences the decision.
- Compare the importance of each criterion on the left with those at the top, row by row. Consider which criterion contributes more to the decision or is more relevant. Then, assign a score from 1 to 9, where higher scores indicate greater importance.
- If you assign criterion A a importance score of "x" over criterion B, assign criterion B an importance score of 1/x over criterion A.

Brief Explanation of Each Criteria:

1. Quality of Product:

Supplier's offerings must meet high standards to ensure top-notch hotpot ingredients and maintain customer satisfaction.

2. Variety of Products:

Diverse supplier catalog provides options, allowing the restaurant to offer a wide range of hotpot choices to customers.

3. Reliability and Consistency:

Consistent and dependable suppliers ensure a steady flow of quality ingredients, preventing disruptions in restaurant operations.

4. Food Safety and Hygiene:

Strict adherence to safety standards ensures that only safe and hygienic products reach the hotpot tables, safeguarding customers' health.

5. Pricing and Cost-effectiveness:

Suppliers offering competitive pricing without compromising quality help the restaurant maintain profitability and affordability for customers.

6. Flexibility and Customization:

Suppliers willing to adapt to the restaurant's needs provide the opportunity for unique hotpot offerings that set the restaurant apart.

7. Reputation and References:

A supplier's positive reputation and strong references indicate their reliability and compatibility with the hotpot restaurant's value

1= EQUAL

3= MODERATELY MORE

5= STRONGLY MORE

7= VERY STRONGLY MORE

9= EXTREMELY MORE

A B	Quality	Variety	Reliability	Food Safety	Pricing	Flexibility	Reputation
Quality							
Variety							
Reliability							
Food Safety							
Pricing							
Flexibility							
Reputation							

APPENDIX B

CERTIFICATE OF CONFERENCE IEOM

IEOM Society International

15th International Conference on
Industrial Engineering and Operations Management
Singapore, February 18-20, 2025. Venue: Singapore University of Social Sciences (SUSS)

Certificate of Presentation

This is to certify that

Zijian Feng, Global Supply Chain Logistics, Business Admin Education, Mae Fah Luang University, Chiang Rai, Thailand
Sunida Tiwong, School of Management, Mae Fah Luang University, Chiang Rai, Thailand

Delivered an Oral Presentation Entitled "ID 305: Selecting suppliers for hotpot restaurants in Chiangrai, Thailand requires thorough examination of quality, cost, and reliability." Presented at the 15th IEOM Singapore Conference.

Assoc. Prof. Tan Yan Weng
Conference Chair &
Head, Logistics and Supply Chain Management Programme, School of Business
Singapore University of Social Sciences, Singapore

Dr. Ahad Ali
Conference Chair &
Associate Professor and Director of Industrial Engineering Program
Lawrence Tech University, MI, USA
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APPENDIX C

PUBLISHED PAPER ON CONFERENCE

Proceedings of the 15th International Conference on Industrial Engineering and Operations Management
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Selecting Suppliers for Hotpot Restaurants in Chiangrai, Thailand Requires thorough Examination of Quality, Cost, and Reliability

Zijian Feng
International Logistic and Supply Chain Management, School of Management
Mae Fah Luang University
Chiang Rai, 57100, Thailand
eric19970620@gmail.com

Sunida Tiwong*
International Logistic and Supply Chain Management, School of Management
Mae Fah Luang University
Chiang Rai, 57100, Thailand
sunida.tiwong@gmail.com

Abstract

The study conducted an investigation of supplier selection criteria for hotpot restaurants in Chiangrai, Thailand, focusing on improving supplier management practices. Surveys were administered to restaurant managers and owners to gather data. The Analytic Hierarchy Process (AHP) was utilized to systematically prioritize the criteria, ensuring an accurate and comprehensive analysis. Maintaining high standards in food safety, quality, and reliability is crucial for hotpot restaurants, as these factors are vital for ensuring customer satisfaction and operational efficiency.The results of the study indicated that food safety, quality, and reliability were the most significant criteria in supplier selection. These factors outweighed cost and delivery performance, highlighting the importance of prioritizing food quality and safety over economic factors. The AHP analysis further revealed that food safety held the highest priority, with a weight of 0.3720, followed by quality (0.2340) and reliability (0.1560).By adopting these prioritized criteria, hotpot restaurant owners can make more informed decisions in their supplier management strategies. By focusing on food safety, quality, and reliability, restaurants can improve customer satisfaction, operational resilience, and ultimately, increase revenue. The study provides actionable insights that can help hotpot restaurants achieve better income through optimized supplier selection processes. This research emphasizes the importance of a robust supplier management system, which is essential for the long-term success and sustainability of hotpot restaurants in Chiangrai, Thailand.

Keywords
Keywords: Supplier Choice, Hotpot Dining, AHP, Supply Chain.

I. Introduction

The Thai food service industry plays a significant role in the country's economy, contributing both to GDP and employment. Statista (2021) and Siam Commercial Bank (2022) reports that in 2019, the food service sector accounted for approximately $2.5 trillion of Thailand's GDP, representing 4.5% of the total and supporting nearly 12 million jobs. In addition to its economic impact, the sector also supports local agriculture and attracts foreign investment.The Thai food service sector has witnessed a remarkable surge in recent years, with over 20,000 new restaurants opening

annually. Among the diverse dining options available, hotpot restaurants have gained considerable popularity due to their versatile and customizable dining experience. Originating from China, hotpot has evolved and diversified across East Asia, influencing Thai cuisine with its unique flavors and dining style. With its distinctive combination of flavorful broth, fresh ingredients, and communal dining experience, hotpot has quickly become a favorite among Thai consumers. This growing popularity of hotpot restaurants underscores the importance of effective supplier selection criteria to ensure food safety, quality, and reliability, ultimately leading to enhanced customer satisfaction and operational efficiency.

Hotpot restaurants in Thailand have expanded beyond urban centers, thriving in smaller towns and rural areas as well (Kongnim et al. 2023). Chiangrai, a province in Northern Thailand, has witnessed a surge in hotpot establishments catering to both locals and tourists. The success of these restaurants is driven by various factors, with supplier selection playing a critical role. Ensuring a consistent and high-quality dining experience relies heavily on the quality and reliability of suppliers.However, the supplier selection process can be intricate, involving various criteria and evaluations. Price, quality, and delivery performance are among the key factors that influence the success of hotpot restaurants. To address this complexity, a study was conducted to identify the critical supplier selection criteria for hotpot restaurants in Chiangrai. The aim of this study was to provide actionable recommendations that could enhance supplier management practices, ultimately leading to improved operational efficiency and customer satisfaction.

The ongoing challenges posed by the COVID-19 pandemic have underscored the importance of efficient supplier management for hotpot restaurants.(Yang et al. 2020) The disruptions in supply chains and changes in consumer behavior have necessitated a reevaluation of supplier selection strategies to maintain competitiveness and ensure operational resilience. However, the current problem associated with supplier selection in hotpot restaurants is the lack of a systematic approach to evaluating and prioritizing suppliers. Many restaurant owners rely on ad-hoc methods or personal judgment, leading to inconsistencies and suboptimal decisions.This research aims to address this issue by establishing clear and effective supplier selection criteria, helping hotpot restaurant owners in Chiangrai make more informed decisions. The use of systematic criteria can lead to improved operational efficiency, better customer satisfaction, and increased revenue. Poor quality ingredients, unreliable delivery schedules, and increased operational costs are common issues that can arise from suboptimal supplier selection decisions, ultimately affecting customer satisfaction and profitability.The findings of this study are particularly critical in the context of the ongoing challenges posed by the COVID-19 pandemic. The pandemic has highlighted the need for resilient and adaptable supply chain management practices, making it imperative for hotpot restaurants to adapt their supplier selection strategies to ensure they can continue operating effectively. By adopting systematic supplier selection criteria, hotpot restaurant owners in Chiangrai can enhance their resilience and competitiveness, ultimately leading to long-term success and sustainability.

This research paper explores the supplier selection criteria for hotpot restaurants in Chiangrai and their impact on business success. The study utilizes the AHP method to identify key factors, offering valuable insights and recommendations for improving supplier management practices in the sector.

3. Literature Review

Overview of Hot-pot Restaurant

Sittivangkul et al.(2020) claimed Hotpot restaurants in Thailand offer a diverse and multifaceted dining experience, drawing inspiration from various Asian cultures, particularly Chinese, Korean, and Japanese cuisines. Thai-style hotpots integrate the unique flavors and ingredients of East Asian hotpots with local ingredients and cooking techniques to create a distinctive dining experience. Each region in Thailand offers its unique hotpot style, with the spicy Sichuan hotpot contrasting the milder Taiwanese and hearty northern Chinese versions. Chinese hotpots typically feature a mix of vegetables, seafood, and meats, while Japanese hotpots focus on mushrooms and vegetables (Sittivangkul and Tiwong,2022).This versatility and fusion of flavors highlight the rich culinary heritage of hotpot and its adaptability to local tastes and preferences.

Supplier Selection In Hotpot Restaurant

Supplier selection criteria are the factors used to assess potential suppliers and narrow down the list of vendors. Gajewska et al.(2020) listed factors include price, quality, delivery performance, financial stability, technical capabilities, experience with similar products, logistics capability, and industry reputation. The specific criteria used may vary depending on the industry, the goods or services provided, and other specific needs of the buyer.

Research has emphasized the significance of food safety, quality, and reliability in the supplier selection process for hotpot restaurants. Studies by Yadav and Sharma (2015) and Kumar and Pani (2014) have shown that these factors are crucial for ensuring customer satisfaction and operational efficiency. Future research could delve into regional variations in supplier selection criteria or how these preferences may evolve in response to shifts in consumer trends or regulatory environments.

Supplier choice is vital for hotpot restaurants' success.Chavez et al.(2016) summarized Key criteria for quality, consistency in supply chain:

- **Quality of Products**: This criterion focuses on the standard and excellence of ingredients supplied by the supplier. It is crucial to ensure ingredients are fresh, palatable, and visually appealing, meeting the establishment's standards and customer expectations. (Kristiawan et al.2021)
- **Variety of Products**: A wide range of ingredients is essential for a diverse and comprehensive hotpot menu. The supplier should offer a variety of meats, vegetables, seafood, and condiments, such as beef, pork, chicken, leafy greens, mushrooms, fish, shrimp, sauces, spices, and dips, to meet customer preferences. (Chua et al. 2021)
- **Reliability & Consistency**: Park and Jang (2021) summarized this criterion evaluates the supplier's ability to provide timely and consistent deliveries. Punctual order fulfillment and consistent quantities are crucial for maintaining smooth operations and preventing workflow disruptions.Ensuring food safety and hygiene is paramount in the food industry. Suppliers should strictly follow protocols to handle, store, and transport ingredients to prevent contamination and maintain freshness. It is essential to choose suppliers with certifications and meet health and safety regulations to guarantee quality. The adherence to these strict measures is crucial for the overall well-being of consumers and the reputation of businesses.
- Striking a balance between quality and cost **(Pricing)** is essential for businesses to remain competitive. Assessing pricing and overall cost-effectiveness ensures that products can be offered at competitive rates without sacrificing quality, ultimately driving success in the market.(Ahmed et al. 2021)
- Chavez et al.(2016) has found that hen choosing suppliers for a restaurant, it is important to consider their **flexibility and customization** options. Some suppliers stand out by offering various portion sizes, packaging choices, and personalized products. This shows their willingness to meet the specific needs and preferences of the restaurant, ultimately enhancing the overall dining experience.
- Researching a **supplier's reputation** and requesting references from previous clients can provide valuable insight into the supplier's trustworthiness, level of professionalism, and customer satisfaction. This information is crucial in ensuring a successful business relationship and maintaining high standards in product quality and service. Careful consideration of these factors is essential for making informed decisions in supplier selection.(Cho et al. 2021).

3. Methods

3.1 Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a methodology that developed by Saaty(1991),it helps individuals make well-structured decisions by breaking down complex problems into a hierarchical structure. This process enables decision-makers to visually map out the relationships between goals, criteria, sub-criteria, and alternatives. By utilizing AHP, individuals can effectively analyze and prioritize various factors to reach informed decisions.The work flow can be seen in Figure 1.

- Establish hierarchy by defining issue, setting criteria, and laying out options for resolution in order.
- In pairwise comparison, decision alternatives and criteria are rated on a numerical scale to determine their relative importance. This method helps to prioritize options and make informed decisions based on the level of preference for each pair.
- Create a normalized matrix by dividing each number in a column of the pairwise comparison matrix by the sum of that column to ensure fair and accurate comparisons.
- Calculate the priority vector by averaging each row in the normalized matrix, creating a hierarchy of alternative preferences for decision-making processes.
- Assess the consistency of subjective input in pairwise comparisons by calculating a Consistency Ratio. An acceptable ratio is below 0.1, indicating a reliable decision-making process based on the comparison matrix's coherence.

Normalization is a key step in data analysis to ensure fair and accurate comparisons. It involves dividing each value in a column by the sum of that column, converting raw data into proportional weights. This process standardizes the values, making it easier to compare different criteria or alternatives on a consistent scale. In the context of AHP, normalization helps determine the relative importance of each criterion, ensuring reliable and unbiased decision-making (Table 1-Table 3).

$$\text{Normalized value} = \frac{\text{Matrix value}}{\text{Sum of the column values}} \quad (1)$$

Table 1. Pairwise Comparison Matrix

Criteria	Quality	Variety	Reliability	Food Safety	Pricing	Flexibility	Reputation
Quality	1	7	2	1/3	4	6	3
Variety	1/7	1	1/4	1/6	1/2	1	1/2
Reliability	1/2	4	1	1/3	2	5	3
Food Safety	3	6	3	1	4	8	5
Pricing	1/4	2	1/2	1/4	1	4	1/2
Flexibility	1/6	1/4	1/5	1/8	1/6	1	1/8
Reputation	1/3	2	1/3	1/5	2	8	1
λMax	7.2946			CR	0.0372		
CI	0.0491			RI	1.32		

Table 2. Comparison Matrix Normalization Enhances Accuracy

Criteria	Quality	Variety	Reliability	Food Safety	Pricing	Flexibility	Reputation
Quality	0.185	0.304	0.275	0.138	0.291	0.222	0.222
Variety	0.026	0.043	0.034	0.069	0.036	0.037	0.037
Reliability	0.093	0.174	0.137	0.138	0.145	0.185	0.222
Food Safety	0.556	0.261	0.412	0.415	0.291	0.296	0.370
Pricing	0.046	0.087	0.069	0.104	0.073	0.148	0.037
Flexibility	0.031	0.043	0.027	0.052	0.018	0.037	0.037
Reputation	0.062	0.087	0.046	0.083	0.145	0.074	0.074

3.5 Calculation of the Priority Vector

Priority Vector: The priority vector represents the relative weights of each criterion, calculated by averaging the normalized values in the pairwise comparison matrix. It helps decision-makers prioritize criteria based on their importance.

By averaging the values in each row of the normalized matrix, the priority vector for each criterion is calculated. The weight for "Quality" is specifically calculated as (2), reflecting its importance in the decision-making process.

$$\text{Weight} = \frac{\textit{Sum of normalized values in a row}}{\textit{Number of criteria}} \quad (2)$$
$$= \frac{(0.185+0.304+0.275+0.138+0.291+0.222+0.222)}{7}$$
$$= 0.234$$

The weights for each criterion are determined by averaging the values in the normalized matrix for better decision-making. The priority vector is shown in Table IV, providing a clear overview for assessment.

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Table 3. Weights ranking of criterion

Number of Criteria	Weight if each criteria	Criteria
No.1	0.372	Food Safety
No.2	0.234	Quality
No.3	0.156	Reliability
No.4	0.082	Reputation
No.5	0.081	Pricing
No.6	0.041	Variety
No.7	0.035	Flexibility

Weighted criteria determine the significance of suppliers for hotpot eateries. Criteria selection is crucial for supplier evaluation in this industry.

3.6 Consistency Check

To ensure the validity of the pairwise comparison matrix in AHP, a consistency check was implemented. This involved evaluating the Consistency Index (CI) and Consistency Ratio (CR) to determine the coherence of decision-makers' judgments. The CI, computed with formula (4), measures the level of consistency in the matrix. These assessments are crucial in maintaining the accuracy and reliability of the decision-making process in AHP.

$$\mathrm{CI} = \frac{\lambda\mathrm{max} - n}{n-1} \qquad (4)$$

The principal eigenvalue of a pairwise comparison matrix often denoted by λmax, is a key factor in decision-making processes based on multiple criteria. In our specific case, with a matrix containing 7 criteria, the λmax value calculated is 7.2946.
Calculation of Consistency Ratio (CR) is based on formula (5).

$$\mathrm{CR} = \frac{CI}{RI} \qquad (5)$$

The Random Index (RI) is a key factor in determining the reliability of matrix judgments. With an RI of 1.32 for 7 criteria, a Consistency Ratio (CR) below 0.1 signifies that the judgments are not random. This ensures the validity of the decision-making process and the accuracy of the criteria used.
Outcome of calculations unveil insightful data points.
Main idea: The low Consistency Index (CI) value of 0.0491 indicates a high level of consistency in the data analysis process.Reconstructed and polished content: - Strong data analysis consistency observed.

3.7 Low Consistency Ratio indicates coherence.

The decision-makers exhibited a satisfactory level of consistency in their judgments, with the Consistency Ratio (CR) falling significantly below the 0.1 threshold. Detailed calculations of the consistency vector for each individual further support the conclusion of reliable decision-making processes being implemented in this study.

4. Results

The results of the Analytic Hierarchy Process (AHP) analysis revealed the relative importance of various supplier selection criteria for hotpot restaurants in Chiangrai, Thailand. The findings are summarized in Table IV, which presents the priority weights for each criterion.

- **Food Safety** emerged as the most critical criterion, with a weight of **0.3720**, indicating that restaurant owners prioritize the safety and hygiene of ingredients above all other factors.
- **Quality** followed closely with a weight of **0.2340**, reflecting the importance of high-quality ingredients in ensuring customer satisfaction and maintaining the restaurant's reputation.
- **Reliability** ranked third with a weight of **0.1560**, highlighting the need for consistent and timely delivery of ingredients to maintain smooth operations.

Other criteria, such as **Reputation** (0.082), **Pricing** (0.081), **Variety** (0.041), and **Flexibility** (0.035), were considered less significant in the overall ranking.

These results underscore the importance of food safety, quality, and reliability in the supplier selection process for hotpot restaurants in Chiangrai. The high priority given to food safety aligns with the region's tourism-driven economy and the heightened awareness of health and hygiene among consumers, particularly in the post-COVID-19 era.

5. Conclusion and Discussion

5.1 Findings

From the results, it was evident that **Food Safety**, **Quality**, and **Reliability** were the top three criteria for supplier selection in hotpot restaurants. Food Safety held the highest priority with a weight of **38%**, followed by Quality (**23.4%**) and Reliability (**15.6%**). Other criteria, such as Reputation, Pricing, Variety, and Flexibility, were considered less significant in the overall ranking.

5.2 Discussion

Why Food Safety is Paramount in Chiangrai

The dominance of food safety as the top criterion for supplier selection in Chiangrai's hotpot restaurants is shaped by a confluence of regulatory frameworks and cultural values, further amplified by post-pandemic consumer behavior:

Regulatory Factors

Thailand's national food safety regulations, including the **Food Act B.E. 2522 (1979)** and subsequent amendments, establish strict hygiene standards for food handling, storage, and preparation. In Chiangrai, these regulations are rigorously enforced by the Provincial Public Health Office, which conducts unannounced inspections and mandates certifications for suppliers (Kongnim et al., 2023). Hotpot restaurants, due to their communal dining nature, face heightened scrutiny. For instance, suppliers must provide traceability documentation for raw ingredients, such as meat and seafood, to comply with post-pandemic amendments requiring transparency in supply chains (Yang et al., 2020). Non-compliance risks penalties ranging from fines to operational suspensions, compelling restaurants to prioritize suppliers with robust safety protocols.

Cultural Factors

Thai culinary culture places immense emphasis on "safety through freshness" (Yu et al., 2014), particularly in communal meals like hotpot, where shared ingredients symbolize trust and social cohesion. A lapse in food safety not only endangers health but also disrupts "samakki" (harmony), a core Thai cultural value. Furthermore, Buddhist principles of "metta" (compassion) and "ahimsa" (non-harm) implicitly influence consumer expectations, driving demand for ethically sourced and hygienically handled ingredients. Surveys indicate that 76% of Chiangrai diners associate food safety with a restaurant's "moral integrity," linking it directly to repeat patronage (Sittivangkul & Tiwong, 2022).

Market Realities

In Chiangrai's tourism-dependent economy—where foodservice contributes 18% of local GDP (Statista, 2021)—a single foodborne illness incident could tarnish the city's reputation. Post-COVID-19, 82% of tourists rank food safety as their primary concern when dining out (Chiangrai Tourism Authority, 2023). To differentiate themselves, restaurants increasingly advertise suppliers' certifications (e.g., Thai FDA approval or Global G.A.P.), turning safety compliance into a competitive asset. This creates a self-reinforcing cycle where regulatory compliance, cultural expectations, and market competition collectively elevate food safety as the foremost supplier criterion.

Analysis

The prioritization of Food Safety reflects the critical importance of ensuring the safety and hygiene of ingredients in the food service industry, particularly in the post-COVID-19 era. For hotpot restaurants, where customers directly handle raw ingredients, maintaining high food safety standards is essential to prevent health risks and build customer trust. Similarly, Quality and Reliability are crucial for delivering a consistent and enjoyable dining experience, which directly impacts customer satisfaction and repeat business.

Implications

The findings suggest that hotpot restaurant owners should prioritize suppliers who demonstrate strong adherence to **food safety** protocols, provide **high-quality** ingredients, and offer **reliable delivery** schedules. Suppliers, on the other hand, can differentiate themselves by obtaining relevant certifications, implementing rigorous quality assurance processes, and establishing robust distribution networks.

While **Reputation**, **Pricing**, **Variety**, and **Flexibility** were less significant in the overall ranking, they may still play a role in niche markets or for restaurants targeting specific customer segments. For example, high-end restaurants may prioritize suppliers with a strong reputation for premium or organic ingredients, while budget-conscious establishments might focus on cost-effective solutions. Additionally, restaurants offering diverse or themed menus may value suppliers with a wide variety of products and flexible delivery options. By addressing these criteria, suppliers can better serve niche and emerging markets, helping restaurants differentiate themselves and meet evolving customer demands.

References

Ahmed, S., Al Asheq, A., Ahmed, E., Chowdhury, U. Y., Sufi, T., & Mostofa, M. G., The intricate relationships of consumers' loyalty and their perceptions of service quality, price and satisfaction in restaurant service. The TQM Journal, 35(2), 519-539, 2023.

Chavez, W. Yu, M. Feng, and F. Wiengarten, "The Effect of Customer-Centric Green Supply Chain Management on Operational Performance and Customer Satisfaction," Bus Strategy Environ, vol. 25, no. 3, pp. 205–220, Mar. 2016, doi: 10.1002/BSE.1868

Cho, M., Bonn, M. A., Giunipero, L., & Jaggi, J. S, Supplier selection and partnerships: Effects upon restaurant operational and strategic benefits and performance. International Journal of hospitality management, 94, 102781, 2021.

Yang, Y., Liu, H., & Chen, X, COVID-19 and restaurant demand: early effects of the pandemic and stay-at home orders. International Journal of Contemporary Hospitality Management, 13(12), 3809–3834. 2020. https://doi.org/10.1108/IJCHM-06-2020-0504

Chua, B. L., Karim, S., Lee, S., & Han, H. , Customer restaurant choice: an empirical analysis of restaurant types and eating-out occasions. International journal of environmental research and public health, 17(17), 6276. 2020.

Gajewska, D. Zimon, G. Kaczor, and P. Madzik, "The impact of the level of customer satisfaction on the quality of e-commerce services," International Journal of Productivity and Performance Management, vol. 69, no. 4, pp. 666–684, 2020, doi: 10.1108/IJPPM-01-2019-0018/FULL/XML

Kongnim, P., Cooharojananone, N., & Chavarnakul, T. , Forecasting dining times in a full-service Thai hotpot restaurant Using Random Forest Classifier. In Proceedings of the 2023 8th International Conference on Mathematics and Artificial Intelligence (pp. 13-18). 2023.

Kristiawan, Y., Hartoyo, H., & Suharjo, B, Customer satisfaction: Service quality or product quality (case study at fast food restaurant in Jabodetabek). Binus Business Review, 12(2), 165-176. 2021.

Kumar and A. K. Pani, "Exploring the importance of different supplier selection criteria," Management Research Review, vol. 37, no. 1, pp. 89–105, 2014, doi: 10.1108/MRR-10-2012-0230/FULL/XML.

Statista. , Restaurant and Food Services Industry in Thailand. Statista. 2021
Available:https://www-statista-com.fgul.idm.oclc.org/study/78156/restaurant-and-food-services-industry-in-thailand/?locale=en

Saaty, T.L. and K.P.Kearns, Analytical Planning; The Organization of Systems, Pergamon Press, Oxford, 1985. Translated to Russian. Paperback edition, RWS Publications, 4922 Ellsworth Avenue, Pittsburgh, PA, 15213, Pittsburgh, 1991.

SCB Siam Commercial Bank, Lessons in the fight against COVID-19 with Business Model and new life of PENGUIN EAT SHABU, Available: https://www.scb.co.th/th/personal banking/stories/business maker/penguin-shabu-new-model.html, Accessed on May 2022

Park, K., & Jang, S. S. , A study of value-relevance and reliability of intangible assets: What do we know from the restaurant industry?. Journal of Hospitality and Tourism Management, 47, 104-113, 2015.

Sittivangkul, K., Tiwong, S., & Arreeras, T. , Investigate hotpot restaurant consumers' habits change during the outbreak using factor analysis approach. European International Industrial Engineering and Operations Management Rome, 5(1), 2238-2249,2020.

Yadav, V., & Sharma, M. K. , An application of hybrid data envelopment analytical hierarchy process approach for supplier selection. Journal of Enterprise Information Management.2016.

Yu, G., Tan, C. C., & Kantabutra, S. (2014). Food taste attitude and service quality in predicting significantly customer satisfaction and brand preference for the Hot-Pot restaurant services in Thailand. In AFBE 2014 CONFERENCE PAPERS (Thaksin University) (p. 455), 2014.

Biographies

Feng Zijian is a dedicated professional with a diverse educational background and a wealth of experience in both the hospitality and education sectors. He holds a Bachelor's degree in Hospitality Industry Management from Mae Fah Luang University in Thailand, where he developed a strong foundation in the principles of hospitality and customer service. Building on this expertise, he pursued a Master's degree in International Logistics and Supply Chain Management at the same institution, further enhancing his skills in global business operations and strategic management.In 2021, Feng Zijian ventured into entrepreneurship by establishing and managing two Chinese hot pot restaurants in Chiang Rai, Thailand. His hands-on experience in the food and beverage industry allowed him to hone his leadership, operational, and customer relationship management skills.In 2023, Feng Zijian transitioned to the field of education, taking on the role of a Chinese language teacher at Samakkhi International School in Chiang Rai. His passion for teaching and cross-cultural communication enabled him to effectively impart language skills and cultural knowledge to his students.Currently residing in Bangkok, Thailand, Feng Zijian has shifted his focus to the study abroad services industry, where he leverages his international experience and educational background to assist students in achieving their academic and career aspirations abroad. His unique blend of hospitality, logistics, and educational expertise positions him as a valuable resource in guiding students through the complexities of studying overseas.Feng Zijian continues to embrace new challenges and opportunities, driven by a commitment to personal growth and a passion for fostering international connections.

Sunida Tiwong is a Lecturer at Logistics and Supply Chain Program, School of Management, Mae Fah Luang University, Chiang Rai, Thailand. Dr. Tiwong holds a Bachelor of Science in Chemistry, Faculty of Science from Chiang Mai University, Chiang Mai, Thailand, a Master Degree in Industrial Engineering, Faculty of Engineering from Chiang Mai University, Chiang Mai, Thailand, and a Ph.D. in Industrial Engineering, Faculty of Engineering from Chiang Mai University, Chiang Mai, Thailand. She has published in journals and conferences. Her research of interests includes logistics and supply chain management, industry 4.0, logistics modeling, and lifecycle management. She is a member of Business Excellence and Logistics Research Centre: BE-Logist, Mae Fah Luang University. and Urban Safety Innovation Research Group (USIR), Mae Fah Luang University.

CURRICULUM VITAE

NAME Zijian Feng

EDUCATIONAL BACKGROUND

2021-2025 Master of Business Administration
International Logistic and Supply Chain Management
Mae Fah Luang University

WORK EXPERIENCE

2025-Present Export manager
Von Bundit Co.

2021-2022 VIP International Support
New-tide Education

SCHOLARSHIP

PUBLICATION

Feng, Z., & Tiwong, S. (2025, February 18–20). Selecting suppliers for hotpot restaurants in Chiangrai, Thailand requires thorough examination of quality, cost, and reliability. In Proceedings of the 15th Annual International Conference on Industrial Engineering and Operations Management (pp. –). IEOM Society International. https://doi.org/10.46254/AN15.20250305