

Implementation of Operations Research for Location Selection of J-Cakes' New Branch in Pulau Penang Using the Factor-Rating Method

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Abstract

This study applies operations research to address the critical task of selecting an optimal location for J-Cakes, a café based in Pulau Penang, as it plans to establish a new branch to meet rising consumer demand. The location selection process involves evaluating key factors, including security, topography, competition intensity, market proximity, and transportation accessibility. Using the Factor-Rating Method, three potential locations—X, Y, and Z—were analyzed. The findings indicate that Location Y is the most favorable, achieving the highest score (129) due to its strong security measures and balanced performance across other criteria. Additionally, the study explores J-Cakes' strategic approach to addressing competition at the selected site, emphasizing operational efficiency, the practical application of operations research methods, and market-oriented strategies.

Keywords: location selection, J-Cakes, factor-rating method, operational efficiency, branch expansion

1. Introduction

The establishment of a new business branch is a strategic decision that plays a critical role in meeting customer demands, ensuring operational efficiency, and sustaining long-term growth (Heizer, Render, & Munson, 2020). For J-Cakes, a café headquartered in Pulau Penang, increasing consumer demand has necessitated the expansion of its operations through the opening of a new branch. The success of this expansion hinges on selecting the most suitable location—a process that involves evaluating multiple factors such as security, topography, competition, market proximity, and transportation (Stevenson, 2014; Haksever, 2000).

In this study, the Factor-Rating Method is utilized as a decision-making tool to systematically analyze potential locations for the new branch. Widely used in operations management, this method assigns weights to key factors and evaluates locations based on observed scores, enabling a systematic and quantitative comparison (Krajewski & Malhotra, 2022; Karlsson, 2023). By generating a composite score for each site, the Factor-Rating Method identifies the location that best aligns with J-Cakes' strategic objectives.

Previous research has underscored the significance of location strategy in operations management, emphasizing its impact on cost efficiency, accessibility, and market reach (Stevenson, 2014; Bamford, Forrester, & Reid, 2023). Location decisions are particularly critical for small-to-medium enterprises (SMEs), where competition is high, and resources are often constrained (Rusmana, Baihaqi, & Kautsar, 2022). For J-Cakes, factors such as proximity

to customers, competitive positioning, and transportation infrastructure are vital in ensuring the success of the new branch. This study builds upon existing research on the Factor-Rating Method, adapting it to the specific needs of J-Cakes in Pulau Penang.

Additionally, studies have highlighted the role of systematic methods like the Factor-Rating Method in reducing uncertainty and enabling better decision-making in location selection (Hidayat & Jatnika, 2024). By addressing multiple criteria in a structured framework, the method supports operational efficiency and helps businesses respond effectively to market demands (Heizer, Render, & Munson, 2020).

This research seeks to address the following questions: (1) What are the key factors influencing the selection of a new branch location for J-Cakes in Pulau Penang? (2) How does the application of the Factor-Rating Method provide a robust and systematic approach to identifying the optimal location? By answering these questions, the study aims to provide actionable insights into effective location selection for J-Cakes while demonstrating the practical application of operations research tools. These findings are expected to support strategic decision-making and contribute to the broader understanding of location analysis in the context of SMEs.

2. Literature Review

2.1 Operations Research and Location Selection

Location selection is a critical component of operations management, as it directly influences an organization's operational efficiency, accessibility, cost structure, and long-term competitiveness (Haksever, 2000; Stevenson, 2014). The decision-making process for location selection requires evaluating a combination of structural and infrastructural factors. Structural factors include transportation links, facility size, and access to suppliers, while infrastructural factors involve workforce capabilities, market proximity, and regulatory compliance (Haksever, 2000; Krajewski & Malhotra, 2022). These factors are interdependent, requiring a systematic approach to ensure alignment with the organization's strategic goals.

Operations research provides a suite of tools and frameworks to support complex decision-making in location analysis. Methods such as the Analytic Hierarchy Process (AHP), the Center-of-Gravity method, and the Factor-Rating Method have been widely applied to optimize location decisions in industries ranging from manufacturing to services (Karlsson, 2023). These methods allow businesses to integrate quantitative data with qualitative insights, enabling a holistic approach to location strategy.

2.2 The Factor-Rating Method

The Factor-Rating Method has been highlighted as one of the most practical and flexible tools in operations research for evaluating potential locations (Slack et al., 2004; Stevenson, 2014). This method involves identifying key criteria relevant to the business, assigning weights to these criteria based on their relative importance, and scoring alternative locations against each criterion. By calculating a total weighted score for each location, decision-makers can systematically compare options and identify the most favorable site (Heizer, Render, & Munson, 2020).

One of the key strengths of the Factor-Rating Method is its adaptability, which allows organizations to tailor the criteria and weights to meet specific business needs. The method

incorporates a mix of quantitative metrics, such as transportation costs, and subjective judgments, such as community acceptance, market visibility, or competitive intensity (Krajewski & Malhotra, 2022). This flexibility ensures that the analysis accounts for both tangible and intangible factors, providing a comprehensive basis for decision-making. Moreover, it enables decision-makers to assess trade-offs effectively, particularly in dynamic environments where market conditions and operational priorities are constantly changing.

The applicability of the Factor-Rating Method is particularly evident in small and medium-sized enterprises (SMEs), where decision-making often involves a blend of objective data and experiential knowledge. As SMEs operate with limited resources, tools like the Factor-Rating Method provide a structured yet creative approach to align operational objectives with market demands (Hermawati & Gunawan, 2021). For example, research in Indonesia has demonstrated the effectiveness of this method in helping SMEs select optimal locations that maximize proximity to customers while minimizing operational costs. Such insights underscore the method's utility in fostering competitive advantages for businesses operating in competitive and resource-constrained environments (Hidayat & Jatnika, 2024).

In addition to its flexibility, the Factor-Rating Method has been recognized for its ability to integrate stakeholder input. This ensures that the perspectives of various decision-makers, including managers, planners, and external consultants, are incorporated into the analysis, enhancing the reliability of the results (Karlsson, 2023). Furthermore, it supports decision-makers in prioritizing factors that align with long-term strategic goals, such as sustainability, innovation, and market growth.

However, the effectiveness of the Factor-Rating Method relies heavily on the accurate identification of criteria and appropriate assignment of weights. Studies have shown that improper weight distribution can lead to biased or suboptimal decisions (Slack et al., 2004; Bamford, Forrester, & Reid, 2023). Therefore, careful consideration and validation of the criteria are essential for ensuring that the results align with organizational objectives. This method has also been found to be particularly effective when paired with supplementary tools, such as sensitivity analysis, to validate and refine the outcomes (Stevenson, 2014).

In the context of the café and service industry, the Factor-Rating Method has shown potential in helping businesses address customer-centric factors such as accessibility, demographic alignment, and market visibility. Research suggests that for service-based businesses like J-Cakes, considerations such as proximity to high-traffic areas, competitive positioning, and transportation infrastructure are critical for achieving operational success (Heizer et al., 2020; Haksever, 2000). By enabling the integration of these factors into a structured decision-making process, the Factor-Rating Method offers businesses a practical framework for addressing the complexities of location selection.

2.3 J-Cakes Bakery: Challenges and Opportunities

For service-oriented businesses like J-Cakes, location selection is particularly critical due to the reliance on high customer visibility and accessibility. J-Cakes, a well-known café in Pulau Penang, operates in a highly competitive market where proximity to customers, ease of transportation, and competitive positioning significantly influence business performance. Research suggests that service-based businesses need to account for additional factors such as customer demographics, competition intensity, and the appeal of high-traffic areas when

selecting a location (Heizer et al., 2020; Stevenson, 2014). Expanding into a new location also presents strategic opportunities for J-Cakes to enhance its market presence and operational efficiency. However, this requires balancing competing factors, such as ensuring market proximity while minimizing operational costs. The Factor-Rating Method provides a structured framework for addressing these complexities by integrating customer-oriented criteria with operational considerations (Hidayat & Jatnika, 2024).

2.4 Application of the Factor-Rating Method to Service-Based Businesses

In the café and service industry, the success of location strategies depends on effectively addressing customer-focused factors such as convenience, visibility, and market reach. Studies in operations management emphasize the importance of transportation convenience, competitive intensity, and proximity to customer-dense areas in sustaining long-term growth (Bamford et al., 2023). For example, in high-density urban areas, access to public transportation and visibility in high-traffic zones are often more critical than facility size (Haksever, 2000). The flexibility of the Factor-Rating Method makes it particularly relevant for service-based businesses. By customizing the criteria and their respective weights to reflect industry-specific needs, decision-makers can ensure that location analysis aligns with customer expectations and operational requirements. For J-Cakes, the ability to systematically evaluate factors such as competition, market demographics, and transportation infrastructure provides a strategic advantage in selecting the optimal location.

3. Research Method

3.1 Research Design

This study employs a predominantly quantitative research design (Creswell & Creswell, 2017), using the Factor-Rating Method to analyze and rank potential locations for J-Cakes' new branch in Pulau Penang. The quantitative approach is supported by structured data from J-Cakes' human resources team, focusing on measurable criteria critical to operational success. While the primary emphasis is on numerical analysis, a qualitative phase was conducted to monitor and evaluate operational processes, ensuring that the selected location aligns with strategic objectives. Mixed-methods approaches, particularly those emphasizing quantitative rigor, are effective in decision-making processes for location selection (Heizer et al., 2020). This study applied the Factor-Rating Method to evaluate and rank three potential locations for J-Cakes' expansion. The method involved several structured steps to ensure an evidence-based decision-making process.

Key factors influencing the location decision were identified based on consultations with J-Cakes' HR team and a review of prior literature. These factors include: (1) Security: Ensuring a safe environment for staff and customers. (2) Topography: Evaluating land suitability and its impact on construction and operation costs. (3) Competition Intensity: Assessing the level of competition in the vicinity. (4) Market Proximity: Determining accessibility to the target customer base. (5) Transportation Accessibility: Evaluating ease of access for customers and supply chain logistics.

Each factor was assigned a weight reflecting its relative importance to J-Cakes' strategic and operational goals. These weights were determined through input from HR professionals and senior management. Field data collected from HR observations and external sources were used to assign scores to each location based on their performance against the identified factors

(Stevenson, 2014; Karlsson et al., 2023).

The weighted scores for each location were calculated by multiplying the scores assigned to each factor by its respective weight. The total weighted score for each location was then determined by summing all individual weighted scores, providing a clear ranking of the sites. The location with the highest total weighted score was identified as the most favorable option for J-Cakes' new branch (Bamford et al., 2023).

3.2 Qualitative Phase: Monitoring and Evaluation

A qualitative phase was included as part of the operations process to monitor and evaluate the implementation of the selected location. This phase focused on gathering insights into operational challenges, staff adaptability, and customer responses post-location selection. Observational methods and informal feedback from staff and customers were used to identify potential improvements in daily operations. While not central to the decision-making process, this qualitative phase provided practical insights for refining operational strategies and ensuring alignment with long-term objectives (Creswell & Creswell, 2017).

3.3 Data Collection

The primary data for this study were sourced from J-Cakes' HR team, including internal operational metrics and observational data collected during site visits. Secondary data were obtained from local government reports, market analyses, and publicly available datasets relevant to the three potential locations. The HR team played a pivotal role in scoring locations against the identified factors, using both field observations and historical performance data from similar locations. This multi-source data collection ensured the reliability and accuracy of the analysis (Hidayat & Jatnika, 2024).

3.4 Analysis Tools

Microsoft Excel was used to calculate the scores for each location and produce the weighted totals. Excel's user-friendly interface and transparency made it a practical choice for handling quantitative data, ensuring that the scoring process was replicable and easy to interpret. Additionally, the insights from the qualitative phase were analyzed using thematic analysis to complement the quantitative findings. This integrated approach ensured that the final recommendations were data-driven while remaining adaptable to operational realities (Heizer et al., 2020).

4. Findings and Discussion

4.1 Findings

The Factor-Rating Method was employed to evaluate three potential locations—X, Y, and Z—for J-Cakes' new branch in Pulau Penang. Each location was analyzed based on five key factors: security, topography, competition intensity, market proximity, and transportation accessibility. The weighted scores for each location are presented in **Table 1**, summarizing the evaluation results.

Table 1: Weighted Scores for Potential Locations

Factor	Weight	Location X Score	Location Y Score	Location Z Score	Weighted Score X	Weighted Score Y	Weighted Score Z
Security	8	4	5	4	32	40	32
Topography	8	4	4	5	32	32	40
Competition Intensity	9	3	3	2	27	27	18
Market Proximity	6	3	3	2	18	18	12
Transportation	3	4	4	4	12	12	12
Total Weighted Score					121	129	114

Weighted Scores for Potential Locations Source: Excel, 2024

The analysis revealed that Location Y scored the highest with a total weighted score of 129, making it the most favorable option for J-Cakes' new branch. The superior performance of Location Y can be attributed to its excellent score in security (5 out of 5), which yielded the highest weighted value (40). Other contributing factors include its strong market proximity score (30) and moderate competition intensity score, which positions it as an ideal location for balancing customer access and market visibility (Heizer et al., 2020).

Strategic Considerations for Location Selection

Beyond using the Factor-Rating Method, J-Cakes' management team considered competitive positioning strategies to ensure long-term success in the Pulau Penang market. These strategies include: (1) Sheltered Placement Strategy: Selecting a location with minimal competition to establish a foothold and reduce exposure to direct market pressures. This strategy is particularly effective in areas with low business density, where first-mover advantages can be leveraged (Stevenson, 2014). (2) Clustering Strategy: Positioning the branch near competitors to benefit from agglomeration effects, increased foot traffic, and enhanced visibility in competitive zones. This approach is often effective for service-based industries (Karlsson et al., 2023). (3) Dispersed Placement Strategy: Targeting a geographically diverse location to expand market reach, reduce reliance on a single region, and tap into untapped customer bases. (4) Market Penetration Strategy: Prioritizing a location with high customer proximity to maximize accessibility and convenience, thereby capturing a larger market share (Bamford et al., 2023).

Integration of Findings and Strategies

Based on the analysis, Location Y aligns most effectively with the Market Penetration Strategy. Its high scores in security and market proximity make it an attractive choice for both customers and operations. Moderate competition at Location Y further enhances its potential by offering market visibility without oversaturation.

While Location X excelled in transportation accessibility, its lower scores in market proximity limited its viability. Similarly, Location Z performed well in topography but lacked strong competition intensity and market proximity, reducing its suitability for J-Cakes' objectives. These findings highlight the importance of integrating both quantitative and qualitative considerations when making location decisions (Creswell & Creswell, 2017; Heizer et al., 2020).

4.2 Discussion

The findings of this study provide valuable insights into the process of selecting an optimal location for J-Cakes' new branch using the Factor-Rating Method. While each location demonstrated unique strengths and weaknesses, the results underscore the importance of a balanced, multi-criteria evaluation in decision-making.

1) Security as a Priority

Security emerged as a critical factor in the location selection process. For service-based businesses like J-Cakes, ensuring a safe environment is essential for fostering customer trust, operational stability, and staff satisfaction. Location Y's strong performance in this category reinforces the importance of prioritizing security when evaluating potential branch sites (Heizer et al., 2020).

2) Market Accessibility and Customer Proximity

Location Y's high score in market proximity reflects the vital role of accessibility in the café industry. Branches located near customer hubs or urban centers are better positioned to attract consistent foot traffic, enhance customer convenience, and drive revenue growth. This finding aligns with previous research emphasizing the significance of market proximity in service-based location strategies (Stevenson, 2014).

3) Balancing Competition and Market Visibility

Moderate competition provides opportunities for market visibility without overwhelming operational resources. Location Y's competitive intensity allows for steady growth while avoiding oversaturation. This finding suggests that SMEs like J-Cakes can benefit from operating in moderately competitive environments that encourage differentiation without diluting market share (Bamford et al., 2023).

4) Topography and Long-Term Infrastructure Needs

Location Z's strong performance in topography highlights the relevance of physical infrastructure and long-term operational feasibility. However, topography alone is insufficient for achieving sustained success without complementary factors, such as strong market proximity and customer access (Haksever, 2000).

5) Insights from Workforce and Skill Development

The study's findings also align with broader research on the role of operational management in SME success. According to Yusriani et al. (2024), effective location decisions are closely linked to human resource strategies, particularly in developing skills that align with operational requirements. The Factor-Rating Method's reliance on inputs from J-Cakes' HR team demonstrates the importance of integrating workforce perspectives into the decision-making process. Such integration not only improves the accuracy of location analysis but also ensures

alignment with long-term operational goals, including staff adaptability and customer satisfaction.

6) Broader Implications for SMEs

The successful integration of the Factor-Rating Method and strategic positioning demonstrates a replicable framework for SMEs. By combining structured quantitative methods with qualitative insights, SMEs can make informed, data-driven decisions that align with long-term operational and strategic goals. This approach not only mitigates risks but also enhances the scalability of location decisions in dynamic market environments (Hermawati & Gunawan, 2021; Karlsson et al., 2023).

5. Conclusion

This study highlights the application of the Factor-Rating Method in selecting the optimal location for J-Cakes' new branch in Pulau Penang. The analysis identified Location Y as the most favorable option due to its strong performance in security, market proximity, and balanced competition intensity. Integrating these findings with competitive strategies underscores the importance of adopting a holistic approach to location selection.

However, this study is subject to several limitations. First, the analysis relies on weighted scores, which are influenced by managerial judgment and could introduce potential biases. Second, the study focuses on a limited number of factors, which may not comprehensively capture all variables influencing location decisions. For instance, environmental sustainability and local government incentives, which could play significant roles in the decision-making process, were not considered in this analysis.

Future research could address these limitations by expanding the scope of factors evaluated in location selection. Additionally, incorporating advanced decision-making tools, such as the Analytic Hierarchy Process (AHP) or customer preference surveys, could enhance the robustness of the findings. Exploring the integration of external factors, such as regional development policies or community engagement, may also provide deeper insights into location strategy.

By addressing these limitations, future studies can build upon the findings of this research to develop more robust frameworks for location analysis in dynamic market environments. Furthermore, adopting a multidisciplinary approach that integrates operational, human resource, and strategic management perspectives could make valuable contributions to the broader field of SME development.

In conclusion, the Factor-Rating Method remains a cornerstone of location analysis due to its practicality, adaptability, and ability to balance quantitative and qualitative considerations. Its demonstrated effectiveness in diverse industries and geographies underscores its value as a tool for strategic decision-making, particularly for SMEs operating in dynamic and competitive markets.

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