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Location Selection Model for Small Wholesale Shops in Samutprakarn Province, Thailand

Vuttapong Larpcharoen[1], Kongkoon Tochaiwat[1*], Kullanan Siripipatkajon[1], Varalee Thumvisuttivarakorn[2]

[1] Faculty of Architecture and Planning, Thammasat University, Thailand

[2] Narai Property Co., Ltd., Thailand

Abstract: The objectives of this research were to study the factors affecting the importance of location selection criteria and present a model for the location selection of a small wholesale store in Samutprakarn province. The research applied the Modified Analytic Hierarchy Process methodology: screening the criteria of location selection from the literature review by interviewing five small wholesale business owners and using a set of questionnaires to collect data from 60 small wholesale merchants, followed by an analysis. The research found that the location zone is the most important factor influencing the location selection criteria. For the stores located in the industrial area, the priority is given to the parking space and the width of the road, while those located in the residential area place the first priority on the proximity or being located along the main and secondary roads. However, the importance level of the location selection criteria ranked in the second and third positions was similar for industrial and residential locations, namely proximity to fresh markets and proximity to distribution centers, respectively. The location selection model will help the small wholesale business owners in Samutprakarn province and similar areas consider the potential location for their business establishments. Furthermore, the commercial building owners can also use this model to assess the rental potential of their commercial buildings. Academia can also use the acquired factors and models for further studies.

Keywords: Modified Analytic Hierarchy Process, location selection criteria, small wholesale shops, location selection model.

泰国北榄府小型批发店选址模型

摘要：本研究的目的是研究影响选址标准重要性的因素，并为北榄省一家小型批发商店的选址提出一个模型。该研究采用改进的层次分析法方法：通过采访五位小型批发企业主并使用一组问卷收集来自 60 家小型批发商的数据，从文献回顾中筛选选址标准，然后进行分析。研究发现，选址区域是影响选址标准的最重要因素。对于位于工业区的店铺，优先考虑车位和道路宽度，而位于住宅区的店铺则优先考虑靠近或位于主次干道上。然而，排名第二和第三位的选址标准的重要性水平对于工业和住宅区来说是相似的，分别是靠近生鲜市场和靠近配送中心。选址模型将帮助北榄府和类似地区的小型批发企业主考虑其营业场所的潜在位置。此外，商业楼宇业主也可以使用此模型来评估其商业楼宇的出租潜力。学术界也可以利用获得的因素和模型进行进一步的研究。

关键词：改进的层次分析法、选址标准、小型批发商店、选址模型.

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About the authors: Vuttapong Larpcharoen, Kongkoon Tochaiwat, Kullanan Siripipatkajon, Faculty of Architecture and Planning, Thammasat University, Thailand; Varalee Thumvisuttivarakorn, Narai Property Co., Ltd., Thailand

Corresponding author Kongkoon Tochaiwat, kongkoon@gmail.com

1. Introduction

The wholesale business accounted for as much as 16 percent of the gross domestic product (GDP) in Thailand from 2008 – to 2018, with an average growth rate of 6.8 percent per year [1]. It is also a business sector that effectively creates employment and generates income for Thailand. There are approximately 1.04 million entrepreneurs in this sector. They represent 37.48 percent of small and medium-sized business owners, which is the largest proportion of all business sizes, and employ 3.38 million people, accounting for 24.02 percent of the total number of employments in the country. This sector ranked third, following the service sector and the manufacturing sector in the employment aspect [2]. In addition, although the wholesale business was affected by the economic slowdown, it still received support from the government measures to stimulate consumption, resulting in the flowing revenue circulating in the economic system from the spending of the public sector. The consumer product is a type of product that generates the highest income and profit for the entrepreneurs [3].

It is obvious that wholesale business is one of the economic activities that affect the country's economic growth and is also an interesting business for many entrepreneurs, especially for small wholesale store owners who choose to run their business mostly in the commercial spaces rather than buying their own piece of land to construct new buildings, due to the relatively high cost of land as well as construction. The factor that plays an important role in the success of the wholesale business is the location factor since it is a business that mainly relies on the potential of the location to operate profitably. The source of goods and labor in business is most accessible from the prompt location, including product transport and distribution from large manufacturers being delivered to the customers, which affects the operating costs, the customer sources, the access to regulations, and the growth of the area affecting the wholesale business [4].

Samutprakarn is one of the provinces in Thailand that has been continuously developed. According to the analysis of the provincial gross product value in 2018, it was found that the value of the province's gross domestic product increased by 8.2 percent from 2017 [5]. The wholesale business is one of the top three business sectors in the economic structure of Samutprakarn province, accounting for 14 percent, following the industrial and transportation sectors [6].

In addition, the area is also an important source of raw materials imported from overseas and various main warehouses, a hub for transportation by land, water, and air. As a result, many entrepreneurs decided to invest in and operate the industrial factories in this area. There are 7,897 registered factories in the province [7]. The industrial estates in Samutprakarn province can be classified into two types. The first one is the general industrial zone, a designated area for the industrial operation, other services, or businesses that are beneficial to the operation of industries or services. Another zone is designated to be the free industrial or commercial zone which is an area for industrial, commercial, or other businesses related to the operation of industry or commerce for the benefit of the economy, the security of the state, the public welfare, the environmental management or other necessities as prescribed by the Board of Committee. Goods imported into the aforementioned areas will be entitled to additional benefits of the tax, duty, and fee as provided by law.

For the reasons mentioned above, the researchers are interested in studying the criteria for the location selection of small wholesale shops in Samutprakarn province. The objectives were to study the factors affecting the importance of the location selection criteria in Samutprakarn province, to analyze the criteria and importance of the criteria for the location selection of small wholesale shops in Samutprakarn province, and propose a model for the location selection of small wholesale stores in Samutprakarn province. The researchers aimed to create a model to help entrepreneurs or those interested in investing in the small wholesale business to be used for the decision making in selecting a potential location and reducing the time and increasing the accuracy of such decision making. At the same time, the commercial building owners can also utilize this model to assess the rental potential of their commercial buildings to small wholesale shop operators. Furthermore, academia can use the factors and models acquired from this research as the information for further studies.

2. Literature Review

2.1. Location Selection and the Factors Affecting the Location Selection

From the literature review, the researchers were able to gather the criteria for the location selection of various businesses in 11 sub-criteria, categorized into four main criteria, as shown in Table 1. The criteria that are likely to be relevant to the location selection of small wholesale stores can be briefly summarized as follows:

(1) The factors affecting the location selection criteria consisted of the location of the commercial building (zoning of a commercial building), the size of the commercial building, the area of the commercial building, the condition of the commercial building, and the age of the commercial building;

(2) The factors affecting the control of location selection guidelines consisted of (1) the size of the wholesaler store, namely small-sized wholesale stores, and (2) the type of the products being sold, namely the consumer products;

(3) The criteria that affect the location selection

consisted of (1) the customer accessibility, i.e, parking space and the width of the road, proximity to the main road and the secondary road, (2) the residence and work sources, i.e, proximity to community, proximity to fresh market, proximity to factory or work source and proximity to the convenience store or community store, (3) raw material source and transportation, i.e, proximity to distribution center and product distributor, and (4) competitor, i.e, being far from both direct and indirect competitors.

In this regard, the location selection criteria collected from the previous publications were then screened by the experts and further analyzed for the importance level value using the Modified Analytic Hierarchy Process.

Table 1 Summary of the location selection criteria gathered from the past studies

Criteria	Publications												
	[2]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[4]	[15]	[16]	[17]	[18]
1. Customer Accessibility Criteria													
1.1 Parking Space and the Width of Road	✶	✶				✶		✶	✶	✶			
1.2 Proximity of Main Road	✶		✶			✶	✶	✶	✶	✶		✶	
1.3 Proximity of Secondary Road	✶		✶			✶	✶	✶		✶		✶	
2. Residence and Work Source Criteria													
2.1 Proximity to Community	✶	✶			✶		✶			✶		✶	
2.2 Proximity to Fresh Market	✶	✶	✶		✶		✶						
2.3 Proximity to Factory or Work Source	✶	✶	✶		✶		✶				✶	✶	
2.4 Proximity to Store		✶	✶				✶						✶
3. Raw Material and Transportation Criteria													
3.1 Proximity to Product Distributor				✶	✶						✶	✶	
3.2 Proximity to Distribution Center				✶	✶						✶	✶	
4. Competitor Criteria													
4.1 Being Far from Direct Competitor	✶	✶				✶			✶			✶	
4.2 Being Far from Indirect Competitor	✶	✶				✶			✶			✶	

2.2. Samutprakarn Province Information

Samutprakarn Province is a province in the central region of Thailand situated in the east of Bangkok, which is the capital city of Thailand. Samutprakarn Province has an area of approximately 1,004.90 square kilometers. The administration is divided into six districts: Mueang Samutprakarn District, Bang Bo District, Bang Phli District, Pra Pradaeng District, Phra Samut Chedi District, and Bang Sao Thong District. Samutprakarn is an important source of imported raw materials from overseas and various main warehouses and a hub for transportation by land, water, and air. As a result, many business owners have come to invest and operate the industrial factories in this province. In 2020, 7,897 industrial factories were operating in Samutprakarn Province [7], of which 4,652 factories, or 58.91 percent, were located in Mueang Samutprakarn District (2,420 plants) and Bang Phli District (2,232 plants).

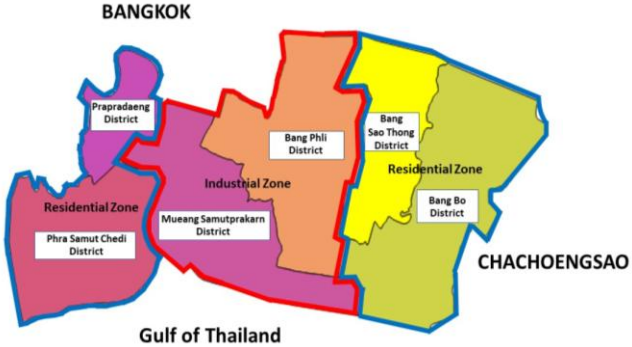

Fig. 1 Map of Samutprakarn Province

Therefore, for this research, the area in Samutprakarn was divided into two parts: (1) the industrial area located in Mueang Samutprakarn District and Bang Phli District, and (2) the residential area located in Bang Bo District, Prapradaeng District, Phra Samut Chedi District, and Bang Sao Thong District, as shown in Figure 1.

2.3. Modified Analytic Hierarchy Process

The Modified Analytic Hierarchy Process is one of the methods used to analyze data to decide on the best alternative. The criterion is to divide the problem structure into hierarchies, including the goals, the main criteria, the sub-criteria, and the alternatives, respectively. The best alternative was then analyzed by comparing the decision criteria in pairs until all the criteria were met. If the importance level value is consistent, the best option out of several options can be obtained. In this regard, the hierarchical analysis aims to prioritize each hierarchy to determine priorities and analyze the consistency of the data [19].

The literature review showed that in the past, many researchers had applied the hierarchical analysis to serve better their research objectives [9], [13], [20], [21], which applied the Modified Analytic Hierarchy Process to determine the factors affecting the location selection of several types for real estate projects. The study modified the hierarchical analysis with the data analysis up to the third hierarchy until the importance value of each criterion was obtained. The Modified Analytic Hierarchy Process is the correlation analysis of the factors most related to the criteria to be used to set goals for the decision-making. Therefore, the Modified Analytic Hierarchy Process is a method that is applied from the hierarchical analysis process and

can be applied to three hierarchies as follows: (1) The first hierarchy is the factors affecting the criteria (2) the second hierarchy is the main decision-making criteria and (3) the third hierarchy is the sub-criteria of each main criterion [11].

3. Methodology

This research used the Mixed Methodology, focusing on finding the criteria and building a model for the location selection of small wholesale stores in Samutprakarn Province. The qualitative data was obtained from the interviews with five experts who are small wholesale shop owners with no more than 30 employees and have been in the wholesale business for at least five years. The factors influencing the criteria for the location selection and the criteria for the location selection collected from the literature review were screened and used to define questions for the questionnaires, which is then the tool to collect information on the importance level of each criterion.

The importance level data of each factor affecting the location selection criterion obtained from the interviews with the experts were analyzed by finding the arithmetic mean and then interpreting the mean value with the ranges proposed in [22] as follows:

If the mean is between 1.00 and 1.80, the factor is of least importance.

If the mean is between 1.81 and 2.60, the factor is of low importance.

If the mean is between 2.61 and 3.40, the factor is of moderate importance.

If the mean is between 3.41 and 4.20, the factor is of high importance.

If the mean is between 4.21 and 5.00, the factor is of most importance.

Afterward, the researchers used the questionnaire containing the screened factors, which have moderate to most important, to collect data on the importance level of each location selection criterion from 60 experts running small wholesale shops in Samutprakarn Province. The results were then analyzed to determine the importance level of each criterion being studied using the Modified Analytic Hierarchy Process. Finally, the comparison criteria for pairwise comparison are shown in Table 2.

Table 2 Weight of criterion in pairwise comparison (Adapted from Saaty [19])

Score	Definition	Description
1	Have the same importance on the decision to buy	Criterion A and Criterion B have equal importance in the decision to buy.
3	Have slightly more or less importance on the decision to buy	Criterion A has slightly more or less importance on the decision to buy than Criterion B.
5	Have moderately more or less importance on the decision to buy	Criterion A has moderately more or less importance on the decision to buy than Criterion B.
7	Have significantly more or less importance on the decision to buy	Criterion A has significantly more or less importance on the decision to buy than Criterion B.
9	Have the most or least importance on the decision to buy	Criterion A has the most or least importance on the decision to buy compared to Criterion B.

Then, the researchers calculated the importance of each criterion obtained from the pairwise comparison for the importance of each hierarchy. Finally, the hierarchical stages were analyzed from the top to the bottom until the importance value of every main and sub-criterion was known by applying the following steps.

(1) Compare each pair of the criteria in the form of a matrix by comparing all criteria horizontally and vertically.

(2) Calculate the Eigenvector of the matrix in each row (Normalized Matrix) by finding the mean of importance value of each row.

(3) Calculate the importance level of each subsequent hierarchy in accordance with the aforementioned (1) and (2). The value obtained from the calculation of a higher hierarchy is to be multiplied by the normalized value of the second hierarchy that was calculated. This would reveal the value of the subsequent hierarchy according to the criteria in that hierarchy. Keep doing the calculation until the importance level of all criteria is calculated.

(4) Check for the consistency of the results by checking the Consistency Ratio (C.R.), the ratio of Consistency Index (C.I.) / Random Consistency Index (R.I.). In the same manner, the Consistency Index can be calculated from the formula: (Maximum Eigenvector – n) / (n – 1), where the Maximum Eigenvector is a value calculated by multiplying the sum of the diagnostic values of each criterion in each row by the sum of the horizontal mean values in each row. The results were then added together, and the n is the size of the matrix [19, 23].

The research methodology can be summarized in the form of a flowchart, as shown in Figure 2.

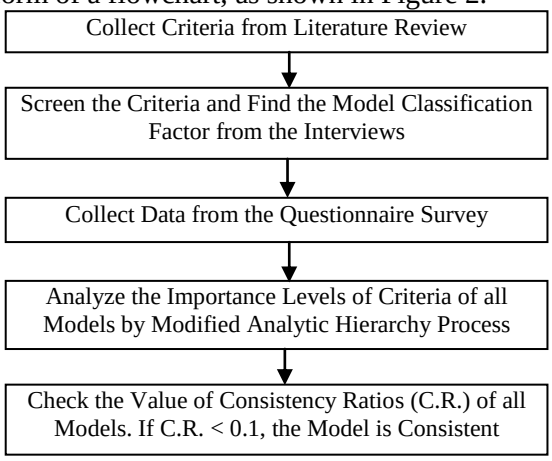

Fig. 2 Flowchart of the research methodology

4. Research Results

4.1. The Factor Affecting the Criteria for the Location Selection of Wholesale Stores

The researchers drew a schematic diagram of the Modified Analytic Hierarchy Process based on the interview results, as shown in Figure 3. It should be noted that the location zone aspect is the factor having the most effect on the location selection criteria, as the experts agreed.

(1) Regarding the factors affecting the criteria for the location selection of small wholesale shops, it was found that the location zone of the commercial building had the highest mean (equal to 4.60), followed by the size, condition, and the age of commercial building which bear the mean values of 4.20 (high importance), 3.60 (high importance) and 2.60 (low importance), respectively. The results expressed that the location zone of the commercial building is the factor that affects the criteria for location selection of small wholesale shops. The experts suggested that small wholesale shops can be classified into two groups according to the different location zones of the commercial building, including the business group of shops located in the industrial area and those located in the residential area.

(2) Regarding the importance level of the criteria for the location selection of small wholesale shops in Samutprakarn Province, it was found that the sub-criteria for location selection of small wholesale stores in Samutprakarn Province had average importance of the moderate to the highest level (with the mean between 2.61 – 5.00) as follows:

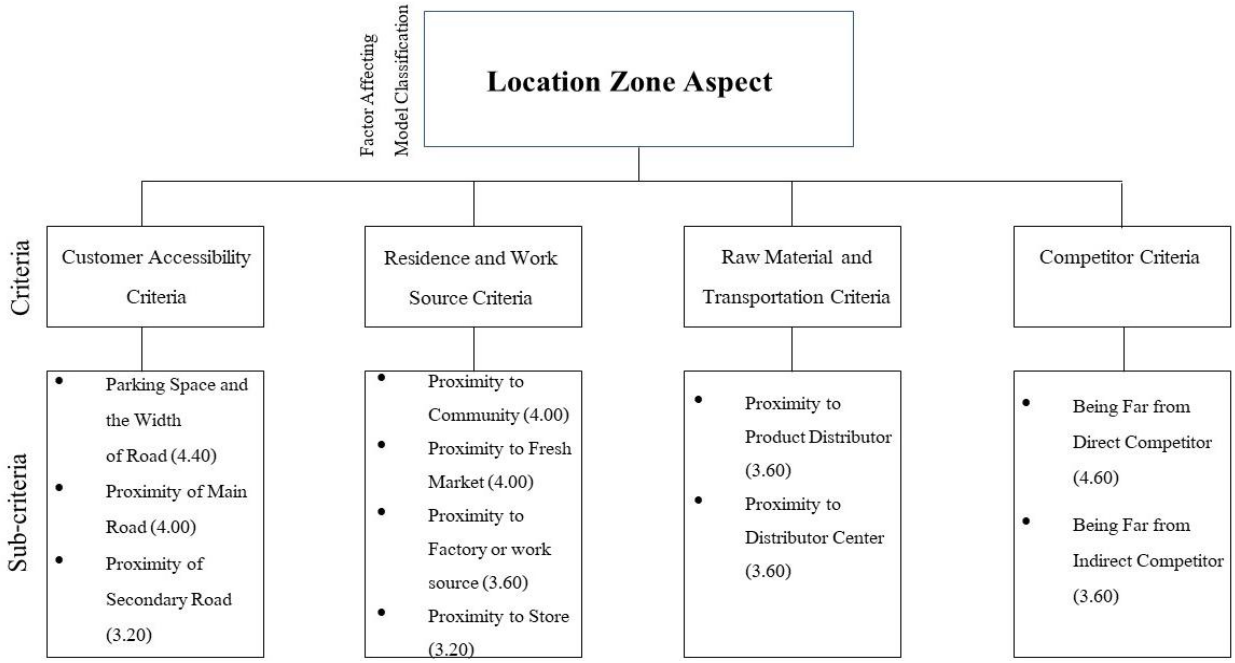

Fig. 3 The Modified Analytic Hierarchy Process network of the research

(1) The sub-criteria of the customer accessibility main criterion are of the moderate to the highest importance. It was found that the experts granted the highest importance level to the sub-criteria of the parking space and the road width (with a 4.40 mean score), followed by being located along the main and the secondary roads, which had the mean values of 4.00 and 3.20, respectively.

(2) The sub-criteria of the residence and work sources are of moderate to high importance. It was found that the experts granted the highest importance level to the sub-criteria of proximity to the community (with a 4.80 mean score). It was followed by proximity to the fresh market, factory or work source, residential area, and convenience store or community store, which had the mean values of 4.00, 4.00, 3.60, and 3.20, respectively.

(3) The sub-criteria of raw materials and transportation are of high importance. It was found that the experts granted equal importance level to the sub-criteria of proximity to distribution center and distributor, which had a mean value of 3.60

(4) The sub-criteria of the competitor are of high to the highest importance. It was found that the experts granted the highest importance level to the sub-criteria of being far from the direct competitors (with a 4.60 mean score), followed by being far from the indirect competitors (with a 3.60 mean score).

4.2. The Importance of the Location Selection Criteria for the Wholesale Shops

The researchers defined the hierarchies in the Modified Analytic Hierarchy Process as follows:

The first hierarchy is the location zone of the commercial building. For example, if we consider the proportion of the factories in each district, the shop locations can be divided into two zones: (1) shops

located in the industrial zone, including Bang Phli and Mueang Samutprakarn districts, and (2) shops located in the residential zone including Bang Bo, Bang Sao Thong, Phra Pradaeng and Phra Samut Chedi districts. The second hierarchy is the main criteria for the location selection consisting of four main criteria: customer accessibility, residence and work sources, raw materials and transportation, and competitors. Finally, the third hierarchy is the sub-criteria of each main criterion screened by five experts' assessments.

However, the researchers analyzed the data using the Modified Analytic Hierarchy Process by finding the mean value of the importance level of each criterion obtained by making a pairwise comparison between each pair of main criteria and sub-criteria. It was found that the Consistency Ratio (C.R) of all hierarchies was lower than 0.10, indicating that the importance level obtained from the analysis was acceptable. The results of the mentioned analysis can be shown in Tables 3 and 4. It should be noted that the highlighted criteria or sub-criteria (as the cases may be) are the criteria or sub-criteria with the highest importance values and the sum of their importance values was greater than 50 percent.

Table 3 The importance level of the criteria

Location Selection Criteria		**Location Zone of Commercial Building**	
		Industrial Zone	**Residential Zone**
Importance Value	Customer Accessibility Criterion (a_1)	40.5	38.25
	Residence and Work Source Criterion (a_2)	38.75	33
	Raw Material and Transportation Criterion (a_3)	13.25	18.75
	Competitor Criterion (a_4)	7.5	10

Table 4 The importance level of the sub-criteria

Location Selection Sub-criteria		**Location Zone of Commercial Building**	
		Industrial Zone	**Residential Zone**
Customer Accessibility Criterion	Being Located Along the Main Road ($a_{1.1}$)	10.55	4.05
	Being Located Along the Secondary Road ($a_{1.2}$)	4.30	24.20
	Parking Space and the Width of Road ($a_{1.3}$)	25.65	10.00
Residence and Work Source Criterion	Proximity to Community ($a_{2.1}$)	5.13	5.20
	Proximity to Fresh Market ($a_{2.2}$)	25.19	16.67
	Proximity to Factory or Work Source ($a_{2.3}$)	6.78	8.66
	Proximity to Convenience Stores or Community Stores ($a_{2.4}$)	1.65	2.47
Raw Material and Transportation Criterion	Proximity to Product Distributor ($a_{3.1}$)	1.66	3.13
	Proximity to Distribution Center ($a_{3.2}$)	11.59	15.62
Competitor Criterion	Being Far from Direct Competitor ($a_{4.1}$)	6.25	8.70
	Being Far from Indirect Competitor ($a_{4.2}$)	1.25	1.30

From Tables 3 and 4, the results of the analysis on the importance level of the criteria for the location selection of small wholesale shops in Samutprakarn Province can be explained as follows:

(1) Shops located in the industrial zone

The customer's accessibility criterion (with an importance value of 40.50 percent) is the most important main criterion for selecting small wholesale shops in Samutprakarn Province located in the industrial zone. It is followed by the residence and work source, raw material and transportation, and competitor criteria which bear the importance values of 38.75, 13.25, and 7.50 percent, respectively.

Regarding the sub-criteria for selecting the location of small wholesale stores in 50 percent of the industrial zone of Samutprakarn Province, it was found that the parking space, the width of the road, and proximity to the fresh market, which bear the importance level equal to 25.65 and 25.19 percent, respectively, are the sub-criteria with the sum of their importance values greater than 50 percent.

(2) Shops located in the residential zone

Similar to the industrial zone, the customer's accessibility criterion (with an importance value of 38.25 percent) is the most important main criterion for selecting the location of small wholesale shops in the residential area of Samutprakarn Province. It is followed by the residence and work source, raw material and transportation, and competitor criteria which bear the importance values of 33.00, 18.75, and 10.00 percent, respectively.

Regarding the sub-criteria for the location selection of small wholesale shops in Samutprakarn Province, it was found that the sub-criteria with the highest importance values and the sum of their importance values was greater than 50 percent for the location selection of small wholesale shops in Samutprakarn Province which located in the residential zone, are being located along the main road, being located along the secondary road, proximity to fresh market and proximity to the distribution center, which bear the importance level equal to 24.20, 16.67, and 15.62 percent, respectively.

5. Discussion

The research results revealed that the location zone of the commercial buildings was the most influencing factor for the criteria of the location selection of small wholesale shops in Samutprakarn Province. Therefore, the researcher split the analyses according to the zoning of the commercial buildings into two zones, namely the ones located in the industrial zone and those located in

the residential zone.

Therefore, the proposed models come in two forms: (1) a location selection model for small wholesale shops in the industrial zone of Samutprakarn Province and (2) a location selection model for small wholesale shops in the residential area of Samutprakarn Province of both the researchers were able to conclude in the equation (1)–(5):

Location Score = (Customer Accessibility) + (Residence and Work Source) + (Raw Material and Transportation) + (Competitor) (1)

$a_{1.1}$*(Main Road) +* $a_{1.2}$*(Secondary Road) +* $a_{1.3}$*(Parking Space and the Width of the Road)* (2)

Residence and Work Source = $a_{2.1}$*(Community) +* $a_{2.2}$*(Fresh Market) +*$a_{2.3}$*(Factory or Work Site) +* $a_{2.4}$*(Convenience or Community Store)* (3)

Raw Material and Transportation = $a_{3.1}$*(Product Distributor) +* $a_{3.2}$*(Distributor Center)* (4)

Competitor = $a_{4.1}$*(Direct Competitor) +* $a_{4.2}$*(Indirect Competitor)* (5)

where $a_{i.j}$ is the coefficient of each determinant, as shown in Table 4.

The coefficients of the main criteria in the model of the shops located in the industrial zone of Samutprakarn Province demonstrated that the customer accessibility was of the greatest importance, being consistent with the results of [4], [14]-[15]. This criterion is followed by the residence and work source, the raw material and transportation, and the competitor criteria. However, the parking space, the width of the road, and proximity to fresh markets, respectively, are sub-criteria with the highest importance values, and the sum of their importance values was greater than 50 percent. At the same time, customer accessibility is the most important main criterion for the shops located in a residential area, followed by the residence and work source, raw material and transportation, and competitor criteria, similar to the results of the industrial zone shops. However, the sub-criteria with the highest importance values and the sum of their importance values were greater than 50 percent for locations along the secondary road, proximity to the fresh market, and proximity to the distribution center, which is consistent with the results of [16] and [17], respectively.

It can be seen that the business operators of small wholesale shops in both zones place the most important concerns on the customers. This is evident from the focus on the main criterion of customer accessibility, consistent with [4] and proximity to residence and work source or the fresh market. These locations are usually crowded with consumers. Retail shops, which are wholesalers' customers, are densely located. This finding is consistent with [2], [8], [9], [11] and [13]. Choosing a location where it is convenient for the customers to park their cars for ordering and goods' loading is of great importance. Therefore, various wholesale shops should be located in the residential zone, preferring to select the shop location along the secondary road with less traffic so that visitors or customers can temporarily park in front of the shops. At the same time, wholesale shops located in the industrial area tend to be in high traffic, making it difficult for customers to park in front of the shops to make purchases and transport goods. It is thus necessary for the shops to provide parking space or choose a road with a large number of lanes which can help alleviate such problem. The results are consistent with the research conducted in [12].

6. Conclusion and Recommendations

The interesting theoretical contribution of this research is that it can detailed explain the definition of a good location for the small wholesale shops located in the area where both industrial and residential zones are presented, like in Samutprakarn Province, Thailand. The main criteria seem to be similar for both zones, but the levels of importance of sub-criteria are different because the contexts of the locations are different. Scrutinizing these findings, the business owners will better understand what they should consider when selecting the shop location to be a success in the wholesale business. However, this research also has a few limitations that should be concerned. Firstly, to evaluate the importance score in the proposed models, the model users must consider the judgment for evaluating the value of each sub-criterion regarding different locations being studied, which may differ depending on the rating criteria of each expert. This subjective evaluation process may cause the reliability issue of the models. Therefore, to solve such a limitation, the researchers recommend that those interested in performing a further study should conduct additional research to present the criteria for each score value, be used to assess each criterion, and achieve more reliability. Secondly, the importance value of every main criterion was divided into sub-criteria. Therefore, the importance of the sub-criteria will relate to the number of sub-criteria of the main calculation criteria. The more sub-criteria present in the main criteria, the less importance the sub-criteria will be allocated. To avoid such an issue, those interested in conducting the studies using the Modified Analytic Hierarchy Process should collect variables obtained from literature reviews to achieve a similar number of sub-criteria for each main criterion to make the importance value more accurate and complete. The sub-criteria in each main criterion should be of a similar number.

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References

[1] THAI MILITARY BANK. *The Direction of Thai Retail and Wholesale Businesses under a Different Circumstance*, 2019. https://media.tmbbank.com//uploads/analytics_industry/file/media/621_file_th.pdf.

[2] DEPARTMENT OF BUSINESS DEVELOPMENT, *Retail Business*, 2015. www.dbd.go.th/ewt_news.php?nid=10399&filename=index

[3] BANK OF THAILAND. *Consumer Product*, 2019. www.bot.or.th/App/BTWS_STAT/statistics/BOTWEBSTAT.aspx?reportID=831&language=th.

[4] TURHAN G, AKALIN, M. & ZEHIR, C. Literature Review on Selection Criteria of Store Location Based on Performance Measures. *Procedia – Social and Behavioral Sciences*, 2013, 99(2013): 391-402. https://doi.org/10.1016/j.sbspro.2013.10.507.

[5] OFFICE OF THE NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT COUNCIL. *Gross Provincial Product*, 2018. www.nesdc.go.th/.

[6] OFFICE OF SAMUTPRAKARN PROVINCE. *Information of Samutprakarn Province*, 2019. www.samutprakarn.go.th.

[7] DEPARTMENT OF INDUSTRIAL WORKS. Information of Industrial Factory for Officers, 2020. http://reg.diw.go.th/executive/prov2.asp?prov=11.

[8] WATCHARAPORN, N. *Location Selection Guidelines to Develop the Commercial Areas for Foods and Beverages SMEs Types*. Master's Independent Study, Thammasat University, 2013.

[9] TOCHAIWAT, K, LIKITANUPAK W. & KONGSUK S. Location Selection Models for Low-rise Condominiums Development in Bangkok. *Veridian E-Journal*, 2017, 10(5): 266-280.

[10] SRINUAL N. *et al*. Application of the Analytic Hierarchy Process on Warehouse Location Selection Factors. *Business Review*, 2016, 8(2): 75-90.

[11] SUKKRAJANG K. The Impact Factor of Decision to Select Location of Gas Retailer by AHP. *Industrial Technology Lampang Rajabhat University Journal*, 2017, 10(1): 1-11.

[12] CHAIYAWONG K. *A Guideline for Selecting the Location of Super Store*. Master's Thesis, Thammasat University, 2017.

[13] SIRITHANANONSAKUN N. *The Location Selection Model for Housing Development in Bangkok*. Master's Thesis, Thammasat University, 2017.

[14] JITSOONTHORNCHAIKUL M. Awaken Passionate Customer with Innovated CRM. *UTCC International Journal of Business and Economics*, 2018, 10(2): 3-20.

[15] CHOU T Y, HSU C L, & CHEN M C. A Fuzzy Multi-criteria Decision Model for International Tourist Hotels Location Selection. *International Journal of Hospitality Management*, 2008, 27(2008): 293-301. https://doi.org/10.1016/j.ijhm.2007.07.029.

[16] INDARTI N. Business Location and Success: The Case of Internet Café Business in Indonesia. *Gadjah Mada International Journal of Business*, 2004, 6(2): 171-192. https://doi.org/ 10.22146/gamaijb.5543.

[17] SINGH R K. Facility Location Selection Using Extent Fuzzy AHP. *International Advanced Research Journal in Science, Engineering and Technology*, 2016, 3(2): 47-51.

[18] RYMARZAK M, & SIEMINSKA E. Factors Affecting the Location of Real Estate. *Journal of Corporate Real Estate*, 2012, 14(4): 214-225. https://doi.org/10.15396/eres2012_091.

[19] SAATY T. L. *The Analytic Hierarchy Process*. McGraw-Hill, New York, 1980.

[20] KOMCHORNRIT K. Location Selection of Logistics Center: A Case Study of Greater Mekong Subregion Economic Corridors in Northeastern Thailand. *ABAC Journal*, 2021, 41(2): 137-155.

[21] VIMONKITTIPONG U, TOCHAIWAT K, SIRITHANYARAT S. & THUMVISUTTIVARAKORN V. Location Selection Model for a Dental Clinic in a Low to Medium Rent Commercial Building. *International Transaction Journal of Engineering, Management, Applied Sciences & Technologies*, 2022, 13(1): 1-11.

[22] BEST J. W. *Research in Education (3rd ed.)*. Prentice-Hall, New Jersey, 1977.

[23] VUDHIVANICH V. *Decision making by Analytic Hierarchy Process*, 2019. http://irre.ku.ac.th/pubart/PubArt/53-AHP-paper.pdf.

参考文:

[1] 泰国军事银行。泰国零售和批发企业的发展方向在不同的情况下，2019。https://media.tmbbank.com//uploads/analytics_industry/file/media/621_file_th.pdf。

[2] 商业发展部，零售业务，2015。www.dbd.go.th/ewt_news.php?nid=10399&filename=index

[3] 泰国银行。消费品，2019 年。www.bot.or.th/App/BTWS_STAT/statistics/BOTWEBSTAT.aspx?reportID=831&language=th。

[4] TURHAN G, AKALIN, M. 和 ZEHIR, C. 基于绩效衡量的商店选址选择标准的文献综述。普罗西迪亚- 社会和行为科学，2013，99（2013）：391-402。https://doi.org/10.1016/j.sbspro.2013.10.507。

[5] 国家经济和社会发展委员会办公室。2018 年省生产总值。www.nesdc.go.th/。

[6] 北榄府办事处。北榄府信息，2019。www.samutprakarn.go.th。

[7] 工业工程部。官员工业工厂信息，2020。http://reg.diw.go.th/executive/prov2.asp?prov=11。

[8] WATCHARAPORN, N. 为食品和饮料中小企业类型开发商业区的选址指南。硕士独立研究，国政大学，2013。

[9] TOCHAIWAT, K, LIKITANUPAK W. 和 KONGSUK S. 曼谷低层公寓开发的选址模型。维瑞迪安电子期刊，2017，10(5)：266-280。

[10] SRINUAL N. 等。层次分析法在仓库位置选择因素中的应用。商业评论，2016，8(2)：75-90。

[11] SUKKRAJANG K. 层次分析法对天然气零售商选址决策的影响因素。工业技术 南邦皇家大学学报，2017，10(1): 1-11.

[12] CAIYAWONG K. 超市选址指南。硕士论文，泰国法政大学，2017。

[13] SIRITHANANONSAKUN N. 曼谷住房开发选址模型。硕士论文，泰国法政大学，2017。

[14] JITSOONTHORNCHAIKUL M. 用创新的客户关系管理唤醒热情的客户。UTCC 国际商业与经济杂志，2018，10(2): 3-20.

[15] CHOU T Y, HSU C L, 和 CHEN M C. 国际旅游饭店选址的模糊多准则决策模型。国际酒店管理杂志，2008，27（2008）：293-301。https://doi.org/10.1016/j.ijhm.2007.07.029。

[16] INDARTI N. 业务定位与成功：以印度尼西亚网吧业务为例。加札马达国际商业杂志，2004, 6(2): 171-192。https://doi.org/10.22146/gamaijb.5543。

[17] SINGH R K. 使用程度模糊层次分析法进行设施位置选择。国际科学、工程与技术高级研究杂志，2016, 3(2): 47-51.

[18] RYMARZAK M 和 SIEMINSKA E. 影响房地产位置的因素。企业房地产杂志，2012，14（4）：214-225。https://doi.org/10.15396/eres2012_091。

[19] SAATY T. L. 层次分析过程。麦格劳希尔，纽约，1980。

[20] KOMCHORNRIT K. 物流中心选址：以泰国东北部大湄公河次区域经济走廊为例。ABAC 杂志，2021，41（2）：137-155。

[21] VIMONKITTIPONG U、TOCHAIWAT K、SIRITHANYARAT S. 和 THUMVISUTTIVARAKORN V. 中低租金商业建筑中牙科诊所的选址模型。工程、管理、应用科学与技术国际交易杂志，2022, 13(1): 1-11.

[22] BEST J.W. 教育研究（第 3 版）。新泽西州普伦蒂斯霍尔，1977。

[23] VUDHIVANICH V. 层次分析法决策，2019。http://irre.ku.ac.th/pubart/PubArt/53-AHP-paper.pdf。