

# *Location Method of Commercial Bank Network Based on Analytic Hierarchy Process*

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**Abstract:** In recent years, due to the outbreak of the COVID-19 epidemic, the national economy has been greatly affected. On the one hand, the central government has increased its support for small and medium-sized joint-stock banks for financing small and medium-sized enterprises, and the competition among banks has become increasingly fierce; On the other hand, with the development of Internet finance and the implementation of interest rate marketization, commercial banks rely on traditional business income such as deposit and loan spreads to bring less and less profit margins. Although the rent of offline bank branches has soared and the labor costs required for operation have become more and more pressurous, offline branches are the main places for people to absorb deposits, obtain income, and carry out publicity. are irreplaceable by online channels represented by Internet finance, and have their necessity of existence. When a commercial bank chooses a site, the factors that need to be considered are very complicated. Based on the theory of bank location, this paper enumerates the factors that affect bank location, and it is difficult to accurately describe them with mathematical models. The analytic hierarchy process (AHP) is used to analyze the influencing factors empirically, and finally a conclusion is drawn.

## 1. Introduction

With the progress of science and technology and the globalization, informatization and intelligence of finance, the competitive advantage of commercial banks in the financial system has gradually disappeared, and they have begun to directly face many opportunities and challenges in the global turbulent economic environment, fierce competition pattern, gradually complex financial profit model, sensitive and huge customer relationships and other factors[1]. The vital operational interests of commercial banks are directly affected by the proper location selection. The scientific

location decision of commercial banks determined by various factors will help branches attract more high-quality customers and improve business conditions, and improper location decisions of banks will seriously restrict the business development of subsequent commercial bank branches[2].

## **2. The Bank Location Problems**

### **2.1. The Location Model Is Unscientific**

At present, most of the site selection analysis of commercial banks is qualitative analysis, and a scientific decision-making method that transforms qualitative analysis into quantitative analysis is urgently needed. Second, the feasibility analysis report was written in the past, lacking of auxiliary decision-making tools; third, there are many links in the site selection process, which usually lasts for more than half a year. The reasons are that the lead departments in various places are not unified, the boundaries of responsibilities of various departments are unclear, and the relevant procedures are cumbersome. To sum up, many commercial banks only rely on historical experience and long-term intuition in site selection, and have not formed an effective scientific site selection model. Most commercial banks have only tasted the application of cloud computing and big data in bank site selection.

### **2.2. Site Selection Guidelines are not Comprehensive**

In the trend of agile transformation of banks, it is becoming more and more common to subtract the operation of existing commercial bank branches. According to statistics, the number of bank branches in China has also decreased in recent years. According to the data from the annual reports of the China Banking and Insurance Regulatory Commission and listed banks, in 2021, a total of 2,805 bank branches of commercial banking institutions ceased operations, a net decrease of 889, and the abolition of bank branches not only performed prominently in large cities, but also became the trend and direction of banking industry layout in many local cities.

### **2.3. Unreasonable network Layout**

In the trend of bank's agile transformation, it is more and more common for the existing commercial banks to operate their outlets by subtraction, and the layout of new outlets is characterized by both "excess" and "deficiency", which shows obvious imbalance in space. According to statistics, the number of bank outlets in China is also decreasing in recent years. According to the annual report data of China Banking and Insurance Regulatory Commission and listed banks in China, in 2021, a total of 2,805 banking outlets of commercial banking institutions were closed, with a net decrease of 889. Abolishing banking outlets not only showed outstanding performance in big cities, but also became the trend and direction of banking layout in many local cities.

### **2.4. Site Selection Training is not Systematic**

Domestic commercial banks have different functions and slightly different emphasis on site selection, which leads to no systematic site selection training in China. Compared with banking departments, channel construction has different levels of attention from leaders, and many financial institutions lack professional training in site selection, so that relevant staff responsible for site selection can't systematically learn advanced and scientific site selection skills and lack systematic theoretical system support.

### 3. The empirical Part

#### 3.1. The Establishment of Index Evaluation System

According to the analysis of historical data and the experience of relevant experts, the factors affecting the location of commercial banks are classified, and the following table 1 is obtained:

Table 1. Influencing factors of bank outlet location

| Target layer a  | Criterion layer b     | Index layer c  | Factor characteristics |
|-----------------|-----------------------|--|------------------------|
| Bank location A | Economic factor B1    | Intra-regional location cost C1                        | quantify               |
|                 |                       | Regional per capita disposable income C2               | quantify               |
|                 |                       | Annual Gross Regional Product (GDP)C3                  | quantify               |
|                 | Political factors B2  | Political stability C4                                 | qualitative            |
|                 |                       | Legal soundness C5                                     | qualitative            |
|                 |                       | Degree of policy support C6                            | qualitative            |
|                 | Cultural factor B3    | Education level C7 of residents in the region          | qualitative            |
|                 |                       | Demand of regional residents for banks C8              | qualitative            |
|                 |                       | Regional demand for banks C9                           | qualitative            |
|                 | Social factor B4      | Occupation distribution C10 of residents in the region | qualitative            |
|                 |                       | Investment habits of residents in the region C11       | qualitative            |
|                 |                       | Scale of regional business circle C12                  | qualitative            |
|                 | Traffic factor B5     | Traffic conditions in the region C13                   | qualitative            |
|                 |                       | Circumjacent traffic facilities C14                    | qualitative            |
|                 |                       | Geographical location within the region affects C15.   | qualitative            |
|                 | Natural factor B6     | Regional business environment C16                      | qualitative            |
|                 |                       | Population density in the region C17                   | quantify               |
|                 |                       | Intra-regional labor resources C18                     | quantify               |
|                 | Competitive factor B7 | Similar commercial bank C19                            | qualitative            |
|                 |                       | Internet C20   | qualitative            |
|                 |                       | Private bank C21                                       | qualitative            |
|                 |                       | Foreign bank C22                                       | qualitative            |
|                 | Self-factor B8        | Product category C23                                   | qualitative            |
|                 |                       | Employee accomplishment C24                            | qualitative            |
|                 |                       | Channel C25  | qualitative            |

#### 3.2 Establish the Hierarchical Structure Chart and the Consistency Test of the First-Level Indicators.

According to the evaluation system of influencing factors of bank location in Table 2,3, Figure 1, a hierarchical structure is established, and a variety of influencing factors with complex relationships are attributed to several comprehensive factors [3] that keep the original factor information, thus improving the location efficiency.

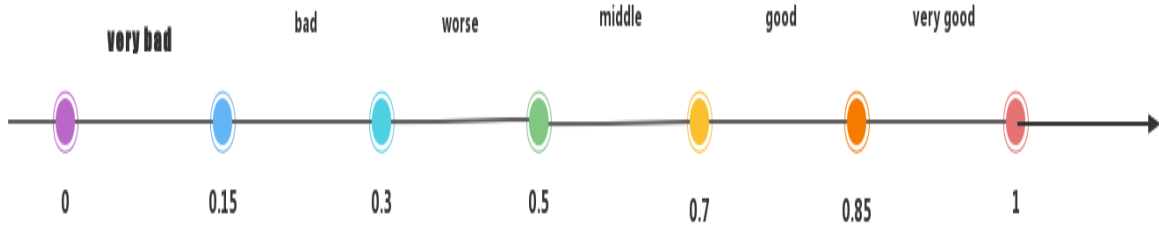


Figure 1. A qualitative factor rank diagram

In order to comprehensively and reasonably judge the weight of each index in the criterion layer, the average value is normalized, and the discriminant matrix and the consistency test results are shown in the table. According to the hierarchy of the system, the location of bank outlets is the target layer A; B is the criterion level, which includes economic factors, political factors, cultural factors, social factors, traffic factors, natural factors, competitive factors and self-factors; C is the sub-criterion layer [4], which contains relevant factors that affect the site selection of bank outlets, and then forms various schemes P. The hierarchical structure diagram is shown in Figure 2:

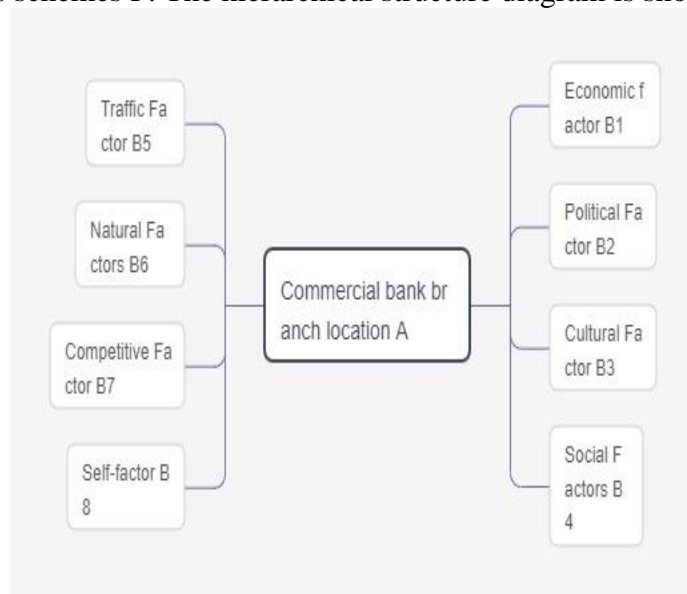


Figure 2. Evaluation index system of commercial bank site selection

It can be seen that among the factors affecting the location of commercial banks, economic factors account for 5.86%, cultural factors account for 13.1%, traffic factors and natural factors account for 4.7%, political factors account for 7.94%, competition factors account for 6.35% and self-factors account for 31.14%. That is to say, if commercial banks have obvious competitive advantages, the indexes of competitive factors, political factors, traffic factors and natural factors have little influence on the site selection of commercial banks, but hierarchical analysis should also be carried out in site selection, so as to get the normalization treatment and consistency test of the influencing factors of each level.

Table 2. Discriminant matrix and consistency test of normalized first-level index

| Z                                 | Economic factor B <sub>1</sub> | Political factors B <sub>2</sub> | Cultural factor B <sub>3</sub> | Social factor B <sub>4</sub> | Traffic factor B <sub>5</sub> | Natural factor B <sub>6</sub> | Competitive factor B <sub>7</sub> | Self-factor B <sub>8</sub> | Proper vector |
|-----------------------------------|--------------------------------|----------------------------------|--------------------------------|------------------------------|-------------------------------|-------------------------------|-----------------------------------|----------------------------|---------------|
| Economic factor B <sub>1</sub>    | 0.121                          | 0.362                            | 0.689                          | 0.246                        | 0.155                         | 0.155                         | 0.333                             | 0.008                      | 0.208         |
| Political factors B <sub>2</sub>  | 0.015                          | 0.045                            | 0.043                          | 0.016                        | 0.017                         | 0.017                         | 0.024                             | 0.458                      | 0.160         |
| Cultural factor B <sub>3</sub>    | 0.015                          | 0.090                            | 0.086                          | 0.098                        | 0.103                         | 0.103                         | 0.095                             | 0.458                      | 0.189         |
| Social factor B <sub>4</sub>      | 0.024                          | 0.136                            | 0.043                          | 0.196                        | 0.103                         | 0.103                         | 0.024                             | 0.006                      | 0.051         |
| Traffic factor B <sub>5</sub>     | 0.04                           | 0.136                            | 0.043                          | 0.025                        | 0.051                         | 0.052                         | 0.024                             | 0.006                      | 0.037         |
| Natural factor B <sub>6</sub>     | 0.04                           | 0.136                            | 0.043                          | 0.025                        | 0.051                         | 0.052                         | 0.024                             | 0.006                      | 0.037         |
| Competitive factor B <sub>7</sub> | 0.017                          | 0.090                            | 0.043                          | 0.098                        | 0.103                         | 0.103                         | 0.048                             | 0.006                      | 0.040         |

Table 3. Consistency test of normalized first-level index

| Z | $\lambda$ | CI     | RI   | CR         |
|---|-----------|--------|------|------------|
|   | 8.0866    | 0.0124 | 1.41 | 0.0088<0.1 |

### 3.3. Weight Calculation and Consistency Test of Secondary Indicators

#### 3.3.1. Analysis of Secondary Indicators of Economic Factors

The normalization method of the same index of economic factors, the corresponding eigenvectors of C1, C and C3 [0.43,1.71,0.86]T,CR=0, accords with the consistency test. Among them, the per capita disposable income in the region has the greatest influence on the location of commercial banks (accounting for 57.14%). Before setting up outlets, we should first investigate the income of residents in the region, which will directly affect the savings pulled by bank outlets. Besides, we should also investigate the gross domestic product (accounting for 8.57%) in the region, which will indirectly affect the total savings of banks.

#### 3.3.2. Analysis of Secondary Indicators of Political Factors

In the normalization method of the same index of political factors, the corresponding feature vectors of C4, C5 and C6 are [0.59,0.13,0.8]T,CR=0.00535, which accords with the consistency test.

Among them, the degree of political stability has the greatest influence on the location of commercial banks (accounting for 59.49%), followed by the degree of policy support (accounting for 7.66%), all of which will affect the business environment of outlets. The location of outlets must be consistent with relevant financial laws and regulations in order to achieve a longer-term development.

### **3.3.3. Analysis of Secondary Indicators of Cultural Factors**

In the normalization method of the same index of cultural factors, the corresponding feature vectors of C7, C8 and C9 are [0.8, 1.85, 0.88] t, and Cr = 0.0054, which is consistent with the consistency test. Among them, the demand of enterprises for banks has the greatest influence on the location of commercial banks (accounting for 87.78%). Banks should carefully analyze and understand the types and development patterns of enterprises in the region, and then analyze the amount of savings funds that can be obtained at present and the potential amount of funds that can be obtained in the future, and finally determine what kind of financial products and services are needed by enterprises.

### **3.3.4. Analysis of Secondary Indicators of Social Factors**

In the method of normalizing the same index of social factors, the corresponding eigenvectors of C10, C11 and C1 are [1.79,0.83,0.39]T,CR =0.00535, which accords with the consistency test. Among them, the occupation distribution of residents in the region has the greatest influence on the location of commercial banks (accounting for 59.9%). Experts generally believe that occupation distribution is the premise of differences in per capita disposable income, risk preference and purchasing power of financial products, which will affect the investment habits of residents in the region, and it is a factor that should be considered in the location of banks.

### **3.3.5. Analysis of Secondary Indicators of Traffic Factors**

In the normalization method of traffic factors with the same index, the corresponding eigenvectors of C13, C14 and C15 are [3.06,0.79,0.3]T,CR=0.06037, which accords with the consistency test. Among them, the traffic conditions in the region have the greatest influence on the location of commercial banks, which requires commercial banks to consider the location from the perspective of fully satisfying customers' transportation convenience, because this is the initial impression of customers on the image of commercial banks, and these externalized visible factors are hard to change, which can increase customers' trust and goodwill, and deepen customers' choice of banks.

### **3.3.6. Analysis of Secondary Indicators of Natural Factors**

The normalization method of the same index of natural factors, the corresponding feature vectors of C16, C17 and C18 are [.39,0.46,0.30]T,

CR=0.041, which meets the consistency test. Among them, the operating environment in the region has a great influence on the location of commercial banks. For example, ICBC will generally be built in the financial district, while most agricultural banks will be built in suburbs and county towns. The population density and labor resources in the region will also affect the decision-making of commercial banks' location.

### 3.3.7. Analysis of Secondary Indicators of Competitive Factors

In the method of normalizing the same index of competitive factors, the corresponding eigenvectors of C 19, C 0, C1 and C are [1.61, 0.86, 1.013, 0.70] t, Cr = 0.047073571, which accords with the consistency test. Among them, similar commercial banks have the greatest influence on commercial bank site selection (accounting for 38.5%). Therefore, before site selection, it is necessary to know in detail how many similar inter-bank outlets are located near the region, and also to mark the geographical location of competing banks on the drawings, and analyze whether the competing banks will pose a greater threat to the candidate outlets. Although private banks have the second influence on bank site selection, it is to fill the market that large financial institutions can't or can't physically take care of, so as to optimize and complete the local financial institution system [5].

### 3.3.8. Secondary Index Analysis of Self-Factors

In the normalization method of the same index of self-factors, the corresponding eigenvectors of C 3, C 4 and C 5 are [1.6, 0.49, 0.89] t, Cr = 0.008854488, which accords with the consistency test. Among them, the type of products has an absolute advantage on the location of commercial banks. The richer the products, the more attractive it is for different customers in the region to buy financial products. The factors influencing the location selection of commercial banks come from employees' literacy (accounting for 53.38%). Therefore, the future physical outlets should not only be comfortable, equal and safe in the design of business environment, but also cultivate employees' professionalism, actively serve and satisfy customers, and provide personalized, professional and comprehensive financial services on this basis [6]. Of course, the establishment and expansion of multi-platform channels (accounting for 7.84%) is very important, which can effectively reduce the work pressure of physical outlets and play a certain role in shunting, thus improving the overall customer satisfaction [7].

## 4. Summary and Discussion

As the core component of the banking financial system, its location will directly affect the steady development of China's economy. Through the scoring of the influencing factors of the candidate addresses of related outlets, it can be seen that self-factors occupy an absolute advantage among the site selection factors. However, when the influencing factors are refined, the site selection cost C1 in the region is also very important to the site selection of commercial banks. Therefore, in general, when making site selection decisions, it is imperative to first consider the construction cost and then consider how to further enhance its comprehensive strength and change its business philosophy. In order to better facilitate the improvement of the competitiveness of commercial banks, the following countermeasures and suggestions are put forward:

(1) Clear market positioning, optimize the network layout.

The physical outlets of commercial banks are not only their fixed assets but also their burdens, the basis of profit creation and the cost trap. In the future, although the proportion of online banking will be larger and larger, it will also lead to more and more serious homogenization competition of banking financial services[11]. Only when each commercial bank has its own clear positioning can it bravely step out of the solidified thinking and move towards differentiated development, gradually form its competitiveness relative to its peers, and enhance its customer stickiness.

Specifically, firstly, it is necessary to subdivide the domestic financial market, and determine the business scope and marketing strategy according to the target customers and network size; Then, we can consider setting up scene-based services through cross-industry cooperation, and explore the



construction of middle and back-office supporting mechanism accordingly [8]; In addition, from the beginning of site selection, it is necessary to consider creating unique outlets, transforming to intelligent, intensive and beautiful, and establishing a good brand image. In short, the future commercial bank outlets should appear in the places where customers need them, so as to achieve accurate services[12].

(2) Promote intelligent outlets and enhance customer experience.

The high operating cost is the biggest difficulty of physical outlets, and it is also the biggest reason for the disappearance of bank outlets at present. Timely adjustment to the new era of intelligent outlets requires both the convenience of customers and the reduction of the bank's operating costs. However, the promotion of intelligent network is not only the promotion of a safe and efficient system, a set of advanced equipment or a kind of high-tech software, but also the change of product logic, service mode and interaction design from the standpoint of customers. From the empirical results, it can be seen that self-factors have the greatest influence on the location of commercial banks, while product types and employee literacy are the most influential factors. Therefore, it is far from enough to rely solely on the decoration of scientific and technological equipment[13]. It is also necessary to continuously strengthen the education and training of bank employees, so as to truly implement the essential connotation of the bank. By establishing a set of dynamic and agile customer sensory monitoring system, we can timely perceive and feed back relevant customer experiences [9], and raise the simple but extreme experience work to a new height.

(3) Strengthen innovation ability and expand service boundary.

The financial service industry has very high requirements for the processing of relevant information. It needs to collect information and process data quickly to realize intelligent banking services, and customers generally require the privacy of personal information. Especially under the background of "internet plus Finance", cash and media have become burdensome at present, and the process of no card is further accelerated. Although the emerging online payment tools are still difficult to get rid of bank cards and exist independently, their dependence is weakening with the development of cardless payment[14].

With the migration of customers' behavior habits, intelligent terminal is obviously the channel closest to customers, so APP will be the main position to maintain the interaction between banks and customers. Whether the APP has complete functions, safe and convenient operation, and attractive internal financial products are the ties to maintain customer loyalty. We should build a full-line service business system and strengthen the integration of online and offline business platforms. By setting up a platform and building an ecology, the connection between banks and customers, banks and peers, banks and external third-party partners can be truly realized [10]. Non-financial services can drive the development of financial services, and the application of banking services in customers' daily life can be practically improved[15].

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Data sharing is not applicable to this article as no new data were created or analysed in this study.



## Conflict of Interest

The author states that this article has no conflict of interest.

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