Preliminary Study of Low-altitude Tourism Forecast under the Condition of Artificial Intelligence

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Abstract. With the development of artificial intelligence (AI) technology, China’s low-altitude airspace reform and opening-up to the outside world continue to advance, and low-altitude tourism development has presented an unprecedented expanding trend. In this paper, Guilin City is taken as an example to introduce the site selection and layout of low-altitude tourism projects. On this basis, an in-depth analysis is performed on the overall benefits of low-altitude tourism development from the economic, social, and environmental perspectives. The analysis shows that under the condition of AI technology in Guilin, the development of low-altitude tourism can not only bring considerable economic benefits but also create considerable social and environmental effects.

Keywords: Low-altitude Tourism, Economic Benefits, Social Benefits, Environmental Benefits, Guilin

1. Introduction
The development of low-altitude tourism is based on the opening-up of low-altitude airspace, with the production of navigational equipment and the construction of general airports (including take-off and landing points) as the carrier, and the tourist attractions as the main attraction to meet the tourist's aerial aesthetic experience as the fundamental purpose of tourism development Activity [1-2]: Since low-altitude tourism provides the perfect match point for general aviation and the tourism industry, low-altitude tourism development has expanded rapidly across the country in recent years. Many low-altitude tourism projects have sprung up [3-4].

This paper takes Guilin City as an example. Through the analysis of 6 districts and 11 counties under the jurisdiction of the city, based on the administrative divisions, geographical scope, tourist flows and the distribution of scenic spots, in-depth investigation and extensive analysis are performed. In Guilin urban areas, Yangshuo, Xing'an, Longsheng and other places, investing in low-altitude tourism projects, developing low-altitude tourism products, designing low-altitude tourism routes, and
operating low-altitude tourism business are the most scientific and reasonable and feasible solutions\textsuperscript{[5-6]}. Through low-altitude tourism development, completely change the homogeneous tourism products in Guilin Structure, enrich the Guilin tourism product system, and find a fundamental way for Guilin's tourism industry to transform, upgrade, and improve quality and efficiency.

2. Analysis of economic benefits

(1) Calculation of the investment cost of low-altitude tourism development in Guilin. The cost calculation of low-altitude tourism development in Guilin can use the most common cost measurement method in the era of AI-total score method and total score method. The total score method is used for investment projects. The total construction time and total workload are measured, and then allocated according to phases, steps, and tasks. The expenses of each phase, step, and task are accumulated to obtain the total estimated cost \textsuperscript{[3]}. The sub-total method is based on each phase, step, and task. The required workload and development time are used to calculate the cost separately, which is then weighted and accumulated in combination with the actual situation of the investment project to obtain the total estimated cost based on the total workload and the total development time.

The cost measurement process is mainly a multi-index evaluation system consisting of \( n \) measured objects \( u_1, u_2, \cdots, u_n \) and \( m \) indicators \( x_{11}, x_{12}, \cdots, x_{mn} \textsuperscript{[4]} \), \( x_{ij} = x_{j}(x_{i}) (i = 1,2, \cdots, n; j = 1,2, \cdots, m) \) is the measured data matrix (decision matrix) of the collected value of the measured object \( u_i \) and the index \( x_j \), as shown in equation (1):

\[
A = \begin{bmatrix} 
    x_{11} & x_{12} & \cdots & x_{1m} \\
    x_{21} & x_{22} & \cdots & x_{2m} \\
    \vdots & \vdots & \ddots & \vdots \\
    x_{n1} & x_{n2} & \cdots & x_{nm} 
\end{bmatrix}_{n \times m} 
\] (1)

The data in \( m,n \geq 3 \) and \( A \) are normalized data after preprocessing.

It can be transformed into equation (2) as follows:

\[
y_i = f(x_{i1},x_{i2},\cdots,x_{in}), i \in N 
\] (2)

Where \( f \) represents a positive transformation function; \( y_i \) represents the comprehensive evaluation value of the evaluated object \( u_i \). \( u_1, u_2, \cdots, u_n \) are sorted based on the value of \( y_1, y_2, \cdots, y_n \) from large to small, and then you can complete the comparison of \( u_1, u_2, \cdots, u_n \).

If there are two evaluation objects \( u'_i, u'^*_i (i',i^* \in N, i' \neq i^*) \), let \( w'_j (i',i^*) \) be a random variable that obeys a distribution on the interval \( \left[ \min\left(w_{rj},w_{rj}\right),\max\left(w_{rj},w_{rj}\right) \right] \), and call \( s(u'_i > u'^*_i) \) the superiority of \( u'_i \) to \( u'^*_i \textsuperscript{[5]} \), as shown in equation (3):

\[
s(u'_i > u'^*_i) = p\left(f\left(u'_i\right) > f\left(u'^*_i\right)\right) + 0.5 p\left(f\left(u'_i\right) = f\left(u'^*_i\right)\right) 
\] (3)

In the equation, the aggregate function indicates the event probability, as shown in equations (4) and (5):
\[ f(u') = \sum_{j=1}^{m} z_j w_j (i', i^*) \]  

(4)

\[ f(u^*) = \sum_{j=1}^{m} z_j w_j (i', i^*) \]  

(5)

1) Fuel expenses: Bell 206L-4 helicopter uses ordinary aviation diesel, and the cost of flying fuel is about 700 yuan/hour. If it is calculated as 1000 hours of flight per year, the fuel cost of a Bell 206L-4 helicopter for 1 year is 700,000. The total fuel cost of 8 Bell 206L-4 helicopters at 4 general airports in Guilin City of Yuanyuan for one year is 5.6 million yuan. Robinson R44 Thunderbird 2 helicopter uses ordinary aviation gasoline, and the cost of fuel is about 650 yuan/hour. The annual fuel cost of a Robinson R44 Thunderbird 2 helicopter is about 650,000 yuan per 1000 hours every year. The total fuel cost of 1 Robinson R44 Thunderbird 2 helicopter at 4 general airports in Guilin is 1 year. 5.2 million yuan (total of the above two items, the annual fuel cost allocated to low-altitude tourism development in Guilin is 10.8 million yuan).

2) Aviation material expenses: If the average aviation materials consumption during the flight of each Bell 206L-4 helicopter is 1500 yuan/hour, then the annual aviation materials consumption of 8 Bell 206L-4 helicopters is 12 million yuan. The average aviation material consumption of each Robinson R44 Thunderbird 2 helicopter during flight is 1200 yuan/hour. The annual aviation material consumption of 8 helicopters is about 9.6 million yuan. Based on the total of the above two, the development process of low-altitude tourism in Guilin can be obtained. The consumption of aviation materials that should be shared by low-altitude flights every year is 21.6 million yuan.

3) Human resource expenses: The human resource expenses of low-altitude tourism development in Guilin are estimated to include the salaries, benefits and other expenses incurred by the staff at the four airports (including take-off and landing points). The crew includes the pilots, tour guides, dispatchers, senior management personnel, maintenance personnel, flight commanders, marketing personnel, office management personnel, logistics support personnel, security personnel, etc. The annual salary, bonus and welfare of the above personnel constitute Guilin personnel expenses for low-altitude tourism development in the city (as shown in Table 1).

**Table 1.** Human resource cost calculation table for low-altitude tourism development in Guilin

| Cost item            | Calculation methods and standards                  | Number of personnel | Annual expenditure |
|----------------------|----------------------------------------------------|---------------------|-------------------|
| Pilot pay            | Man-machine ratio 1.5: 1.3 million yuan/person/year| 16\times1.5=24      | 720               |
| Tour guide salary    | Man-machine ratio: 11.12 million yuan/person/year  | 16\times1=16        | 192               |
| Crew compensation    | Man-machine ratio 2:17 thousand yuan/person/year  | 16\times2=32        | 224               |
| Dispatcher compensation | 70,000 yuan/person/year                          | 8                   | 56                |
| Commander compensation | 70,000 yuan/person/year                          | 8                   | 56                |
Marketing staff compensation 80,000 yuan/person/year 20 160
Office staff compensation 60,000 yuan/person/year 16 96
Logistics staff compensation 60,000 yuan/person/year 8 48
Security personnel compensation 40,000 yuan/person/year 8 32
Executive compensation 120,000 yuan/person/year 16 192
Total 156 1776

(4) Operating and administrative expenses: Operating and administrative expenses refer to expenses incurred in the low-altitude tourism operation and management, reception services, and marketing (as shown in Table 2), including airport take-off and landing expenses, office management expenses, marketing expenses. The items such as logistics support expenses are also amortized in the cost accounting at one time.

**Table 2. Annual calculation of low-altitude tourism management in Guilin**

| Cost item                      | Calculation methods and standards | Annual operating income | Annual expenditure |
|-------------------------------|----------------------------------|-------------------------|--------------------|
| Airport take-off and landing expenses | 150 yuan/time/half hour           | 60                      | -                  |
| Marketing expenditure         | 5% of annual operating income    | 43200                   | 2160               |
| Office management expenses    | 4% of annual operating income    | 43200                   | 1728               |
| Logistics support expenses    | 3% of annual operating income    | 43200                   | 1296               |
| Total                         |                                  | 5244                    |                    |

The above are the various expenses that have occurred during the operation of low-altitude tourism in Guilin. These expenses and expenses are measured based on an operating cycle (based on “year” as the operating cycle). The sum of the annual shared fixed cost and the annual shared variable cost is used: the total cost of low-altitude tourism development = the fixed cost of low-altitude tourism development + the variable cost of low-altitude tourism development. Then, according to the above calculation results, and the total cost is as follows: 3944 + 1080 + 2160 + 1776 + 5244 = 141.84 million yuan. This cost is the minimum cost for low-altitude tourism development in Guilin to be amortized annually.

(2) Calculation of operating income of low-altitude tourism development in Guilin

The low-altitude tourism operating income measurement in Guilin is performed based on the unified caliber of "investment cost measurement". As mentioned earlier, 4 general airports and supporting facilities will be constructed in the urban areas of Guilin, Longsheng, Xing'an, and Yangshuo. After the project is completed and put into operation Each operation site has two Bell 206L-4 8-seater helicopters, and two Robinson R44 Thunderbird 2 5-seater helicopters. Based on the previous weather conditions in Guilin and relevant regulations of the air traffic control department, the number of suitable space is determined to be 250 per year. If each helicopter can fly a maximum of 4 hours a day, and the total annual flight hours of a helicopter is 1000 hours.

Based on the space capacity and seating settings of the two helicopters, each Bell 206L-4 8-seater
helicopter is fully loaded with 6 passengers/time, and each Robinson R44 Thunderbird 2 5-seater helicopter is fully loaded with 3 people/time. Currently, the low-altitude tourism consumption in the market is priced at 100 yuan/person/minute. If calculated based on the full load, the operating income of one Bell helicopter per hour is 36,000 yuan, and the operating income of one Robinson helicopter is one hour, which is estimated at 18,000 yuan per hour. The operating income of 4 low-altitude tourism operation points in Guilin for one day should be: \(36,000 \text{ yuan/hour/frame} \times 8 \text{ frames} \times 4 \text{ hours} + 18,000 \text{ yuan/hour/frame} \times 8 \text{ frames} \times 4 \text{ Hours} = 1.728 \text{ million yuan, then the annual low-altitude tourism operating income in Guilin is as follows:} \ 1.728 \text{ million yuan} \times 250 \text{ days} = 432 \text{ million yuan}

(3) Economic Benefit Evaluation of Low-altitude Tourism Development in Guilin

The low-altitude tourism investment and development in Guilin. If general airports and supporting facilities are built in Guilin urban area, Longsheng, Xing'an, and Yangshuo, respectively, after the project is completed and put into operation, the total cost will be 141.84 million yuan per year, and annual operating income will be 43200. Ten thousand yuan: If the business tax rate is 5%, the income tax rate is 25%, the urban maintenance and construction tax rate is 7%, the education surcharge tax rate is 3%, and the surplus reserve ratio is extracted by 10%, etc. Subsequently, the tax deduction will be made. The annual net profit can reach 145.08 million yuan, and the entire investment can be recovered in about 3 years.

3. Analysis of social benefits

(1) Promote the local economic development of Guilin

Accelerating the development of the local economy is undoubtedly the greatest social benefit of low-altitude tourism development in Guilin, which is located in the north of Guangxi Zhuang Autonomous Region. The administrative scope includes 6 districts and 11 counties, with a total area of 27,800 km² and a total population of more than 5 million. The economic development level of Guilin area is lagging, and the living standards of local people are generally not high, especially in counties such as Longsheng, Resources, Guanyang, and Quanzhou on the border with Hunan which are typically less developed regions and have poor natural conditions. Due to the backward traffic conditions, the economic development potential is severely insufficient. Hence, the investment in low-altitude tourism projects and accelerating the development of low-altitude tourism can fully leveragetourism resources and further promote local economic development.

(2) Increase employment in Guilin

The most direct social benefit of the development of low-altitude tourism in Guilin is the capacity to improve employment rate, thereby providing more employment opportunities for local people. In recent years, due to various factors, more and more rural people have returned to work from rural areas. How to properly arrange these migrant returnees is not only a critical work content of the local employment department but also a topic of common concern to all sectors of society. If low-altitude tourism development can be used to absorb some of the rural surplus labor force, they will become local migrant workers who can not only earn a higher income but also take better care of their family and loved ones. Hence, it will be vigorously supported by massive villagers and help maintain social stability.

(3) Enriching the material and cultural life in Guilin

The ultimate goal of economic development is to improve people's material and cultural life and
continuously improve the level of material and cultural life. Guilin's low-altitude tourism development is entirely consistent with economic development goals. In the past, people came to Guilin for tourism and admired the landscape of Guilin. On the surface of the earth, it is difficult to see the whole picture of Guilin. After the consumption form of low-altitude tourism, people can use helicopters and other navigational equipment to see the worldly beauty of “Guilin landscape” in the air and deepen the “scenic landscape”, to obtain higher aesthetic enjoyment and spiritual pleasure. Therefore, accelerating the investment and development of low-altitude tourism in Guilin can better enrich people's material and cultural life.

(4) Changing the traffic situation in Guilin
Since the reform and opening-up, although China's civil aviation transportation industry has developed rapidly, public aviation has become a critical transportation method for citizens to travel long distances. However, from the perspective of local traffic conditions, China's regional air transportation network has not been fully established. The primary choice of travel is road and rail transportation. Small planes and regional airports should be further strengthened and improved to change the objective status quo of local traffic in China. To accelerate the development and construction of low-altitude tourism in Guilin can not only enrich the content of tourism activities but also promote the development of regional air transportation and change local traffic conditions, thereby achieving the diversification of short-distance transportation modes.

(5) Improving Guilin's rescue and disaster relief capabilities
The investment and construction of low-altitude tourism projects should be based on the development of general aviation. Without this underlying condition, low-altitude tourism development will make no sense. The public aviation industry chain is very long. Application in industrial and agricultural production, meteorological detection, marine monitoring, scientific experiments (especially forest fire protection, natural disaster relief), general aviation has a wide range of essential uses, can play an irreplaceable unique role. Hence, accelerating the development of low-altitude tourism in Guilin City can improve emergency rescue capacity

4. Conclusions
In this paper, Guilin is taken as an example to conduct an in-depth analysis of comprehensive benefits from low-altitude tourism development based on a comprehensive introduction to the site selection and layout of low-altitude tourism projects from the economic, social, and environmental perspectives. The analysis shows that under the condition of AI technology in Guilin, the development of low-altitude tourism can not only bring considerable economic benefits but also create considerable social and environmental effects.

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