

Hybrid SWOT-AHP Analysis of Strategic Decisions of Coastal Tourism: A Case Study of Shandong Peninsula Blue Economic Zone

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ABSTRACT

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Coastal tourism is an important growth point of marine economic. Shandong Peninsula Blue Economic Zone (SPBEZ) is the first approved strategic marine economic development zone in China. Its coastal tourism development not only has an important demonstration role, but also has important significance for the marine ecological civilization. This study combined SWOT analysis with the analytical hierarchy process (AHP), and with experts' professional knowledge, quantitatively calculated the intensities of strengths, weaknesses, opportunities and threats of coastal tourism in SPBEZ. From the perspective of SWOT-AHP model, drew strategic quadrilateral, calculated strategic vector, and scientifically established the strategic type and the strength of strategy implementation. The results show that the pioneering strategy of seizing opportunities should be actively implemented, and the implementation focus of OS strategy, OW strategy, ST strategy and WT strategy are further clarified.

ADDITIONAL INDEX WORDS: Coastal tourism, SWOT-AHP, strategic decision, China, Shandong peninsula blue economic zone.

INTRODUCTION

The 21st century is the century of oceans, and it has become a common understanding all over the world to vigorously develop the marine economy. As a large maritime country, China has a coastline of more than 18,000 kilometers, governing about 3 million square kilometers of sea area and more than 5,000 islands, and has abundant marine resources. However, due to the Chinese people's deep-rooted continental view and the profound influence of loess civilization, the national marine consciousness is relatively weak, resulting in a lack of exploitation and utilization of marine resources. Thus, the development of marine economy is unsatisfactory. With the proposal of the Belt and Road (B&R), China has accelerated the pace of marine economic construction, and is committed to finding a scientific way to develop the marine economy.

Coastal tourism, as an important part of marine economic development (Wang and Zhu, 2014), has the characteristics of strong industry driving and ecological friendliness. The development of coastal tourism can not only effectively improve the total added value of marine industry (Scott *et al.*, 2012), but also realize the optimization of marine industrial structure and the protection of marine resources (Kim, 2012; Gong *et al.*, 2019). Therefore, it is an efficient way to develop China's marine economy through coastal tourism. However, at present, the research on China's coastal tourism industry mainly focuses on the classification of coastal tourism resources, the

evaluation of resources carrying capacity, and the evaluation of cities' coastal tourism competitiveness. There is a lack of systematic research on how to develop China's coastal tourism resources, especially on from a strategic point of view.

In view of this, this paper chooses the first marine economy-oriented region in China as the research object, namely the Shandong Peninsula Blue Economic Zone (SPBEZ). Based on the regional resource endowment and the reality of socioeconomic development, scientifically identifying the development direction of coastal tourism from the strategic level, expecting to build the region into a demonstration zone of coastal tourism with international advanced level. This is not only related to the modernization of China's marine industry system, directly affecting the realization of the strategic goal of China's maritime power, but also of great significance to the marine ecological civilization worldwide. The remainder of the paper is structured as follows: Section2 introduces research method. Section3 constructs SWOT-AHP model and obtains the output of the model. Section4 is the result discussion. Section5 draws conclusions.

METHODS

The SWOT approach is used extensively in strategic planning (Lallo *et al.*, 2016; Pratiwi *et al.*, 2017). However, Kangas (2000) pointed out that SWOT method had the defect of too subjectivity, then he developed a method to eliminate this by combing the analytic hierarchy process (AHP). An AHP is a key multicriteria decision-making method (Chang *et al.*, 2012), which is helpful to select strategic types scientifically. SWOT-AHP method has been widely applied in various areas such as

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Strengths(S)	Weaknesses(W)
S1: "Friendly Shandong" tourism brand is deeply rooted among the public S2: Coastal tourism has taken shape S3: Coastal tourism resources are abundant S4: Strong marine economic strength S5: Distinctive location advantage S6: Developed transportation network	W1: Environmental damage in offshore waters W2: Imperfect tourism market management W3: Lack of linkage in coastal tourist attractions W4: Single structure of tourism products W5: Chaotic exploitation of coastal resources W6: Restriction of regional culture
Opportunities(O)	Threats(T)
O1: Development of artificial intelligence technology O2: This area has become a national strategy O3: Large domestic market volume O4: The strategy of "The Belt and Road" O5: Marine economy enters golden development period.	T1: Impact from disastrous weather T2: Intense competition in this industry T3: Challenges of ecological civilization construction T4: Imperfect laws and regulations T5: A mature and diversified demand market

Figure 1. Strengths, weaknesses, opportunities and threats of the SPBEZ in developing coastal tourism.

environmental management, logistics and agriculture (Olum et al., 2018; Sharifipour and Mahmodi, 2012; Tavana et al., 2016). Steps of this method are as follows.

Step 1: Identify SWOT factors. **Step 2:** Calculate factor score. **Step 3:** Construct pairwise comparison matrix A.

$$A = (a_{ij}) = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} = \begin{bmatrix} 1 & w_1/w_2 & \dots & w_1/w_n \\ w_2/w_1 & 1 & \dots & w_2/w_n \\ \vdots & \vdots & \ddots & \vdots \\ w_n/w_1 & w_n/w_2 & \dots & 1 \end{bmatrix}$$

Where a_{ij} means relative importance for i to j in each SWOT group; and $a_{ij} = 1/a_{ji}$. When $i=j$, $a_{ij} = 1$. The value of w_i varies from 1 to 9, and 1/1 indicates equal importance, while 9/1 indicates extreme or absolute importance (Saaty, 2008). **Step 4:** Compute maximum eigenvalue (λ_{max}) and eigenvector (w_{ai}) of pairwise comparison matrix. The calculation methods are shown in Equation (1) and (2) respectively (Saaty, 2008).

$$w_{ai} = \frac{\bar{W}_i}{\sum_{i=1}^n \bar{W}_i}; \bar{W} = \sqrt[n]{\prod_{j=1}^n a_{ij}} (i = 1, 2 \dots n) \quad (1)$$

$$\lambda_{max} = \sum_{i=1}^n \frac{\sum_{j=1}^n A_{ij} \bullet w_{ai}}{n \bullet w_{ai}} (i' = 1, 2 \dots n); \lambda_{max} \approx \sum_{i=1}^n \frac{(AW)_i}{n W_i} \quad (2)$$

Step 5: Consistency test. The consistency index (CR) of a matrix of comparisons is given by Equations (3). RI varies functionally according to the matrix size (Saaty, 2008). The CR value of 10% or less is considered as acceptable. Otherwise, a new pairwise comparison matrix should be obtained by re-comparing. (Kangas, 2000).

$$CR = \frac{CI}{RI}; CI = (\lambda_{max} - n)/(n-1) \quad (3)$$

Step 6: Calculate factor intensities. The method is shown in Equation (4).

$$I_F = S_F \times W_F \quad (4)$$

Step 7: Establish strategic type and implementation intensity. According to the final intensities of strengths, weaknesses,

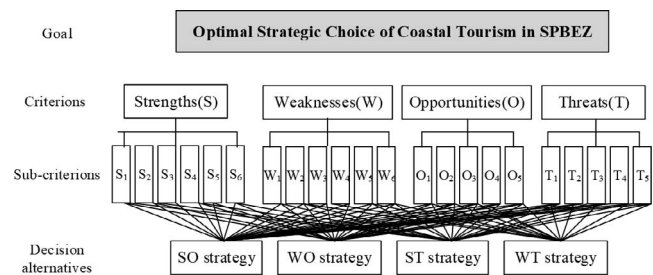


Figure 2. SWOT-AHP model of coastal tourism development in the SPBEZ. By calculating the intensity of each factor in the sub-criterion level, the priority of various decision alternatives is defined, so as to select the most suitable coastal tourism development strategy.

opportunities and challenges, determining the most appropriate strategic types and the implementation intensity.

RESULTS

Based on the existing research and the current situation of coastal tourism development in the SPBEZ, it can be concluded that the strengths, weaknesses, opportunities and threats of the coastal tourism development in this region. Then SWOT-AHP model is established, and with the help of expert knowledge, intensity of strengths, weaknesses, opportunities and threats are obtained.

SWOT Factors Recognition

The main planning scope of the SPBEZ includes the whole coastal areas of Shandong Province and eight cities such as Qingdao, Yantai, Weihai, Weifang, Zibo, Dongying and Rizhao, as well as the coastal land areas of Wudi and Zhanhua in Binzhou City. The sea area in this region is 159,500 square kilometers and land area is 64,000 square kilometers. Based on the actual development and combined with the existing research of scholars (Cao and Gong, 2013; Creo and Fraboni, 2011; Jiang et al., 2014; Klaus, 2018; Lin and Zins, 2016; Lu and Hu, 2014; Tegar and SautGurning, 2018; Wang et al., 2015; Yang et al., 2017; Yin et al., 2018), the strengths, weaknesses, opportunities and threats of coastal tourism in the SPBEZ are shown in Figure 1.

Accordingly, the SWOT-AHP model is shown in Figure 2.

Factor Intensity

(1) Factor score

The factor score in this paper refers to the degree of strengths (weaknesses) of the SPBEZ compared with its competitors, and the size of opportunities (threats) faced by the coastal tourism industry. Referring to the relevant literature, the score is classified into nine grades, namely, -4, -3, -2, -1, 0, 1, 2, 3, 4. Among them, the factor scores of strengths and opportunities are expressed by positive value, while the factor scores of weaknesses and threats are expressed by negative value. The greater the absolute value, the higher the factor scores. Twelve scoring experts are selected from experienced managers and scholars in this field. Assuming that all experts have the same level of decision-making, the final score of each factor is the average score of all experts, as shown in Table 2.

Table 1. Scores, weights and intensities of SWOT factors

	λ_{max}	Normalized eigenvector	n	CR	Consistency test
G	4.1638	(0.2941,0.1201,0.4160,0.1698)	4	0.0607	Y
S	6.0457	(0.0410,0.2997,0.2997,0.1913,0.0411,0.1272)	6	0.0074	Y
W	6.3793	(0.4000,0.2609,0.1287,0.1053,0.0637,0.0414)	6	0.0612	Y
O	5.2857	(0.2614,0.3994,0.1085,0.1521,0.0787)	5	0.0638	Y
T	5.2007	(0.1751,0.0946,0.2054,0.3623,0.1626)	5	0.0448	Y

(2) Factor weight

In SWOT-AHP model (Figure 2.), the calculation of all factor weights is similar. Thus, this section takes the calculation of W_{st} of the pairwise comparison matrix of Strength group as an example, the specific calculation steps are as follows:

According to the scoring scale, experts give the relative significance between factors within Strength group. After six rounds of information feedback, the final result is obtained, that is the pairwise comparison matrix **S**.

$$S = \begin{bmatrix} 1 & 1/7 & 1/7 & 1/5 & 1 & 1/3 \\ 7 & 1 & 1 & 2 & 7 & 2 \\ 7 & 1 & 1 & 2 & 7 & 2 \\ 5 & 1/2 & 1/2 & 1 & 5 & 2 \\ 1 & 1/7 & 1/7 & 1/5 & 1 & 1/3 \\ 3 & 1/2 & 1/2 & 1/2 & 3 & 1 \end{bmatrix}$$

The eigenvector is obtained according to Equation (1).

$$W = [0.0410 \ 0.2997 \ 0.2997 \ 0.1913 \ 0.0411 \ 0.1272]^T$$

According to Equation (2), the λ_{max} of matrix **S** is as follows:

$$\begin{aligned} \lambda_{max} &= \sum_{i=1}^6 \frac{(SW)_i}{nW_i} \\ &= \frac{(SW)_1}{6W_1} + \frac{(SW)_2}{6W_2} + \frac{(SW)_3}{6W_3} + \frac{(SW)_4}{6W_4} + \frac{(SW)_5}{6W_5} + \frac{(SW)_6}{6W_6} \\ &= 6.0457 \end{aligned}$$

Next, conduct consistency testing. The value of *RI* is 1.24 when n =6. According to Equation (3), $CI = (6.0457-6) / (6-1)$

=0.00914; $CR = CI/RI = 0.0074 < 0.1$, indicating that the result is acceptable. Using the same method, the intra-group pairwise comparison matrix *G* and inter-group pairwise comparison matrix of Weakness (*W*), Opportunity (*O*), and Threat (*T*) can be obtained. The results are shown in Table 1.

Through multiplying vectors, the final weights of all factors are obtained in Table 2.

(3) Factor Intensity

According to Equation (4), the intensities of all factors are shown in Table 2.

Strategic Type and Implementing Intensity

(1) Strategic quadrilateral

A four half-dimension coordinate system is constructed with four variables, namely the intensity of Strength, Weakness, Opportunity, and Threat, each of which is a half-axis respectively (Saaty, 1997). Point **H** represents the origin of the coordinate system. Point **S'**(0.8606, 0), **W'** (-0.3762, 0), **O'** (0, 1.3940) and **T'** (0, -0.5777) are on the relevant semi-axis of the coordinate system. The strategic quadrilateral **S'O'W'T'** can be obtained by connecting four points in turn.

The order of strategic triangle area in Figure 3 is $S_{\Delta SHO} > S_{\Delta WHO} > S_{\Delta SHT} > S_{\Delta WHT}$. Therefore, the order of strategy selection is **SO** strategy (pioneering), **WO** strategy (twisting), **ST** strategy (diversification), and **WT** strategy (defensive).

(2) Strategic azimuth

The pioneering strategy can be further divided into strength-based type and opportunity-based type. In order to more

Table 2. Scores, weights and intensities of SWOT factors

	Weight between groups	Factor	Weight among group	Factor score	Final weight	Factor intensity	Group intensity
S	0.2941	S1	0.0410	3.2	0.0121	0.0386	0.8606 $I_S = \sum I_{Si}$
		S2	0.2997	2.8	0.0881	0.2468	
		S3	0.2997	3.1	0.0881	0.2732	
		S4	0.1913	2.4	0.0563	0.1350	
		S5	0.0411	3.6	0.0121	0.0435	
		S6	0.1272	3.3	0.0374	0.1235	
W	0.1201	W1	0.4000	-3.2	0.0480	-0.1537	-0.3762 $I_W = \sum I_{Wi}$
		W2	0.2609	-3.5	0.0313	-0.1097	
		W3	0.1287	-2.8	0.0155	-0.0433	
		W4	0.1053	-3.1	0.0126	-0.0392	
		W5	0.0637	-2.6	0.0077	-0.0199	
		W6	0.0414	-2.1	0.0050	-0.0104	
O	0.416	O1	0.2614	3.6	0.1087	0.3915	1.3940 $I_O = \sum I_{Oi}$
		O2	0.3994	3.6	0.1662	0.5981	
		O3	0.1085	2.8	0.0451	0.1264	
		O4	0.1521	3.1	0.0633	0.1961	
		O5	0.0787	2.5	0.0327	0.0818	
T	0.1698	T1	0.1751	-3.2	0.0297	-0.0951	-0.5776 $I_T = \sum I_{Ti}$
		T2	0.0946	-3.1	0.0161	-0.0498	
		T3	0.2054	-3.7	0.0349	-0.1290	
		T4	0.3623	-3.5	0.0615	-0.2153	
		T5	0.1626	-3.2	0.0276	-0.0884	

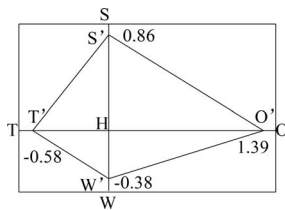


Figure 3. The strategic quadrilateral of coastal tourism development in the SPBEZ; point S'(0.8606, 0), W' (-0.3762, 0), O' (0, 1.3940) and T' (0, -0.5777) corresponds to the intensity of overall strength, overall weakness, overall opportunity and overall threat respectively.

accurately identify the suitable type, it is necessary to further calculate the strategic azimuth angle (θ) of the quadrilateral, which is the angle between the center of gravity and the point H. For strategic quadrilateral S'O'W'T', its barycentric coordinates P(X, Y) is determined as follows:

$$P(X, Y) = P(\sum xi/4, \sum yi/4) = (0.1211, 0.2041)$$

Where x_i and y_i indicate separately the horizontal and vertical axis of point S', W', O' and T' in the strategic quadrilateral. Mathematically, the azimuth angle θ is $\tan \theta = Y/X$ ($0 \leq \theta < 2\pi$), therefore, $\theta = \arctan Y/X = \arctan (0.2041/0.1211) = 59.32^\circ \in [\pi/4, \pi/2)$ Thus, it is more suitable to adopt the pioneering strategy of seizing opportunities.

(3) Strategic intensity coefficient

Besides, the intensity of strategy implementation is also an important aspect to be considered, which is usually determined by the strategic intensity coefficient ρ , $\rho \in [0, 1]$. Generally, when $\rho \geq 0.5$, it is suitable to adopt a progressive approach; when $\rho < 0.5$, it is suitable to adopt a conservative approach. The calculation method of ρ is as follows:

$$\rho = U / (U + V); U = I_S \times I_O; V = I_W \times I_T \quad (5)$$

U and V means the positive intensity and the negative intensity respectively. I_k means the intensity of strength, weakness, opportunity and threat. According to Equation (5) and the data in Table 2, the results are: $U = 1.1997$, $V = -0.2173$, $\rho = 0.8466 > 0.5$. Therefore, the implementation of the strategy should be more active.

To sum up, for the SWOT-AHP model of coastal tourism development in the SPBEZ, the strategic vector $M(\theta, \rho) = (59.32^\circ, 0.8466)$. The most suitable type of strategy and its implementation are shown in Figure 4.

DISCUSSION

From the above analysis, SPBEZ should actively implement the pioneering strategy of seizing opportunities to develop coastal tourism. Combining with the intensities of all factors (Table 2), the key points of strategy implementation are as follows:

OS Strategy: Grasp Opportunities and Give Full Play to Strengths

a. Combination of O2/O5/S2/S4: Under the background of the golden age of marine economy, grasping the historical

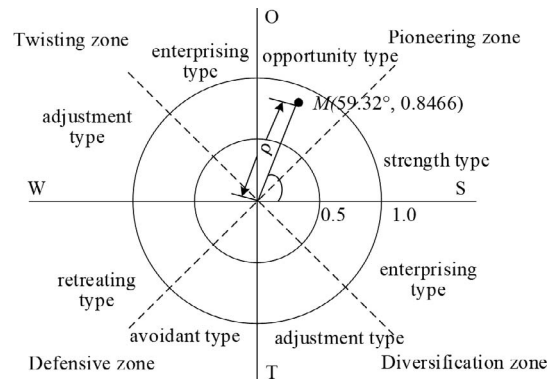


Figure 4. The suitable type of strategy and its implementation of coastal tourism in the SPBEZ. The coordinate of point M can show the type of strategy adopted and the intensity of strategy implementing.

opportunity of becoming a national strategy, SPBEZ should further strengthen the marine economic strength, and improve the relevant supporting facilities needed for the development of coastal tourism.

- b. Combination of O3/S1/S3: Taking the huge potential of domestic coastal tourism market as an opportunity, SPBEZ should strengthen the resources development, enhance the experience and leisure of tourism products, innovate the city linkage marketing mode, and consolidate the brand status of Friendly Shandong.
- c. Combination of O4/S1/S5/S6: With the strategic opportunity of the "Belt and Road", SPBEZ should give full play to the advantages of Shandong Peninsula as the node of marine transportation and land transportation, create a comprehensive, three-dimensional and convenient transportation system, expand import and export in parallel, and let the brand of Friendly Shandong resound all over the world.

OW Strategy: Take Advantage of Opportunities to Overcome Weaknesses

- a. Combination of O1/W2/W5: With the opportunity of rapid development of AI and cloud computing, SPBEZ should accelerate the construction of intelligent tourist management platform, real-time monitoring platform, disaster warning platform and digital integrity checking platform to remedy the shortcomings of imperfect tourism market management and the chaotic exploitation of coastal resources.
- b. Combination of O1/W3/W4: With the help of the intelligent data analysis ability of Big Data, the information of landscape features and transportation modes of each attraction in the region can be presented in an all-round way. Meanwhile, virtual reality technology can be used to innovate the form of tourism products, enhance the interactive experience, and improve tourists' satisfaction.
- c. Combination of O2/O4/W6: Taking the construction of the "Belt and Road" and the SPBEZ becomes a national

strategy as opportunities, enhancing openness. While inheriting the essence of harmony in the “harmony and peace” culture, SPBEZ need to integrate the innovation and openness of marine culture, and focus on cultivating overseas tourism market.

ST Strategy: Relying on Strengths to Resist Threats

- a. Combination of S1/S5/T2: Relying on the tourism brand system of Friendly Shandong, as well as the geographical advantages, SPBEZ needs to vigorously promote health check-up tourism, medical beauty tourism and food tourism, so as to stand out from the fierce competition of domestic coastal tourism.
- b. Combination of S3/S4/T5: Based on the abundant coastal tourism resources and with the help of strong marine economic strength, SPBEZ should strengthen the integration and development of coastal tourism products, innovate science investigation tourism, sports tourism, coastal rural tourism and other forms, so as to create characteristic and high quality tourism products to meet the diversified demand.

WT Strategy: Make Up for Weaknesses and Reduce the Impact of Threats

- a. Combination of W1/T3: SPBEZ must integrate 4R concepts (reduce, reuse, recycle, replace) into the coastal tourism and adhere to the ecological development model, starting from strengthening punishment measures, encouraging public participation, strengthening inspection and timely restoration.
- b. Combination of W2/W5/T2: Honesty is particularly important for the sustainable development of tourism. It is necessary to construct the tourism integrity system from the aspects of education guidance, system guarantee, centralized governance and public supervision, so as to deal with the fierce market competition.
- c. Combination of W3/W4/W6/T5: SPBEZ needs to give full play to the characteristics of inclusiveness and differentiation in the “harmony and peace” culture, break the administrative division in regions, fully consider the regional culture and coastal resources endowment, and plan the development sequence and regional layout of the area as a whole. Creating a characteristic coastal tourism chain to enhance the viscosity of tourists and respond to the diversified needs of the market.

CONCLUSIONS

Coastal tourism is an important growth point for the vigorous development of marine economy. Against the background of the golden age of marine economy, China's coastal tourism will usher in bright and broad prospects. Shandong Peninsula Blue Economic Zone (SPBEZ) is the first strategic area with marine economy as its theme in China. Its coastal tourism development not only has an important demonstration role for China's coastal tourism industry, but also is an important component of marine ecological civilization. This paper combined the SWOT analysis with analytic hierarchy process (AHP), with the help of experts' professional knowledge, scientifically established

the type and implementation intensity of coastal tourism development strategy in the SPBEZ. That is, SPBEZ should actively implement the pioneering strategy of seizing opportunities. Meanwhile, this paper draws the following two main conclusions:

- (1) **Shandong Peninsula Blue Economic Zone has six strengths, six weaknesses, five opportunities and five threats. The strengths are:** (a) “Friendly Shandong” tourism brand is deeply rooted among the public. (b) Coastal tourism has taken shape. (c) Coastal tourism resources are abundant. (d) Strong marine economic strength. (e) Distinctive location advantage. (f) Developed transportation network. **The weaknesses are:** (a) Environmental damage in offshore water. (b) Imperfect tourism market management. (c) Lack of linkage in coastal tourist attractions. (d) Single structure of tourism products. (e) Chaotic exploitation of coastal resources. (f) Restriction of regional culture. **The opportunities are:** (a) Development of artificial intelligence technology. (b) This area has become a national strategy. (c) Large domestic market volume. (d) The strategy of the “Belt and Road “. (e) Marine economy enters golden age. **The threats are:** (a) Impact from disastrous weather. (b) Intense competition in this industry. (c) Challenges of ecological civilization construction. (d) Imperfect laws and regulations. (e) A mature and diversified demand market.
- (2) **The strategic vector $M(0, \rho) = (59.32^\circ, 0.8466)$.** The intensity of the overall strengthens, weaknesses, opportunities and threats of coastal tourism development in the SPBEZ are 0.8606, -0.3762, 1.3940 and -0.5776 respectively. The priority of strategic choice is SO strategy, ST strategy, WO strategy and WT strategy. The strategic azimuth (θ) is 59.32° , means that it is suitable to adopt a pioneering strategy of seizing opportunities. The strategic intensity coefficient $\rho=0.8466 > 0.5$, indicating that active implementation should be adopted.

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