




Artificial Intelligence-Driven Qinhuangdao Tourism Cultural Innovation Within Regional Cultural Environment

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Abstract. Regional culture is a culture with unique characteristics in a specific area. Cultural and creative tourism is both a commercial terminal and a cultural carrier. Regional culture can inject more cultural value into tourism culture and creativity, enhance emotional connection with consumers, and protect and inherit regional culture, showing its unique charm. Based on regional culture, this paper analyzes the difficulties faced by regional culture in the comprehensive development of tourism culture and creative design and puts forward design strategies. Taking the Qinhuangdao district as an example, this paper investigates and studies cultural and innovative products with regional characteristics through observation, interviews, and a questionnaire survey. It is found that there are typologies, lack of novelty, and other problems with regional products at present. Regional cultural resources are being transformed into advantages for the regional cultural tourism industry. Through case analysis, the innovative design idea proposed in this paper is very effective.

Keywords: regional culture, tourism culture, and creativity, Qinhuangdao, cultural and creative (C&C); Artificial Intelligence-Driven

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1 INTRODUCTION

Culturally creative tourism products accompany the development of tourism. With the increasingly apparent needs of the public, designers should abandon traditional design thinking, effectively grasp and apply regional cultural elements, and enrich the design of tourism works[25]. In developing original tourism products, it is necessary to clarify the unique value of local culture, highlight the original characteristics of tourism literature, extract cultural elements with historical significance, and apply them to product design to further enhance their value [1].

However, the economic industry is in a transition period, and the design of tourism literature needs to be constantly improved to maintain its unique value. This requires the creation of tourism

literature and integrating geographical elements with rich cultural connotations so that cultural products can become the carriers of local culture[2]. However, the C&C mechanism in the tourism industry needs to be developed more, and the culture and attention to creative talents are insufficient. At present, the problem of tourism market scale still exists, and some types of tourism design face the following difficulties:

1. Product homogenization

Most of the products are key chains and postcards. Some merchants pay attention to short-term interests and do not pay attention to developing innovative designs, and the products they sell are likely to cause visual fatigue to tourists [27],[7]. However, the C&C products of some scenic spots are similar, and their cultural appeal is not strong, so it isn't easy to attract consumers to buy them. This has also become an essential reason for the need for more competitiveness in the tourism C&C market.

2. Lack of visual elements

Our country's regional culture is full of splendor, but the visual elements used in tourism C&C design are relatively scarce. In some cities with iconic architectural attractions, their C&C products are often derivatives of related architectural attractions[20]. Although these products' design styles differ from product type to product type, consumers can love them. Still, they have little effect on cultural dissemination, do not profoundly explore other regional cultures, and are highly useful [24]. In addition to the defect of single use of fixed visual elements, some C&C products also have the problem of insufficient innovation of optical elements, resulting in a single visual effect, which makes it challenging to give C&C design the added value it deserves.

3. Lack of cultural connections

If these two dilemmas are only the product's defects, the lack of cultural connection means that the importance of regional culture is ignored in C&C tourism design. C&C products emphasize cultural elements, and the design of tourism C&C also needs specific commemorative significance [5]. If C&C tourism design only focuses on formal beauty, simplicity, and practicality, then products are often indistinguishable from ordinary commodities without C&C value-added. Cultural identity makes it easier for consumers to establish emotional ties with tourist spots, ultimately affecting their values.

2 RELATED WORKS

The international community has a relatively clear definition of the C&C industries, as shown in Table 1. Many regions in China have established their own C&C industry bases with unique regional characteristics. As a result, many C&C products came into being, which were made into commodities and flowed into the market, becoming outstanding tourism derivatives.

<i>Country / Region</i>	<i>Industry name</i>	<i>Include</i>
<i>U.SA</i>	<i>Copyright industry</i>	<i>Core copyright industry, partial copyright industry, distribution copyright industry, copyright-related industry</i>
<i>U.K.</i>	<i>Creative industry</i>	<i>Advertising, architectural art, television broadcasting, arts and crafts production, publishing, fashion design, music production, interactive leisure software, fashion design, art peace and cultural relics trading</i>
<i>South Korea</i>	<i>Cultural content</i>	<i>Film and television, broadcasting, games, performances, networks and related industries</i>

	<i>industry</i>	
<i>Taiwan, China</i>	<i>Cultural and creative industries</i>	<i>Visual art industry, cultural exhibition and performance facilities, creative life industry, design brand fashion industry</i>
<i>China Hong Kong</i>	<i>Creative industry</i>	<i>Art, antiques and handicrafts, music, performing arts, advertising, architecture</i>

Table 1: Industry names and classifications of some countries and regions.

C&C products are the crystallization of the laborers' wisdom, the result of the designer's mental and physical labor, and commodities with economic value derived from the C&C industries. The primary function of C&C products is to meet consumers' diverse cultural demands and needs and provide a unique and exciting experience. It contains two core parts: the content of artistic creativity and the physical objects that carry the content. The economic value of ordinary commodities may lie more in the material part, while the value of C&C products lies more in the C&C content they carry[17].

2.1 Product Attributes of C&C Products

As a commodity with special attributes, C&C products have their unique characteristics. The explicit and inner image of the content contained in C&C products will convey different cultural feelings to consumers. Therefore, C&C products are artistic, cultural, aesthetic, intuitive, imaginative, spiritual, and emotional[21]. Among them, imagination, intuition, spirituality, and emotion are interpreted based on consumers' subjective feelings, and different product attributes are reflected in consumers' feelings of appreciation for activities such as inspection and experience of cultural creativity.

2.2 Value Attributes of C&C Products

The value of C&C products is mainly reflected in the connotation of the unique spiritual activities of human beings that they convey and the related influences caused by such connotations. Which also makes the marginal pricing method used in economics insufficient [14]. Due to professional limitations, this research also wants to be superficial on the value attributes of C&C products. It can only summarize and analyze the existing literature, then combine the traits and characteristics of C&C products mentioned above to translate the C&C products. Features common to creative products [18]. The design and production of C&C products have created a market for cultural needs and cultivated a group of C&C consumers. The economy cannot measure the value of this part. It has the effect of accumulating value in the process of dissemination. See Table 2.

<i>Years</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>	<i>2020</i>
<i>The added value of culture and related industries (unit: 100 million yuan)</i>	<i>7632</i>	<i>8788</i>	<i>11053</i>	<i>15517</i>	<i>18072</i>	<i>21352</i>	<i>23941</i>
<i>Proportion of added value of culture and associated industries in GDF</i>	<i>2.42%</i>	<i>3.55%</i>	<i>2.71%</i>	<i>3.22%</i>	<i>3.39%</i>	<i>3.64%</i>	<i>3.77%</i>

Table 2: Growth of the added value of my country's cultural and related industries from 2014 to 2020.

By combining the connotation characteristics of C&C products, the core value of C&C products is its inherent cultural connotation and intellectual property rights, and the realization of its market value is also a process of continuous accumulation and appreciation of artistic creativity [9],[4]. By pricing and selling C&C products, intangible value attributes are transformed into tangible currency reserves, which can bring certain economic benefits and employment promotion. The combination of these economic benefits is the value attribute of C&C products, as shown in Figure 1.

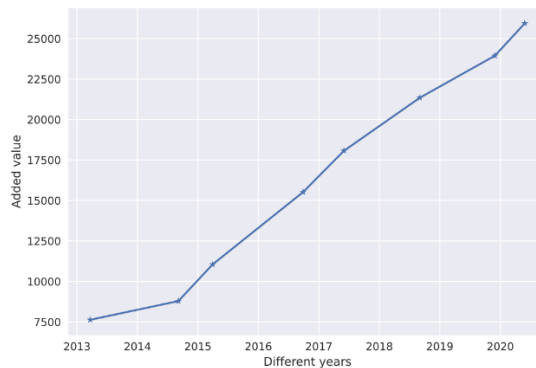


Figure 1: The added value of culture and related industries (100 million yuan).

As a highly cultural human activity, tourism is an excellent carrier for inheriting and promoting culture. Culture and tourism have always been a natural coupling [10]. Tourists' aesthetic needs, value orientation, and behavior will change with their cultural accomplishment, knowledge reserve, and aesthetic level. Culture is the essential resource, foundation, soul, and backbone of tourism, and tourism is a necessary carrier of culture, making culture more dynamic and attractive.

The complementary relationship between culture and tourism makes them have a vital communion and can also achieve improvement and win-win in this communion [23]. C & C products are among the best products under this integration. It injects cultural flavor into products and transforms culture into products, an organic carrier to convey to consumers so that they can use various forms of experience, understand, and feel the local cultural connotation [19].

The first stage is a period of reform and opening. During this period, the tourism industry has always been the golden stage of Qinhuangdao's economic development. With the rapid development of tourism, its accompanying C&C products have developed to a certain extent [13]. However, tourism at that time was only a welfare undertaking, mainly the government's development and improvement of tourism-supporting facilities and scenic spots. There was no concept of profit, industry, development, etc., and it could only be called the government's play and vacation for the people. Leisure and leisure infrastructure and alternative and tradable C&C products are even rarer. Moreover, with the advent of the knowledge economy, the tourism industry faces new development requirements and intense survival challenges, prompting the C&C products to be reformed [6].

The second stage is from 1998 to 2010. In the past ten years, Qinhuangdao's tourism industry has developed rapidly, won the title of "China's Excellent Tourism City," and was named the first batch of excellent tourism cities in the country by the National Tourism Administration. At the same time, cultural tourism is also gradually emerging [3],[11],[12]. People are no longer satisfied with simply enjoying the natural scenery and strengthening their health, and cultural tourism has gradually become a new tourism fashion. However, the boundary between these two factors could be more precise, similar to two vague and overlapping factors. Therefore, the current state of

tourism is a relatively ambiguous development [8]. To create and develop this unclear tourism industry type, it is necessary to design products with high-end taste and quality to adapt to the new value orientation brought by new tourists [15],[26]. Such themes already have a broad audience and cultural themes that resonate with culture, such as the Great Wall culture, which has the most profound history in Qinhuangdao, and the C&C products born from this have developed very well in this stage.

3 METHODS

As a traditional tourist city, Qinhuangdao has always received attention from all parties. With the support of the state for cultural industries and innovative industries, the design level of Qinhuangdao's C&C products has also been gradually improved. In September 2016, the 2016 Qinhuangdao·Beijing-Tianjin-Hebei-C&C Industry (Trade) Expo kicked off in Bei Daishe Village. The biggest highlight of this expo is the move from a traditional indoor pavilion to an open one. The outdoor village- the whole town is the fairground. This expo is a leap-forward development of Qinhuangdao's C&C industry. It integrates cultural and artistic sense into Qinhuangdao's regional culture around the core spirit of cultural creativity and combines original spirit with experience design. It can bring better spiritual enjoyment to consumers.

3.1 Construction of Sample Set and Evaluation Index System

In designing and developing C&C products, the key to innovation is to investigate user needs. A reasonable analysis of needs is the basis for design and determines the goal of product innovation. Select user demand factors to maximize the user experience and function of the product. To clearly illustrate the method in this paper, a wearable product is selected as a case to construct a sample set and an evaluation index system.

3.2 Construction of a Representative Sample Data Set of C&C Products

The collection of sample data is essential for the construction of product data sets. The screening process is divided into three steps to screen samples more objectively and accurately.

1. Using the design knowledge and design tool databases, the image data of the existing C&C wearable devices in the sales market was collected by browsing major shopping websites and shopping malls. Using the PS image processing tool, the more precise and less occluded schematic design drawings or real photos were preliminary screened, and 64 samples were obtained.

2. Invite designers with four years of product design experience to divide into 8 sample initial cluster centers based on the relevant knowledge of C&C wearable devices, using the KJ method to refer to the similarity principle of the sample and determine the dissimilarity among the 64 samples. The sample data set to be clustered $X = \{x_1, x_2, x_3, \dots, x_n\}$, where $x_i = \{x_{i1}, x_{i2}, x_{i3}, \dots, x_{im}\}$ is the number of samples in the sample set, and m is the number of sample attributes. Calculate the dissimilarity of the samples and construct the dissimilarity matrix. The dissimilarity between samples x_i and x_j is expressed as:

$$r_{ij} = \sum_{s=1}^m \frac{|x_{is} - x_{js}|}{\max\{x_{rs}\} - \min\{x_{rs}\}} \quad (1)$$

Among them, $\max\{x_{rs}\}$ represents the maximum value of the s -th attribute, and $\min\{x_{rs}\}$ represents the minimum value. After statistics, a set of integers whose value range is $[0, 8]$ is set. The value is proportional to the dissimilarity between samples, and the dissimilarity of all samples is expressed as a dissimilarity matrix. See Table 3.

Sample	H1	H2	H3	H4	...	H64
H1	0	*	*	*	...	*
H2	9	0	*	*	...	*
H3	5	8	0	*	...	*
...	*
H64	9	7	7	6	...	0

Table 3: Phase difference matrix of the sample data set.

3. To screen the preliminary product samples more objectively, multivariate scale analysis and cluster analysis methods further determine the final representative design plan data set. The required sample coordinate values and dimensional pressure coefficients are obtained using multivariate scale analysis on the dissimilarity matrix in step (2). Then, the sample space coordinate value is inputted into SPSS software to carry out K-means cluster analysis and systematic cluster analysis, respectively, to obtain the center distance of the sample group so that the 64 samples are divided into ten categories. Due to space constraints, specific details are omitted. Finally, combined with the two analysis results, ten representative samples were obtained to form a usual sample data set for product design.

Constructing the evaluation index system for C&C wearable devices Select emotional demand factors from the user's point of view and statistically analyze user demand information through the perceptual score table. The process can be divided into three steps.

1. Obtain emotional demand factors. Collect data through on-site interviews with product sales consultants and related personnel, and then combine the user demand research (fuzzy Kano user survey questionnaire data) in the retrieval literature to ensure that emotional demand information has certain absolute validity and research value, and collect C&C wearables. Description of the design requirements of the device. Given the characteristics of too many user demand factors, possible redundancy, and low importance, use focus groups to screen user needs initially. Then, with data analysis tools such as SPSS and Orange, the user's emotional needs are deeply excavated, and the dynamic demand factors of C&C watches are obtained.

2. Analyze the user demand perceptual score table. Since users as evaluation groups have vital subjective preference factors, to ensure accurate and effective extraction of user demand information, ten experts (with more than five years of product design background) were invited as evaluation sets $E = \{E_1, E_2, E_3, \dots, E_{10}\}$ for scoring; the design scheme evaluation index is used as the condition index set $C = \{C_1, C_2, C_3, \dots, C_9\}$, and the expert knowledge is used to analyze the representation of each evaluation index in a targeted manner. Use the above representative sample data set U and nine emotional demand factors to draw a 5th-order evaluation index scale and set the emotional score value from 1 to 5. The more biased the score from left to right is, the more the sample U_i is in line with the emotional demand factor. As shown in Table 1, a perceptual score table of emotional demand factors is obtained; the demand factors are used as condition attributes, and comprehensive satisfaction is used as a decision-making attribute, represented by the qualitative evaluation of an evaluation expert E_i on a representative sample set, to form a user demand perceptual score table, as shown in Table 4.

Demand factor	Representative sample dataset U									
	U_1	U_2	U_3	U_4	U_5	U_6	U_7	U_8	U_9	U_{10}
C_1	2	6	3	5	5	3	4	5	3	5
C_2	5	4	4	3	4	4	4	4	4	2
C_3	4	3	3	4	3	1	3	3	2	3

C_4	5	4	5	5	5	3	5	4	1	4
C_5	2	4	4	2	4	4	3	2	3	2
C_6	3	3	3	4	5	3	2	3	4	3
C_7	4	3	2	4	4	5	4	4	2	4
C_8	6	2	4	4	3	3	1	3	3	5
C_9	6	4	4	2	5	4	5	2	4	2
<i>Decision attribute D</i>	5	4	5	4	4	5	4	3	4	3

Table 4: Perceptual rating of user needs of representative samples.

3. Build an evaluation index system. Analyze and organize the demand factors of C&C wearable devices and simplify the demand factors scientifically and reasonably. After the research and discussion of professionals and experts in the industry, the demand division problem of C&C wearable devices to be solved is decomposed into different levels of elements, and a tree-like hierarchical structure is formed according to the interaction relationship between demand factors to build a corresponding evaluation index system, as in Table 5.

<i>Primary evaluation index</i>	<i>Evaluation index system of cultural and creative watches (A)</i>		
<i>Secondary evaluation index</i>	<i>Aesthetics B₁</i>	<i>Innovative B₂</i>	<i>Functional B₃</i>
<i>Three-level evaluation index</i>	<i>Aesthetic characteristics C₁</i>	<i>Novelty C₄</i>	<i>Reliability C₇</i>
	<i>Epochal C₂</i>	<i>Personalized C₅</i>	<i>Technical C₈</i>
	<i>Coordination C₃</i>	<i>Added value C₆</i>	<i>Practicality C₉</i>

Table 5: Evaluation index system of cultural creative watch design.

3.3 User Demand Weight Determination

Algorithm Based on Subjective and Objective Weight Judgment Set the intelligent product design scheme data set $U = \{U_1, U_2, U_3, \dots, U_m\}$, and the iset feasible design scheme $U_i | i = (1, 2, 3, \dots, m)$; the evaluation index set $C = \{C_1, C_2, C_3, \dots, C_n\}$ of the design scheme, the jrd. evaluation index C_j is $j = (1, 2, 3, \dots, r)$; the evaluation expert set $E = \{E_1, E_2, E_3, \dots, E_r\}$, the s-the expert E_s is $s = (1, 2, 3, \dots, r)$. Based on RS and F-AHP, a user needs assessment model for subjective and objective weight judgment is constructed, as shown in Figure 2.

Using the F-AHP algorithm and rough set theory to make design decisions can be understood as solving a multi-attribute decision-making problem. Therefore, the index weight is calculated as the algorithm's core link. The RS theory alleviates the defect of The F-AHP algorithm being too subjective, and the F-AHP algorithm is used to deal with the situation where the attribute weight value is equal to zero in the RS calculation process. The evaluation index weight value is calculated separately. According to the unique properties of RS theory and the F-AHP algorithm, the weight values obtained by the two algorithms are expressed as objective weight $\alpha = \{\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_n\}$ and subjective weight $\beta = \{\beta_1, \beta_2, \beta_3, \dots, \beta_n\}$. Then, dynamic adjustment parameters are introduced to fuse the subjective and objective weights, and the linear weighted combination method is used to determine the final demand weight $\omega = \{\omega_1, \omega_2, \omega_3, \dots, \omega_n\}$.

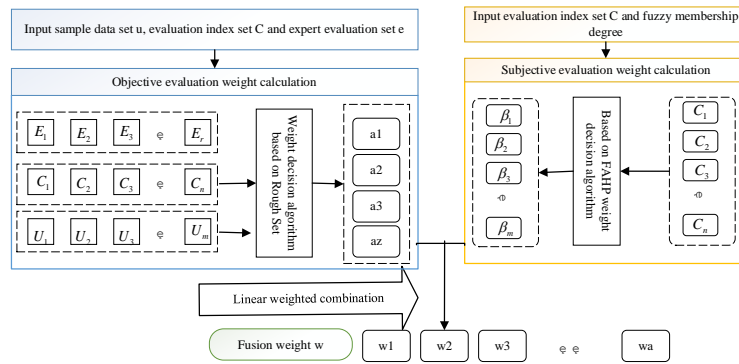


Figure 2: Flow chart of user demand weight determination algorithm based on subjective and objective weight decision.

3.4 RS-Based Objective Weight Determination Method

This paper uses the fuzzy analytic hierarchy process and rough set theory to calculate the subjective and objective weights of the design scheme evaluation indexes. First, the wild set theory is introduced, and its data is fully used for decision-making reasoning. The attribute index information and its importance are calculated and analyzed to obtain more realistic objective weights. The Specific steps are as follows:

1. Determine the decision matrix. First, integrate all the evaluation index data involved in the calculation, and the evaluation indicators as conditional attributes include aesthetics, personalization, practicality, etc., and their users are represented as $P = \{P_1, P_2, P_3, \dots, P_n\}$. The evaluation index table as a decision attribute is the design scheme satisfaction; the optional design scheme data set is.

2. Calculate the degree of dependence. Calculate the positive region of the condition index C of D, and the reliance of the decision index D on the condition index C is:

$$\gamma_C(D) = \frac{\text{Card}(\text{POS}_C(D))}{\text{Card}(U)}, 0 \leq \gamma_C(D) \leq 1 \tag{2}$$

Where is the cardinality of the set U. Remove the condition indicators $\{C_i\}, \{C_i\}, i = 1, 2, 3, \dots, n$, one by one to calculate the $C - \{C_i\}$ positive field and dependency of D:

$$\gamma_{C-C_i}(D) = \frac{\text{Card}(\text{POS}_{C-G}(D))}{\text{Card}(U)}, 0 \leq \gamma_{C-C_i}(D) \leq 1 \tag{3}$$

3. Calculate the importance. The importance of the i th condition index in the entire evaluation index set to degree K_i is:

$$k_i = \gamma_C(D) - \gamma_{C-C_i}(D) \tag{4}$$

4. Determine the objective weight value. By normalizing the index importance, the accurate weight k_i of the condition index α_i corresponding to the user demand is expressed as:

$$\alpha_i = \frac{k_i}{\sum k_i}, i = 1, 2, 3, \dots, n \tag{5}$$

5. Referring to the calculation method of formulas (5~6), determine the weight α_i corresponding to each index C_i by the importance of the conditional attributes, then the objective weight is: $\alpha = \{\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_n\}$.

3.5 Subjective Weight Determination Method Based on F-AHP

In this paper, F-AHP is used to express user needs, which organically combines the inclusiveness of fuzzy comprehensive evaluation with the quantitative and objective advantages of AHP [17]. However, considering the ambiguity of the personal needs provided by users, design experts are selected as the evaluation group, and the subjective weights determined by this are more credible. The specific steps to assess the emotional weight are as follows:

1. Build a priority relationship matrix. Assume that the n index parameters that affect the decision-making of the design scheme are $R = \{r_1, r_2, r_3, \dots, r_n\}$, P is the number of the decision maker, and $P = \{P_1, P_2, P_3, \dots, P_P\}$ is obtained from multiple decision makers. The attribute indicators are compared in pairs; the AHP judgment matrix is obtained. $R^P = [r_{ij}]_{m \times n}^P$

In the formula, $0 \leq r_{ij} \leq 1, r_{ij} + r_{ji} = 1, r_{ij}$ is the membership degree of the fuzzy relationship between user demand indicators C_i and C_j . The membership degree of this paper is shown in Table 6, and it can be seen that $r_{ji} = 0.5R$ is a fuzzy complementary matrix.

Scale value	Definition of the importance of C_i relative to C_j
0.001	Requirement C_j is more critical than requirement C_i
0.138	Requirement C_j is more critical than requirement C_i
0.326	Requirement C_j is more critical than requirement C_i
0.436	Requirement C_j is slightly more critical than requirement C_i
0.502	Requirement C_j is equally essential to requirement C_i
0.563	Requirement C_i is slightly more important than requirement C_j
0.676	Requirement C_i is more important than requirement C_j
0.863	Requirement C_i is more important than requirement C_j
0.901	Requirement C_i is extremely important than requirement C_j

Table 6: Membership degree of customer demand fuzzy relation.

2. Construct a fuzzy consistent matrix. The fuzzy consensus matrix is: $A^P = [a_{ij}]_{m \times n}^P$. Among them: $a_{ij} = \frac{a_i - a_j}{2(n-1)} + 0.5$, $a_i = \sum_{j=1}^n r_{ij}, i = 1, 2, \dots, n$ fuzzy consistency matrix has satisfied the consistency condition, so the consistency check step is omitted.

3. Calculate the subjective weight value. The emotional weights of the condition indicators corresponding to user needs are:

$$\beta_i = \frac{ai+(n/2)-1}{n(n-1)} (i = 1, 2, \dots, n) \tag{6}$$

3.6 Determination Method of Fusion Demand Weight Based on Linear Weighted Combination

To make the optimal product design scheme meet users' needs and have a certain degree of objectivity. The subjective and objective weights are comprehensively processed, and the parameter δ that dynamically adjusts the ratio of subjective and objective weights is introduced according to the actual needs of users. The Calculated fusion weight vector ω_i is expressed as:

$$\omega_i = \delta\alpha_i + (1 - \delta)\beta_i \quad (7)$$

Among them, if $\delta \in (0,0.5)$, the evaluation result pays more attention to user needs; that is, the subjective weight has a large proportion. The corresponding value is determined according to the actual user demand, and the final fusion demand weight $\omega_i = \{\omega_1, \omega_2, \omega_3, \dots, \omega_n\}$ is obtained.

3.7 Optimal Model of Product Design Scheme Based on TOPSIS

To comprehensively evaluate the design scheme, the final fusion weight obtained using the subjective and objective weight judgment algorithms is substituted into the TOPSIS method. Since the last fusion weight ω_i is based on the direction vector to select the optimal design scheme, the feasible design scheme is statistically analyzed by calculating the Euclidean distance to reach the optimal ideal scheme. The final design scheme is sorted.

1. Normalize the multi-attribute decision matrix A to get the normalized matrix $R = (r_{ij})_{m \times n}$:

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^m (a_{ij}^2)}} \quad (i = 1, 2, \dots, n) \quad (8)$$

2. Construct the normalized matrix $V = (v_{ij})_{m \times n}$ as follows:

$$v_{ij} = \omega_i r_{ij} \quad (i = 1, 2, \dots, n), (j = 1, 2, \dots, m) \quad (9)$$

In the formula, ω_i is the weight of the i st demand evaluation index, and r_{ij} represents the corresponding position element value in the matrix R.

3. Determine the positive ideal solution S^+ and the negative blank S^- . The positive and negative perfect solutions of the evaluation index are expressed as:

$$S^+ = (v^+, v_2^+, v_3^+, \dots, v^+) \quad (10)$$

$$S^- = (v^-, v^-, v_3^-, \dots, v^-) \quad (11)$$

4. Calculate the distance scale between each design scheme and the positive and negative ideal solutions. The Euclidean distance d_i^+ of the feasible design scheme U_i to the optimal scheme and the Euclidean distance d_i^- of the worst scheme can be expressed as:

$$d_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_i^+)^2} \quad (12)$$

$$d_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_i^-)^2} \quad (13)$$

5. Calculate the closeness.

$$c_i^+ = \frac{d_i^-}{(d_i^+ + d_i^-)}, 0 \leq c_i^+ \leq 1 \quad (14)$$

The order of pros and cons of the product design scheme set U is obtained according to the closeness c sub i to the plus value of each design scheme. Therefore, the optimal product design scheme. Corresponding to the maximum value of c_i^+ can be found in the sorted closeness table.

3.8 The Development Status of C&C Tourism Products with Regional Characteristics in Qinhuangdao

We prepared a questionnaire for unique tourism products and an interview plan to survey visitors and shop employees in the southern suburbs of China. A total of 300 questionnaires were sent out, of which 273 were questionnaires. Interviews were conducted with 28 stores, 54 salespeople, and 60 visitors. The analysis of the research group reached the following conclusions:

1. The variety of C&C products is ordinary and needs new ideas. The shops along the street in Shenanigan Ancient City can briefly examine the goods sold.

Most of them are bracelets, gourd products, children's toys, refrigerator magnets, fans, selfie sticks, and other products available at other typical attractions. Most are ordinary pearls, shell products, simple gourd products, woodcut products, etc. There are few C&C products with Shenanigan characteristics. Tourists said, "Hulu Dao shell decorations are more beautiful, stylish, and distinctive than those in Shenanigan." The C&C products sold by the stores in the first pass in the World and the old leading scenic spots have a sense of design and local characteristics, but the prices of such products are generally high.

2. C&C products significantly impact it in other regions and need regional uniqueness.

During the visit, we found that almost every scenic spot has 3-4 specialized stores of Russian commodities. In addition, although many stores are not named "Russian Commodity Stores," there are also many stores inside. Russian goods such as Matryoshka dolls, vodka, vanity mirrors, etc. There are also C&C products that belong to the scope of Greater Chinese culture, such as peach wood products that ward off evil spirits and bring luck. The sales of cultural products in other regions have reduced the presence of local C&C products. At the same time, very few products are related to the unique "Great Wall Culture" and "Ocean Culture" in Shenanigan.

3. Most C&C products pay more attention to practicality and lack aesthetics.

Many tourism products focus on practicality and can consider the actual needs of tourists, but they need a sense of design. When designing, practicality and aesthetics should be combined. It can meet not only people's low-level material needs but also their spiritual and cultural needs. When it comes to cultural significance, their introduction is also very superficial, such as "General Shawnie's seasoning jar and cannon-shaped pen holder are designed according to the appearance of the cannon on the Great Wall" or marketing from the price, such as "Our commemorative coin is only 10 yuan, which is much cheaper than those sold on automatic coin vending machines." Little is known about the cultural significance of C&C products, which makes it difficult to stimulate tourists' desire to buy.

3.9 Under the Background of Qinhuangdao's Tourism Industry Upgrading, The Development Strategy of Regional Characteristic Tourism C&C Products

1. Relying on local scientific research strength, establish a C&C product development company.

Qinhuangdao has specialized institutions and scholars for local culture sorting and research. Taking the Great Wall Culture as an example, Qinhuangdao has established scientific research institutions and academic organizations such as the China Great Wall Culture Research Center, the Qinhuangdao Cultural and Art Institute, and the China Great Wall Qinhuangdao Society. Yanshan University and Hebei Normal University of Science and Technology also have scholars studying Great Wall culture.

2. Deeply excavate cultural resources and highlight the regional cultural characteristics of products.

Shenanigan has rich cultural resources, typical of which are the Great Wall culture, customs clearance culture, marine culture, and folk culture. Several themes can be selected to represent the relevant culture and conduct in-depth development when developing cultural products, such as patriotic education in the Great Wall culture and the pioneering spirit in the culture of the East. Secondly, the images and related elements such as the Great Wall, dragon, Qin Shi Huang, Meng Jiangnu, etc., which tourists highly recognize, can be re-created or reconstructed according to modern aesthetics and the user's simple and practical aesthetic needs to highlight the regional characteristics of Shenanigan further.

3. Strengthen the publicity of C&C products and expand the online sales channels of C&C products.

Survey data shows that one-third of tourists purchase products through specialty stores. At the same time, the network has a broad audience, and customers come from all over the World. Using the Internet to promote C&C products has low costs and long-lasting promotion effects. Therefore, it is necessary to actively use websites, online stores, WeChat stores, WeChat public accounts, etc., to publicize and promote Shenanigan C&C products.

4. According to the needs of different customer groups, set up the C&C product market by grade.

The primary product block is mainly based on the sales of C&C products, suitable for the store model of "front shop and back factory," highlighting the characteristics of new products and low prices. For example, there are folding fans, vests, coasters, USB flash drives with the shape of a faucet, and incense sticks with the faucet. The middle-level product block mainly sells functional C&C products, relying on the sales of specialty stores, and highlights the product brand. For example, the Great Wall Brick Carving and Rubbing Art Museum, the Qin Huang Mengjiu Store, etc.

The high-end C&C product block combines products with scenic tours, focuses on selling experiential C&C products, and highlights cultural experiences. For example, Chuangguandong cultural tourism is designed to drink Chuangguan wine and go through the formalities. The personnel who handle the "customs clearance" are dedicated actors who wear the costumes of the guards of the Qing Dynasty, and soldiers of the Qing Dynasty guard the gates. Visitors without the "customs clearance letter" cannot enter the customs office. When handling the customs clearance letter, the doorman should ask the customs clearance personnel for information such as the household registration and the reason for customs clearance. C&C products such as "Qin Huang Dream Wine" and "Customs Clearance" are naturally integrated. This enhances the quality of the tourist experience for tourists.

4 CASE STUDY

4.1 Analysis of Design Elements of C&C Products in Qinhuangdao

4.1.1 Analysis of the Three Elements of "People," "Objects," and "Environment."

"people," as the goal of design, is the first factor to be considered for a product. His living habits and psychological and physiological characteristics affect the product's direction. Design is for people. Although people from different regions, ethnic groups, and cultural traditions create other things, they continue to study and design new technologies, forms, materials, functions, and structures. All are to meet people's unique needs.

As a tourist city, Qinhuangdao is mainly aimed at tourists from all over the World. They have different living habits and cultural demands. Therefore, Qinhuangdao's design of C&C products

poses a lot of challenges. At present, some design companies take economic benefits as the starting point of design and pursue high profits and high returns as the purpose of design. It can no longer be called actual design. This type of design replaces life with the economy, replaces the humanistic appeal of consumers with market competitiveness, supersedes the ease of use of products with external beauty, and replaces traditional Chinese characteristics with simple exotic models. Starting from the root of the design, the "human" factor was not considered. The current design should involve the integration and reconstruction of art and technology. From beginning to end, it should be based on people, with people as the foothold and people as the final value judgment of design. Using science and creativity to create "things" needed for life for "people" is the goal of design.

Through the investigation of the current situation of tourism in Qinhuangdao City, it was concluded that in terms of age structure, among the domestic tourists who come to Qinhuangdao for tourism, married young people aged 24-30 account for a more significant proportion, accounting for 51.58%, followed by 15-24 years old. The proportion of unmarried teenagers is 29.49%; from the perspective of the cultural level of tourists, 69.93% of the tourists have a college degree or above; from the perspective of the occupational composition of tourists, government civil servants, teachers, and students are the main ones, which are more consistent with the educational level data. High, indicating that the cultural level of tourists is proportional to the travel rate; from the source of tourists, there is a clear law of distance attenuation. Because they are located in the Beijing-Tianjin-Hebei economic circle, most Beijing, Tianjin, and Hebei areas can. It is convenient to reach Qinhuangdao for tourism, so the proportion of tourists from the three provinces is relatively large. The specific data is shown in Table 7. Through these data, we can better analyze the main composition of the primary consumers of Qinhuangdao C&C products and carry out a more systematic integrated design.

<i>level</i>	<i>Tourist ratio</i>	<i>Main causes</i>	<i>Provinces and regions included</i>
<i>1</i>	<i>48.88%</i>	<i>Proximity and high-income</i>	<i>Beijing, Tianjin, Hebei</i>
<i>2</i>	<i>37.54%</i>	<i>Close distance, high income</i>	<i>Liaoning, Heilongjiang, Jilin, Henan, Shanxi, Inner Mongolia</i>
<i>3</i>	<i>13.59%</i>	<i>Far away</i>	<i>Other provinces and autonomous regions</i>

Table 7: Spatial structure of tourists to Qinhuangdao.

Qinhuangdao City is rich in tourism resources, and there are many tourist attractions along the route, from the No. 1 Pass in the World to the Changli Gold Coast. Tourists mainly concentrate on scenic spots such as the No. 1 Pass in the World, Laolongtou, Pigeon Nest Park, Underwater World, Tiger Stone Bathing Beach, Nanda He International Entertainment Center, etc. Among all the scenic spots, Laolongtou is a popular place for tourists to visit, and the visit rate has reached more than 80% because the old dragon head is the sea starting point of the Great Wall; you can climb the Great Wall and watch the magnificent Bohai Bay, and it has the wealthiest cultural connotation, which also creates a good sales environment for C&C products.

4.1.2 Market and Demand Analysis

Different nationalities will have different aesthetics and be accompanied by other living habits and taboos. If we don't consider these and copy some bronze bells and bronze swords, and tourists buy these products to give to friends, there will be taboos of "death" and "too murderous." The types of C&C products should not be limited to copying and imitating cultural relics. Still, they should also be committed to applying the researched and refined cultural heritage elements to

operas, film and television dramas, animations, handicrafts, tableware, and clothing. The same cultural heritage elements can be applied to different products. For example, the heritage elements of Chu silk fabric patterns can be used to frame paintings, screens, ornaments, pendants, handbags, wallets, clothing, ties, scarves, head scarves, home textiles, fabrics, fashion hardcover, office supplies, religious supplies, unique customization, and other products above, and form a series of products.

There are many kinds of souvenirs in Qinhuangdao Scenic Spot, most of which are assembled wholesale by individual merchants. According to the survey, tourists generally feel that the product is too expensive, the price is low, and it is not worth buying. On the one hand, the quality of the products needs to be improved. For example, the ornaments of bronze ware are only simple engravings of the utensils. They could be better made because they only have decorative functions like drinking juice. The main reason is to ignore current consumer demand. From Figure 3, the main reasons why the products in the scenic spot where Qin Huangqiuxian entered the sea were not able to attract tourists were: they did not show local characteristics and cultural heritage; there was no commemorative significance or collection value; and there was no beautiful implication. The core of these three reasons is culture. With the improvement of cultural consumption levels, the public has higher and higher requirements for cultural products and pays more attention to the cultural connotations of products. Appearance design requirements have also increased accordingly.

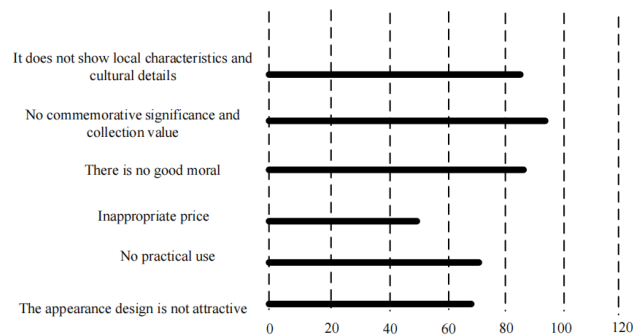


Figure 3: Why the products of the scenic spot where the emperor of Qinhuangdao immortality could not attract tourists.

First, as a well-known tourist city, Qinhuangdao attracts many tourists yearly. The scenic spot where the Qin emperor sought immortality to enter the sea, located in the Hai Gang District of Qinhuangdao City, has unique advantages and distinctive cultural IP as "the first place to look to the sea and pray for blessings in China." It can use the joint development of other scenic spots for a broader marketing environment. According to the results of the survey of tourists, in addition to the existing knowledge, the way tourists understand the culture of the scenic spot is the most significant number of people who check the Douyin official account, which shows the incredible power of self-media in people's lives (Figure 4). However, the souvenirs of the scenic spot still need to be more creative, have low commercial value, and need the cultural characteristics of the scenic spot. The marketing method is still in the form of physical stores. The marketing method needs to be more complex and backward and be combined with the advantages of the Internet and the media to expand.

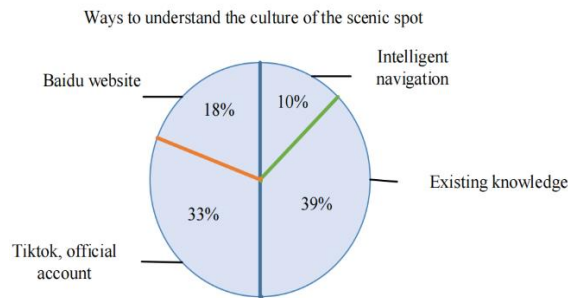


Figure 4: Ways for tourists to understand the culture of the scenic spot where the Qin emperor sought immortality to enter the sea.

4.2 The Development Strategy of C&C Products---Take the Qinhuangdao Image Design Project as an Example

4.2.1 Overview and Extraction of Potential IP Resources of the Scenic Spot where Qin Huang Qian Enters the Sea

In 2011, the place where the Qin emperor sought immortality to enter the sea was named "the first place in China to look to the sea and pray for blessings" by the Chinese Culture Promotion Association. By sorting out the potential IP resources of the scenic spot, it is found that the construction of the scenic spot is mainly related to prayer. Therefore, the design of the IP image and related derivative products are also elements related to worship in the scenic spot. (See Table 8). Publicity channels, and regularly upgrade and update products. According to the survey data, the price range supported by most people is between 30 yuan and 100 yuan, forming a fan membership group online, organizing online activities for fan interaction at unique festivals, and giving Qin Emperor immortality to enter the sea architectural series of small gifts.

<i>natural resources</i>	<i>geographical position</i>	<i>Qinhuangdao Port</i>	<i>Sea view and ancient trees</i>	
<i>History and Culture</i>	<i>Warring States Customs</i>	<i>Celebrity deeds</i>	<i>Wu Qi, Qu Yuan</i>	
		<i>Seven Heroes of the Warring States Period</i>		
	<i>Shi Huang Joshi's line</i>	<i>Taoist thought</i>	<i>Heaven and man are one</i>	
		<i>Merit of the first emperor</i>	<i>Seek immortality</i>	
<i>Art and culture</i>	<i>Architecture</i>	<i>Qian Hall</i>	<i>Circular disc</i>	<i>Auspicious patterns</i>
		<i>Gate</i>	<i>A fabulous, sculpted creature</i>	<i>Auspicious implication</i>
		<i>Eight trigrams maze</i>	<i>Zhuyin</i>	<i>Feng Shui</i>
	<i>inscription on a tablet</i>	<i>Shi Ji carved stone</i>	<i>Seal script</i>	
		<i>Portrait of Qin Shi Huang</i>		
	<i>Sculpture</i>	<i>Joshing relief</i>	<i>Seek immortality</i>	
		<i>Twelve divine beasts</i>	<i>Auspicious implication</i>	

Table 8: Overview of potential IP resources for Qin emperor to seek immortality.

4.2.2 The IP Image Design of Qin Emperor Sought Immortality to Enter the Sea and the Development Strategy of Tourism C&C Products

1. "IP + industry" model

Clarify the IP era's trend and recognize IP's characteristics: recognizability, transformability, scalability, and sustainability. To enhance IP's recognizability, the scenic spot's IP image is designed in combination with the picturesque spot culture. Transform the core culture of tourist attractions, "Blessing," into C&C IP and design-related C&C products. Both products and scenic spots are carriers of core IP, and the two are closely related to promote the integration of culture and tourism and drive the development of tourism, C&C products, and tourism.

2. Considering the needs of consumers and cultural creativity

The ultimate service target of products is consumers. During the design process of C&C IP, it is necessary to update products at any time according to market demands to avoid being eliminated by the trend. The Qin emperor sought immortality to enter the sea. C&C design is to keep up with the trend of IP. Before the design, a questionnaire was used to research tourists. Most tourists think that the current tourism products of the Qin emperor seeking immortality to enter the sea scenic spot have no local characteristics or cultural heritage. Most tourists prefer national, humorous, and straightforward styles to re-create the IP image and products of the Quiana Sea Tourism Scenic Spot. Under the guidance of market research data, the product type, design style, price, etc., are determined [26,27].

Considering the combination of culture and functionality, in terms of categories, choose the ones that tourists like with commemorative and practical functions and at a moderate price, such as coasters, mobile phone cases (Figure 5), refrigerator magnets (Figure 6), and so on. C&C products, such as mouse pads (Figure 7) and refrigerator magnets (Figure 8), were made according to the architecture of the scenic spot.



Figure 5: Qin Huang seeks immortality, IP image, and cultural and creative products.

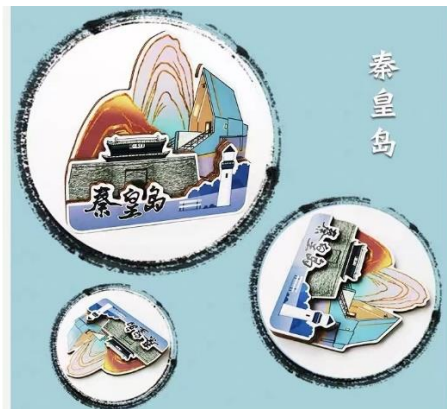


Figure 6: Qin emperor seeking immortality image cultural and creative refrigerator magnet.



Figure 7: Cultural and creative products of the scenic spot where the immortal enters the sea mouse Pad.



Figure 8: Cultural and creative products in the scenic spot where the Qin emperor seeks immortality refrigerator stickers.

We further investigated the change in satisfaction with creative works, and the specific results are shown in Figure 9. After improving our innovative design, the recognition of works has significantly increased, which shows that our creative design has a significant role.

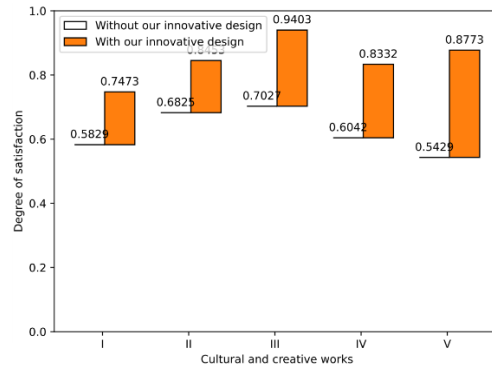


Figure 9: Satisfaction with creative works.

4.3 Adapt to the Internet Era and Expand Product Marketing Channels

People's lives have become more and more inseparable from the Internet. The Qin Huang project has put forward the following ideas for the online promotion and marketing of C&C products in scenic spots:

1. While designing e-commerce, it can also be combined with social media to achieve the best results. Use websites, APPs, Weibo, and other self-media to form online
2. Open Taobao and WeChat stores, expand sales channels, create brand effects consistent with the logos of online and offline stores and scenic spots, improve recognition, and facilitate product marketing and brand promotion.

5 CONCLUSION

Tourism C&C design needs to be based on regional culture. Integrating regional culture into tourism C&C products can convey its unique cultural attributes and protect and disseminate local and regional culture while realizing the function of product use. In addition, it can also encourage tourists to feel a sense of intimacy and substitution, strengthen emotional connections, and achieve the purpose of exporting regional cultural values. Today, many problems remain to be solved in the tourism C&C design industry, such as design innovation, talent training, and form exploration. In the future, with the development of 5G technology and digital technology, people need to protect and inherit regional culture more flexibly and promote the development of tourism C&C design. With the innovative application of Artificial intelligence-driven solutions, from personalized tourism apps to immersive virtual experiences, this convergence of technology and tradition has redefined how visitors engage with and appreciate the profound narratives woven into the city's fabric.

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