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An Empirical Study on Coupling Coordination between the Cultural Industry and Tourism Industry in Ethnic Minority Areas

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Abstract: Background/Objectives: China is actively promoting the reform of its economic structure and industrial upgrade, and the integration of the cultural industry and the tourism industry is an important approach. It is necessary to explore the degree of coordination and coupling between the cultural industry and the tourism industry in ethnic minority areas and find ways to promote the coordinated development of the two industries. **Methods/Statistical Analysis:** This study selected Guangxi Zhuang Autonomous Region as the sample, collected data from 2010 to 2018, and analyzed it based on the coupling coordination theory. **Findings:** The results revealed that the comprehensive development evaluation index of the cultural industry and the tourism industry basically showed a year-on-year upward trend, and the development speed of the cultural industry is slightly higher than that of the tourism industry; the coupling degree of the regional cultural industry and tourism industry was at a high level; the coordination degree of the two industries increased gradually from 0.3971 in 2010 to 0.9425 in 2018. It indicated that the coupling development of the two industries continues to improve. However, the development speed of tourism industry slightly was slower than the development speed of the cultural industry. **Improvements:** This study attempts to develop an index to evaluate the tourism and cultural industries in an ethnic minority region and assess the coupling and coordination degree through an empirical analysis. This study emphasizes the need to better understand the integration of the cultural industry and the tourism industry as a process to complement each other, which can produce a positive synergy effect to benefit both the economy and the environment. This paper also provides development suggestions for the culture and tourism industry stakeholders in other areas of the world from the perspective of open innovation.

Keywords: minority areas; the cultural industry; the tourism industry; coupling coordination; open innovation

1. Introduction

As interest in cultural tourism has been rising, the issue of the coupling and coordination of the tourism industry and cultural industry has been raised, especially after the Chinese government combined the National Tourism Administration and the Chinese Ministry of Culture into the Ministry of Culture and Tourism. Minority areas have abundant cultural resources and thus the integration of the cultural industry and tourism industry has become an important means to promote the optimization and upgrading of the industrial structure, cultivate emerging economic growth points, and achieve high-quality economic development. Although the Chinese economy has been developing upwards, the relatively backward situation in minority areas has not changed. There is an urgent need to maintain rapid economic development and build a sustainable national economic structure while

avoiding high energy consumption and high pollution development modes in ethnic minority areas. In the process of economic development, China's minority areas, such as Guangxi, Xinjiang, Tibet and Inner Mongolia, have experienced social problems such as the widening gap between the rich and the poor, religious issues, ethnic minority gender inequality, and empty-nest families and left-behind children in rural areas caused by the migration of ethnic minorities [1,2], and environmental problems like pollution [3]. The minority areas have distinct social histories, physical geographies, production methods, economic situations, customs, religious beliefs, languages, and oral literatures [4], which, though creating obstacles, also provide advantages to develop cultural tourism for their unique cultural factors [5].

In physics, coupling refers to the phenomenon that two or more systems interact with each other through various interactions to produce a joint relationship. The good interactions between the subsystems form a dynamic relationship of interdependence, coordination and mutual promotion. If the degree of interaction and mutual influence is high between the composing elements in the two systems, coordinated development exists, that is, the coupling degree of the two parties is high. The concept of industrial integration originated from Rosenberg's study (1963) of the evolution of the U.S. machinery industry [6] and now it has expanded to the entire industrial economy [7]. Industrial coupling is the inheritance, development and expansion of industrial union and industrial integration [8]. Since the coupling relationship between industries is a more efficient and comprehensive development model, with the advantages of low development cost, flexible mechanism and reasonable industrial structure [9], a good coupling relationship between the cultural industry and the tourism industry can not only promote the development of the cultural industry and the tourism industry, but it can also promote the development of regional industries, enhance competitiveness, and thus promote economic and social development to meet the needs of China's current industrial structural adjustment and transformation and upgrading.

Coupling coordination theory is used to describe the degree of interaction between two or more subsystems [10]. An important purpose of the coupling relationship is to use the coupling model to evaluate the coupling coordination relationship between industries, analyze the results for evaluation, and then propose countermeasures. The coupling degree of two industries is used to measure their integration level. Coupling degree is an index to quantitatively measure the degree of mutual influence and interaction between systems or elements. Its value can reflect the strength of the correlation between the two systems. If the coupling value gradually decreases, it means the interaction between the two systems gradually decreases; if the coupling value gradually increases, the interaction between the two systems gradually increases. In recent years, scholars have begun to conduct research on the coordination of the economy and the tourism industry, tourism and regional economy, and tourism, economy and the environment, by using the coupling coordination theory [11–14]. These studies focused on the coupling and coordination degree of the economy and tourism industry, economy and environment, and tourism and economic structure adjustment. Previous studies mainly focused on the relationship between tourism and regional economy, tourism and environment, tourism innovation and culture, and tourism and economy and environment. They mainly focused on certain regions and ignored the spatial-temporal evolution. The coupling coordination theory has not yet been applied in the ethnic minority areas to study the degree of coupling and coordination between the tourism and culture industries. Thus, it has become an urgent issue to study the current status of culture and tourism industry integration in minority areas, and how to promote the high-quality development of culture and tourism industry integration.

The concept of open innovation was proposed in contrast to that of closed innovation in the industrial economy era [15]. In the closed innovation model described by Chesbrough [16], technological innovation activities take place entirely inside an organization. The company hires the best R&D personnel and engineers to carry out technological innovation and thus use technological innovation results exclusively. The organization discovers the opportunities to apply the technology and puts it on the market through internal production. Although there are certain technological alliances,

the closed innovation model structure has not changed, and the technological boundaries of different organizations are completely closed. However, with the flow of intellectual employees, the widespread use of the Internet and the prosperity of the venture capital market, one organization has to cooperate with various types of partners to obtain ideas and resources from the external environment. Open innovation emphasizes the permeability of enterprise boundaries, that is, the inflow or outflow of ideas, resources, and employees. An organization is increasingly dependent on the inflow and outflow of knowledge to accelerate internal innovation and expand the market through the use of external innovation. In the context of an era where knowledge is at the core of competitiveness, innovation-driven supply-side reform has become China's national development strategy. China's cultural industry has been undergoing continuous innovation and development in recent years, and the tourism industry has also entered the stage of mass tourism [17], but the entire tourism industry is still far from perfect, with insufficient cultural connotations and lack of innovation awareness of tourism products. Ethnic minority areas have beautiful natural scenery and unique ethnic minority cultures, and the integration of the cultural and tourism industry is an effective way to promote the development of minority areas and realize industrial transformation. Based on the above theory and reality, this paper will discuss approaches to the integration of the tourism and cultural industries from the perspective of open innovation based on the research on the current situation of integration of the cultural tourism industry in ethnic minority areas.

2. Literature Review

2.1. Application of Coupling Coordination between Industries

There are interrelated and complementary characteristics between industries, and competition and cooperation coexist in the industry chain [18]. The contribution of different industries to the national economy can be objectively and statistically measured through observation indicators, but the degree of interaction between industries is difficult to measure. In order to solve this problem, scholars use the coupling concept from physics to study industrial interaction. In physics, coupling refers to the phenomenon that two (or more) systems or forms of motion affect each other through various interactions [19]. When the system or the internal elements of the system cooperate properly and promote each other, it is a benign coupling; otherwise, it is a bad coupling.

The coupling degree describes the degree to which systems or elements interact with each other. Industrial coupling is not only the sharing and integration of technology and knowledge among different industries, but also the comprehensive cooperation and interaction of markets, production factors, product research and development, and technological innovation. The coupling coordination degree is used to reflect the stage in the process of the system from disorder to order, and can identify the degree of coordination of systems. The coordination of different industries is a correlation between two or more systems. Through a well-coordinated, harmonious and benign cycle relationship between systems, healthy development can be ensured within the coordinated systems [13,20].

Different industries interact and influence each other in a region to form scale effects through resource allocation, information sharing, talent flow and policy support among enterprises, which can greatly improve the development level of multiple industries. The different directions of the tourism industry and the cultural industry will affect their development momentum, and their coupled development performance will also show different stages. In order to ensure the healthy, sustainable and rapid development of cultural tourism, it is necessary to adopt corresponding development strategies according to the different stages of development. Finally, the distribution of elements between the cultural and tourism industry systems will become more reasonable and the benefits will be maximized, and the purpose of realizing coordinated, healthy and sustainable development among the various systems can be achieved.

In the study of the coupling coordination between two or more industrial systems, the coupling relationship between industries should be analyzed, an evaluation index system should be established

according to the coupling coordination mechanism, and different indicators can be obtained through nondimensionalization to obtain data of comparability. The weight of the system is used to calculate the relative development index of the industrial system, and finally the coupling degree model is used for calculation. According to the research on coupling degree and coupling coordination degree, we can draw the stage of industrial coupling, the dynamic evolution process of the coupling stage, the strength of mutual promotion of different industries, etc. [7].

2.2. Research on the Coordinated Development of the Cultural Tourism Industry

As competition between tourism destinations increases, culture has become an important source of capital to create new products and services to attract tourists [21], and culture provides a never-ending source of novelty [22], cultural tourism is regarded as one of the largest and fastest growing segments of global tourism. In terms of the combination of the tourism industry and the cultural industry, tourism festival activities have a 'Halo Effect' [23], a 'showcase effect' [24] and a 'feelgood effect' [25] and they are considered to be able to obtain publicity effects in a short time. Film and television tourism originating from literature has become a driving force to attract tourists [26]. Traditional culture and heritage resources connected culture and tourism [27]. Cultural tourism resources have economic benefits and spiritual entertainment benefits. The core of tourism is culture, and the purpose of tourism for tourists is to experience and understand exotic cultures [28–31]; cultural tourism destinations (museums, concerts, playgrounds, theatres, art galleries, etc.) are favored by tourists [32–35]. The development of cultural relics and tourism also plays a vital role in the sustainable development of cultural tourism [27,36]. The research on the relationship between different industries was conducted mainly from the perspective of industrial integration, industrial coupling, and interactive development.

2.3. The Application of Open Innovation Theory

Chesbrough [16] first proposed the concept of open innovation. Compared with the closed innovation model, open innovation considers the boundaries of enterprises to be permeable and open to the outside world [16]. The innovative ideas of a company may come from the R&D department within the company or from outside the company. Open innovation emphasizes the organic integration of internal and external technologies in an organization, and creates new products on the basis of existing technologies. The transition from closed innovation to open innovation will go through three stages: unfreezing, moving and institutionalizing [37]. The three-stage transformation takes place in four dimensions: inter-organizational networks, organizational structures, evaluation processes and knowledge management [15]. Open innovation research started from large high-tech companies, but now studies have revealed that open innovation strategies are even more suitable for SMEs and start-ups [38]. The open innovation strategy applies not only to the manufacturing industry, but also to the service industry [39]. For example, some scholars have found that for small restaurants in the tourism industry, open innovation is an important reason for their success, because open innovation allows restaurants to gain a competitive advantage and obtain added value through the sale of services or ingredients [40]. Open innovation can help public sectors to remove institutional obstacles, and identify and solve collective action problems [41]. After the advent of the four industrial revolutions, for industries in the transition period, an open business model is essential to the rapid and substantial development of the industry [42]. However, the open innovation relationship should be well maintained to avoid one party from dominating the other party [43]. At the same time, the government needs to change its role, from regulation in the past to facilitation of innovative activities [39].

Based on the above theory and practice, open innovation is a process of innovation that integrates internal resources and external resources to achieve a mode of industrial innovation. The open innovation system is an open system that can make up for the lack of internal resources and improve the efficiency of innovation by acquiring and using innovation resources from the outside, and obtaining the latest market information and technology [17]. From the perspective of open innovation, in the process of culture–tourism industry integration, tourism companies absorb internal and external

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cultural and creative tourism resources to create tourism products with cultural characteristics and high-tech content; the cultural organizations use the business capital from travel organizations, expand the cultural industry value chain and the life cycle of cultural products [44]. The two industries realize industrial integration and the interactive effect and promote regional economic development through the integration of technology, products, organizations and markets.

3. Materials and Methods

3.1. Sample Description

In this study, Guangxi Zhuang Autonomous Region is selected as the sample to study the coupling of the tourism and culture industries. It is located in southwestern China, covers an area of 237,600 square kilometers and inhabits 12 ethnic groups including *Zhuang*, *Han*, *Yao*, *Miao*, *Dong*, *Molao*, *Maonan*, *Hui*, *Jing*, *Yi*, *Shui* and *Gelao*. According to the sixth national census in 2010, the total population of ethnic minorities in Guangxi reached 19.9576 million, accounting for 37.9% of the total population, making it the province with the largest minority population in China. The ethnic minorities in Guangxi have a long history and thus formed their own unique cultural characteristics. There are abundant cultural resources in Guangxi including folk songs, handicrafts, architecture, folk literature, music, dance, festivals and traditional medicine with ethnic characteristics. However, with the establishment of the China-ASEAN Free Trade Area and of the Guangxi Beibu Gulf Economic Zone, the regional economy has grown rapidly, but the development of Guangxi's culture and tourism industries has lagged behind and their bottleneck effect has become very prominent [45]. Their contribution to GDP is low and it has not become a pillar industry as expected [46], and the development of the cultural industry lacks directionality and pertinence [47].

3.2. Data Collection Methods

The data in the research was selected from the *Statistical Yearbook of China Tourism and Economic Development* and the *Statistical Yearbook of Chinese Cultural Relics*, and the Guangxi Statistics Bureau website. This study collected relevant data of the cultural industry and tourism industry of Guangxi Zhuang Autonomous Region from 2010 to 2018. The selection of indicators is mainly based on the following three criteria: the first criteria is the measurability and coverage of the indicators on the industries; the second criteria is the high frequency of occurrence in the cultural industry and tourism industry literature; the third criteria is the availability and comparability of the indicator. The primary indicators include economic performance, the number of tourism/cultural organizations and the industrial scale, as is shown in Table 1.

3.3. Coupling Model

Based on the industry coupling model applied in the relevant literature and the objectives of this study, we constructed the culture and tourism industry coupling model and conducted the following deduction methods.

The first step is to standardize the inconsistent indicators of each unit to make the indicators comparable because each item has their own measurement units. Since all indicators are positive indicators, the following method can be used:

$$U_{ij} = \frac{X_{ij} - X_{jmin}}{X_{jmax} - X_{jmin}} + 0.01 \; (i = 1, 2, 3 \ldots m; \; j = 1, 2, 3 \ldots n) \tag{1}$$

In this formula, U_{ij} represents the degree of contribution of the item X_{ij} to the industrial system, $0 \leq U_{ij} \leq 1$; X_{ij} represents the initial value of the j-th indicator in the i-th year; X_{jmax} and X_{jmin} refer to the maximum and minimum values of the j-th indicator in the data group. In order to avoid the occurrence of 0 result after dimensionless calculation under which circumstance the data cannot be further calculated, 0.01 is added to all standardized data.

Second, the entropy method is used to determine the weights of each item in the coupling model. The weight of the *j*-th indicator in the *i*-th year of the whole j indicator group can be calculated by the following formula:

$$L_{ij} = \frac{U_{ij}}{\sum_{j=1}^{n} U_{ij}}$$

(2)

The information entropy value of the *j*-th indicator is:

$$E_j = -(\ln m)^{-1} \sum_{j=i}^{n} \left(L_{ij} \ln L_{ij} \right)$$

(3)

Table 1. Indicators for measuring the development of the tourism and cultural industries.

Subsystem	Primary Indicators	Secondary Indicators
Tourism Industry	Economic performance	International tourism annual income The province's domestic tourism revenue Travel agencies income Star-rated hotel business income
	Tourism organizations	Number of travel agencies Number of star-rated restaurants
	Industrial Scale	Number of overseas visitors Number of domestic visitors Employed persons in travel agencies and star-rated hotels
Cultural industry	Economic performance	Culture-related business units' income Revenue of institutions affiliated with cultural relics department Cultural construction fee Art performance groups income
	Cultural organizations	Number of public libraries Number of Mass cultural institutions
	Industrial Scale	Number of visitors to the museum Employed persons in art performance groups Art performance revenue

The utility value of the *j*-th indicator is:

$$h_j = 1 - E_j (j = 1, 2, 3 \ldots, n)$$

(4)

The weight of the *j*-th indicator is:

$$w_j = \frac{h_j}{\sum_{j}^{n} h_j} (j = 1, 2, 3 \ldots, n)$$

(5)

In the above formulas, *m* is the total number of years measured, and *n* is the total number of indicators selected for each of the two industries.

The next step is to calculate the overall index of the cultural industry and tourism industry. The overall measurement formula of the cultural industry is:

$$C(y) = \sum_{j=1}^{n} w_j q_{ij} (i = 1, 2, 3 \ldots m; \ j = 1, 2, 3 \ldots n)$$

(6)

Among them, $C(y)$ represents the overall measured index of the cultural industry, w_j represents the weight of the measured formula of the *j*-th indicator of the cultural industry, and q_{ij}. represents the standardized value of the *j*-th indicator in the *i*-th year of the cultural industry.

The overall measurement formula of the tourism industry is:

$$T(x) = \sum_{j=1}^{n} w_j p_{ij} (i = 1, 2, 3 \ldots m; j = 1, 2, 3 \ldots n) \tag{7}$$

Among them, $T(x)$ represents the overall measured index of the tourism industry, w_j represents the weight of the measurement indicator of the *j*-th indicator of the tourism industry, and p_{ij} represents the standardized value of the *j*-th indicator in the *i*-th year of the tourism industry.

When $T(x) > C(y)$ and $|T(x) - C(y)| > 0.02$, it indicates that the area is in a state where the development of the cultural industry lags behind the tourism industry (the cultural industry lagging); when $T(x) < C(y)$ and $|T(x) - C(y)| > 0.02$, the region is in a state where the development of the tourism industry lags behind the cultural industry (the tourism industry lagging); when $|T(x) - C(y)| \leq 0.02$, the two major industries in the region are in the state of simultaneous development.

Finally, a coupling model was built to calculate the development of the integration of the two industries. Since there are only two items (the cultural industry and the tourism industry), the formula of the coupling degree between them is:

$$M = 2 \sqrt{\frac{T(x) \times C(y)}{(T(x) + C(y))^2}} \tag{8}$$

Among them, M is the coupling value of the two developments of the cultural industry and tourism industry, $0 \leq M \leq 1$; $T(x)$ is the overall measurement index of the tourism industry; $C(y)$ is the overall measurement index of the cultural industry.

3.4. Coupling Coordination Model

The above coupling model only measures the closeness of the connection between the cultural industry and the tourism industry, but it cannot reflect the integration and coordinated development of the two industries. In some cases, the coupling value between different systems is big, but the coupling coordination degree is not high. In order to study the stage of culture and tourism industry integration development, a coupling coordination degree model should be further constructed to measure the integration of the cultural industry and tourism industry development status. Based on related literature, the calculation model can be conducted as follows:

$$S = \alpha T(x) + \beta C(y) \tag{9}$$

The S in the above formula represents the comprehensive coordination index for the integration of the culture and tourism industries, and measures the contribution of the overall development level of the two industries in the coupled coordination degree model. α and β indicate the importance degree of the culture and tourism industry in the process of measuring the coupled coordination degree. According to the previous research, we define $\alpha = 0.5$, $\beta = 0.5$. After S is calculated, we can conduct the following calculation.

$$D = \sqrt{M \times S} \tag{10}$$

In the above formula, M is the degree of coupling, S is the measurement index of comprehensive coordination development of the two industries, and D is the degree of coupling coordination.

3.5. Explanation for the Coupling Level and Coupling Coordination Degree

Based on the classification method of coupling degree related to the theory of industrial life cycles proposed by scholars, the coupling degree of culture and tourism industries can be divided into four stages according to the coupling levels [48,49] in Table 2. They are defined as the stages of low-level, medium-level, high-level, and extremely high-level coupling. According to different coupling coordination degrees, 5 levels of coupling coordination development types are divided based on previous studies. The coordination degree of the cultural tourism industry has also continuously changed from imbalance to high-quality coordination.

Table 2. The hierarchy of the coupling degree.

Coupling Degree Interval	Coupling Type
0–0.3	low-level
0.3–0.5	medium-level
0.5–0.8	high-level
0.8–1	extremely high-level

4. Empirical Results

4.1. Description of the Data

After constructing the above-mentioned models, we calculated the coupling level and coordination degree value based on the related data of Guangxi Zhuang Autonomous Region from 2010 to 2018. According to Formula (8), the coupling degree of the cultural industry and tourism industry can be measured, and according to Formula (10), the coupling coordination degree of the culture and tourism industries can be measured. The empirical analysis results are shown in Table 3. The measured indexes of the cultural industry and tourism industry demonstrate whether the two industries are well coordinated. If one industry has the smaller index value, it indicates that its development is lagging behind and does not grow simultaneously with the other industry. The coupling level and coordination degree of the culture and tourism industries reflect the level of integration level and development stages of the two industries. The larger the coupling coordination degree value, the higher the level of culture and tourism industry integration.

Table 3. The hierarchy of coordination degree.

| Coordination Degree Interval	Coordination Type
0.0–0.2	serious imbalance
0.2–0.4	moderate imbalance
0.4–0.6	barely balance
0.6–0.8	moderate balance
0.8–1.0	good balance

4.2. The Results of Empirical Analysis

From the empirical result, it can be concluded that the integration and development of Guangxi's cultural industry and tourism industry has steadily increased. In 2018, the comprehensive evaluation value of the cultural industry development reached 0.9340, and the comprehensive evaluation value of the tourism industry development reached 0.8450 (see Table 4). This shows that after the government formulated a series of policies to vigorously support the integrated development of the culture and tourism industries, certain results have been achieved.

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Table 4. Empirical analysis results of the integration of the Guangxi cultural industry and tourism industry.

Year	Tourism Industry Development Index	Cultural Industry Development Index	Coupling Degree	Coordination Degree	Coordination Type	State of Integration Development
2010	0.1300	0.1912	0.9817	0.3971	moderate imbalance	the tourism industry lags behind
2011	0.2274	0.2926	0.9921	0.5079	barely balance	the tourism industry lags behind
2012	0.3355	0.3643	0.9992	0.5913	barely balance	the tourism industry lags behind
2013	0.3421	0.3103	0.9988	0.5708	barely balance	the cultural industry lags behind
2014	0.3811	0.3109	0.9948	0.5867	barely balance	the cultural industry lags behind
2015	0.5039	0.5009	1.0000	0.7088	moderate balance	synchronous development
2016	0.5261	0.6050	0.9976	0.7511	moderate balance	the tourism industry lags behind
2017	0.5295	0.8452	0.9733	0.8179	good balance	the tourism industry lags behind
2018	0.8450	0.9340	0.9987	0.9425	good balance	the tourism industry lags behind

### 4.3. Analysis of the Development Index of Culture and Tourism Industry

The result of the development of the culture and the tourism industries shows a general upward trend. In Figure 1 it can be found that in 2010, 2011, 2012, 2016, 2017 and 2018, Guangxi was in a state of tourism lagging behind. The reasons might be inadequate deepening of the tourism industry, inadequate supporting service facilities, single tourism products, lack of cultural thickness, etc. The lagging development of the tourism industry also affects the integration and development capabilities of the cultural industry. However, from 2013 to 2014, the development of the cultural industry lagged behind the tourism industry, suggesting that the development potential of the cultural industry should be deeply explored, especially in the integration with the tourism industry. From our investigation, Guangxi has problems such as insufficient protection and exploration of traditional cultural resources, insufficient investment and insufficient integration with tourism. In the year of 2015, Guangxi's culture and tourism industry developed synchronously. It indicated that there is potential for the two industries to achieve coordination.
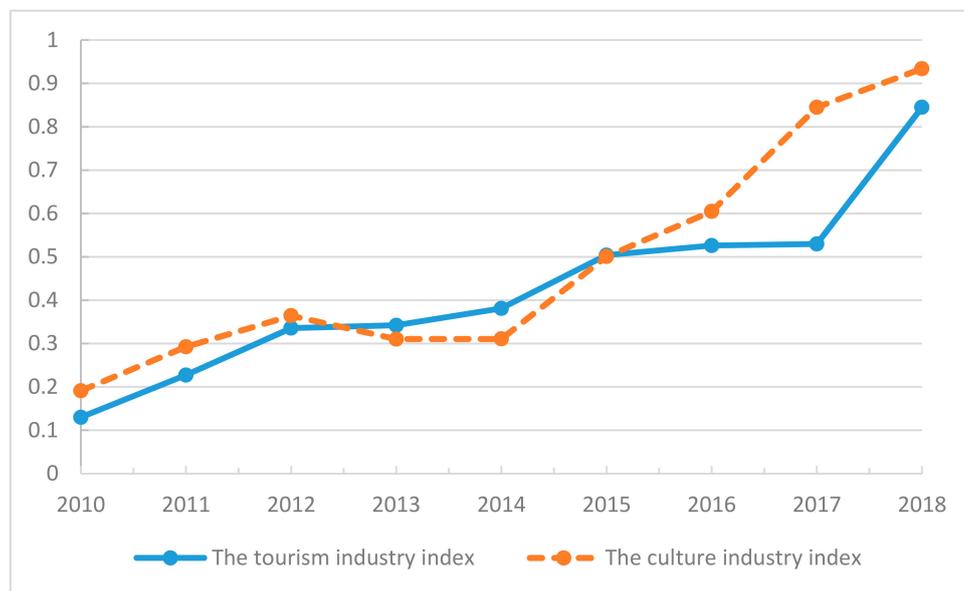
Figure 1. The tourism and cultural industry development index.

4.4. Analysis of the Coupling Index of Guangxi Cultural and Tourism Industry
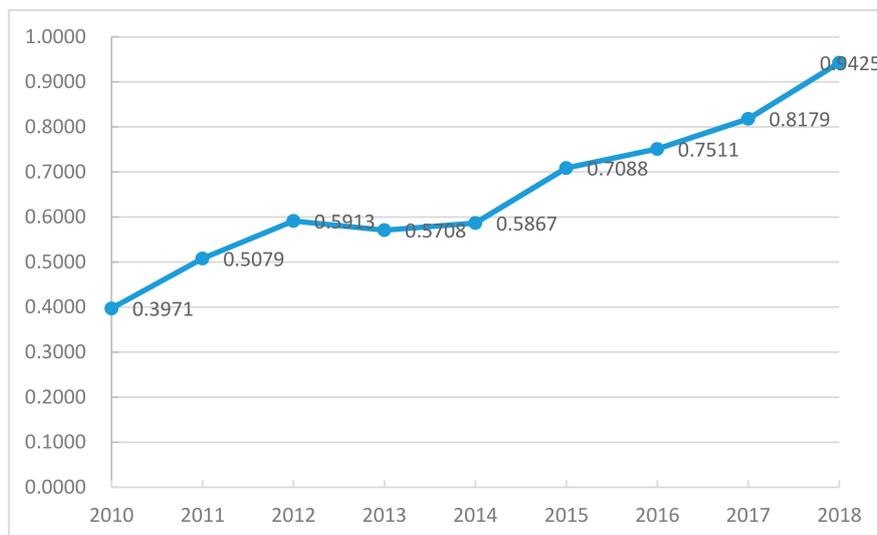
The result of the coupling degree of the cultural and tourism industry in Guangxi indicates that the integrated development of the cultural and tourism industry is at a very high level. The coupling degree is used to measure the closeness of the connection between the cultural industry and the tourism industry, which can reflect the integration and development of the cultural industry and the tourism industry. As shown in Figure 2, from 2010 to 2018, although the coupling degree value between the cultural industry and the tourism industry in Guangxi Province fluctuated, it was always at a very high level. From 2010 to 2015, the coupling degree of the cultural and tourism industry showed a fluctuating upward trend. From 2016 to 2017, although both industries continued to develop, the development speed of the cultural industry surpassed that of the tourism industry and thus their coupling degree declined. However, with the establishment of the Culture and Tourism Department of Guangxi Zhuang Autonomous Region and the government's regulation of the tourism industry and cultural industry, the two once again showed a trend of simultaneous development in 2018.
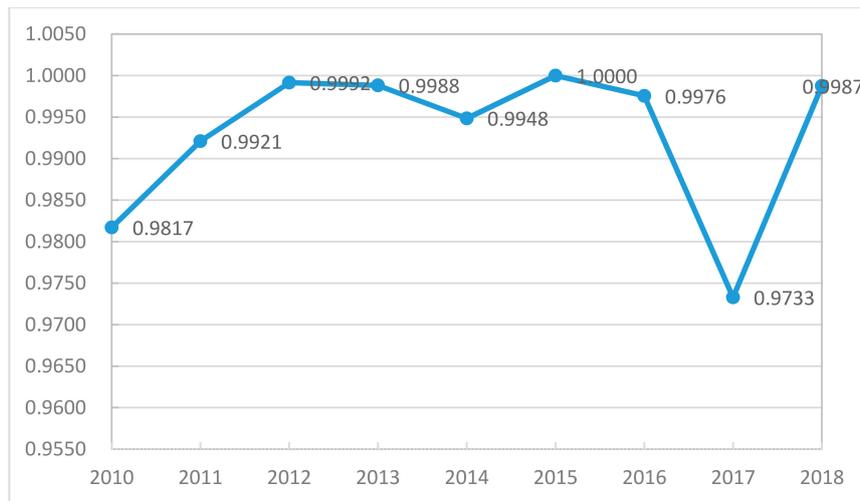
Figure 2. The coupling degree of the culture and tourism industries.

4.5. Analysis of the Coupling Coordination Degree

The integration of Guangxi's cultural and tourism industry is approaching a stable and coordinated development stage. According to the practice in academia, if the coupling coordination degree is in the range of 0–0.3, it indicates that the industrial integration and development are in a state of budding development, which means that the two are not closely connected. If the coupling coordination degree rises to 0.3–0.5, it indicates that the industrial integration development is just at the primary stage, and the interaction between the two gradually strengthens; once the coupling coordination degree enters the range of 0.6–0.8, it indicates that the integration and development of the two major industries has reached a state of stable coordination. If the coupling and coordination degree reaches above 0.8, it means that the industrial integration and development has entered a mature stage and achieved benign coordination. The empirical results in Figure 3 show that the value of the coupling coordination degree of the cultural and tourism industry is on the rise (see Figure 3). In the 9 years from 2010 to 2018, the minimum value of the Guangxi culture and tourism industry coupling coordination degree was 0.3971, and the maximum value was 0.9425, indicating that the cultural tourism industry integration has gradually approached the stage of stable development from the initial stage.

Figure 3. The coordination degree of the cultural and tourism industries.

5. Conclusions and Suggestions

Through the analysis of the coupled development of the cultural industry and the tourism industry in Guangxi, it is concluded that: (1) The comprehensive development evaluation index of the cultural industry and the tourism industry in Guangxi from 2010 to 2018 has shown an upward trend. After an alternate lead from 2010 to 2015, the comprehensive evaluation index of the cultural industry in 2016, 2017 and 2018 was higher than that of the tourism industry. At the same time, the development speed of the cultural industry was slightly higher than that of the tourism industry, and its comprehensive evaluation index has grown more steadily compared to the tourism industry. (2) From 2010 to 2017, the coupling state of the cultural industry and tourism industry in Guangxi was at a high level. It means that after years of development, the mutual influence and dependence between the two industries is strong, and the development level of the two industries tends to be consistent. At the same time, with the establishment of the Culture and Tourism Department of Guangxi Zhuang Autonomous Region on 15 November 2018, the administrative barriers between different departments have been eliminated. It is predicted that the degree of coupling between the cultural industry and the tourism industry in Guangxi will remain at a high level in the future. (3) The coupling degree between the cultural industry and the tourism industry in Guangxi is very high, indicating that the development of the two industrial subsystems is at the same level, and the coordination degree between the two has been increasing year by year during 2010–2018. There was a gradual transition from the middle level in 2010 to the extremely high level in 2018, and it shows that the subsystems were in a period of healthy development during those 9 years.

From the above analysis, it can be seen that the cultural industry and tourism industry in Guangxi Zhuang Autonomous Region have achieved a high degree of coupling development, indicating that the two industries have good permeability. From the perspective of open innovation, the tourism industry and the unique culture of ethnic minority regions penetrate each other and promote each other, and cultural factors can be penetrated in tourism activities such as restaurants, hotels, transportation, sightseeing, shopping, and entertainment. The penetration of the cultural industry expands and deepens the innovation of the tourism industry, and promotes the transformation of the traditional tourism industry into a knowledge-intensive industry and high-tech service industry; the tourism industry provides support and guidance for the development of the cultural industry, extending the cultural industry's value chain and the life cycle of cultural products. The two industries achieved integration through the integration of technology, products, organizations and markets and as a result, cultural tourism products with connotations of cultural heritage and high technological value were developed.

From the perspective of open innovation, in order to promote the integrated development of cultural tourism in ethnic minority areas in other parts of China and the world, the following suggestions are made. (1) The cultural tourism industry has the characteristics of diversity, complexity, relevance and sociality [50], which requires the needs of the government, social economic organizations, and enterprises to cooperate with each other to promote the development of the cultural tourism industry. For example, due to their relatively low economic level, ethnic minorities have long faced the problem of brain drain and lack of reserve talents [51]. Government organizations and volunteer organizations should jointly cultivate local talents and promote the coordinated development of the two industries. The government can also provide assistance and favorable policies to cultural and creative tourism enterprises in terms of financing and taxation, encourage cultural and creative innovation products to apply for patents, and formulate relevant laws and regulations to protect the rights and interests of tourism enterprises and cultural enterprises to protect innovative development. Enterprises can actively cooperate with universities and scientific research institutions to train talents and develop new products. (2) For enterprises, they should not solely rely on the acquisition of resources from the outside. They should also use big data and other technologies to fully understand tourism market needs and maximize their own internal innovative potential and recreate new cultural and creative tourism products. (3) The integration of the cultural tourism industry should form the coordination

effect of industrial agglomeration, and adopt innovative viewpoints to promote the industrial chain development of the cultural tourism industry [52]. The government can make plans to develop cultural and creative industrial parks, and develop the high-value industrial chains in the industrial parks and cultural and creative industry clusters to develop creative cultural tourism products. Creative exhibitions and festivals can be held to embed culture into the tourism market and reshape the brand image of minorities. (4) While developing the cultural and tourism industries, it is necessary to protect the natural environment and historical sites to achieve sustainable development. Tourists and local residents' awareness of environmental protection should be raised. Although the local government has done a relatively good job on this point, it still needs to increase its guidance to drive the enthusiasm of organizations and individuals in the whole region for environmental protection and action. Problems such as unemployment, conflicts and tensions exist in ethnic minority areas, especially in developing countries where government intervention has the greatest impact on the development of tourism [53]. National and local government, social organizations, enterprises and local residents should work together to promote the development of the cultural and tourism industries.

Author Contributions: Conceptualization, Z.Z. and D.-J.K.; methodology, Z.Z.; software, Q.Y.; validation, Z.Z., D.-J.K. and Q.Y.; formal analysis, Q.Y.; investigation, Q.Y.; resources, Z.Z.; data curation, Q.Y.; writing—original draft preparation, Z.Z.; writing—review and editing, Z.Z.; Q.Y.; visualization, Q.Y.; supervision, D.-J.K. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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