

Analysis of Tourism Economic Resilience and Its Influencing Factors in the Pearl River Delta, China

การวิเคราะห์ความยืดหยุ่นและปัจจัยที่มีอิทธิพลทางเศรษฐกิจการท่องเที่ยวใน
สามเหลี่ยมปากแม่น้ำเพิร์ล ประเทศจีน

Xiaoxiao Yi*

เซาเซา ยี่

Faculty of Tourism and Hotel Management, Mahasarakham University

คณะการท่องเที่ยวและการโรงแรม มหาวิทยาลัยมหาสารคาม

Sutana Boonlua

สุธนา บุญเหลือ

Mahasarakham Business School, Mahasarakham University

คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม

Paranee Boonchai

ปารณีย์ บุญไชย

Faculty of Tourism and Hotel Management, Mahasarakham University

คณะการท่องเที่ยวและการโรงแรม มหาวิทยาลัยมหาสารคาม

*598751087@qq.com

Abstract

The Pearl River Delta has become a key engine of China's economic growth. The region's rapid urbanization has driven the robust development of its tourism economy, yet it also faces numerous social challenges. The most prominent of these challenges is the gap between central and peripheral cities, particularly in terms of capabilities when responding to crises. This study combines the entropy method and the obstacle degree model to assess the resilience of the tourism economy in the Pearl River Delta, analyzing data from 2003 to 2022 across 18 indicators in three dimensions: resistance and recovery, adaptation and adjustment, and innovation and transformation. Findings reveal that the core cities exhibit relatively strong and improving tourism economic resilience, whereas peripheral cities remain significantly constrained—particularly in the dimension of innovation and transformation—highlighting the persistent disparities in resilience across the region. Key barriers identified include the number of travel agencies, education expenditure, fiscal expenditure, and the

number of people employed in tourism. The study highlights that enhancing tourism economic resilience in the Pearl River Delta requires targeted structural interventions, including promoting regionally balanced development, fostering innovation in peripheral cities, strengthening the role of travel agencies, aligning educational investment with labor market needs, leveraging fiscal expenditure, and improving workforce quality.

Keywords : measurement, influencing factors, tourism economy resilience

บทคัดย่อ

สามเหลี่ยมปากแม่น้ำเพิร์ลได้กลายเป็นเครื่องยนต์สำคัญในการเติบโตทางเศรษฐกิจของจีน การขยายตัวอย่างรวดเร็วของเมืองในภูมิภาคนี้ได้กระตุ้นการพัฒนาเศรษฐกิจการท่องเที่ยวอย่างแข็งแกร่ง แต่ในขณะเดียวกันก็ต้องเผชิญกับปัญหาสังคมมากมาย ปัญหาที่โดดเด่นที่สุดคือช่องว่างระหว่างเมืองหลักและเมืองขอบ ซึ่งโดยเฉพาะในด้านความสามารถในการตอบสนองต่อวิกฤต การศึกษานี้ได้รวมวิธีการเอนโทรปีและโมเดลอุปสรรคในการประเมินความยืดหยุ่นของเศรษฐกิจการท่องเที่ยวในสามเหลี่ยมปากแม่น้ำเพิร์ล โดยการวิเคราะห์ข้อมูลจากปี 2003 ถึง 2022 ตามตัวชี้วัด 18 รายการในสามมิติ ได้แก่ ความต้านทานและการฟื้นฟู การปรับตัวและการปรับเปลี่ยน และนวัตกรรมและการเปลี่ยนแปลง ผลการศึกษาพบว่า เมืองหลักมีความยืดหยุ่นทางเศรษฐกิจการท่องเที่ยวที่ค่อนข้างแข็งแกร่งและปรับตัวดีขึ้น ในขณะที่เมืองขอบยังคงมีข้อจำกัดอย่างมาก โดยเฉพาะในมิติของนวัตกรรมและการเปลี่ยนแปลง ซึ่งแสดงให้เห็นถึงความไม่สมดุลในความยืดหยุ่นที่ยังคงมีอยู่ในภูมิภาค ปัจจัยอุปสรรคหลักที่พบ ได้แก่ จำนวนตัวแทนท่องเที่ยว การใช้จ่ายด้านการศึกษา การใช้จ่ายทางการเงิน และจำนวนผู้ทำงานในอุตสาหกรรมการท่องเที่ยว การศึกษานี้เน้นย้ำว่าการเสริมสร้างความยืดหยุ่นทางเศรษฐกิจการท่องเที่ยวในสามเหลี่ยมปากแม่น้ำเพิร์ลจำเป็นต้องมีการแทรกแซงโครงสร้างที่มุ่งเน้น รวมถึงการส่งเสริมการพัฒนาภูมิภาคอย่างสมดุล การส่งเสริมนวัตกรรมในเมืองขอบ การเสริมสร้างบทบาทของตัวแทนท่องเที่ยว การลงทุนด้านการศึกษาที่สอดคล้องกับความต้องการตลาดแรงงาน การใช้จ่ายทางการเงิน และการพัฒนาคุณภาพแรงงาน

คำสำคัญ : การวัด ปัจจัยที่มีอิทธิพล ความยืดหยุ่นของเศรษฐกิจการท่องเที่ยว

Introduction

During the rapid urbanisation process, the Pearl River Delta has profoundly impacted the sustainable development of the regional tourism economy. From the perspective of economic pillars, the PRD has become a key engine for China's economic growth and one of the most competitive urban agglomerations in the world (Yang et al., 2020). As the core area of the Guangdong–Hong Kong–Macau Greater Bay Area in China, the PRD encompasses important cities such as Guangzhou, Shenzhen, and Zhuhai. The total regional area exceeds 56,000 square kilometres, with a permanent population of over 70 million. Tourism plays

a crucial role in the national economy, becoming a key driver of high-quality regional economic development (Zhao et al., 2022). Furthermore, the urbanisation process has facilitated the integration of regional transportation, the consolidation of cross-regional tourism resources, and the collaborative development of service systems, further enhancing the scale and diversification of the tourism economy (Pang et al., 2023).

However, the rapid urbanisation of the Pearl River Delta (PRD) has also brought about a series of environmental and social challenges, posing a threat to the sustainable development of the tourism economy (Pang et al., 2023). From a social perspective, high population density, rising living costs, traffic congestion, and worsening social inequality have increased the pressure on the tourism service system, diminishing the region's attractiveness and the quality of the tourism experience. To address these challenges, the resilience theory has provided a new analytical framework for sustainable tourism economy research, giving rise to tourism economic resilience. Tourism economic resilience aims to enhance stability, reduce vulnerability, and improve adaptability (Bhamra et al., 2011). It provides theoretical foundations and practical guidance for regional tourism to cope with external risks and strengthen adaptive capacity. Amid rising natural disasters, public health crises (e.g., COVID-19), and economic uncertainties, it is essential to identify the determinants of tourism economic resilience in the Pearl River Delta and develop evidence-based strategies. Other Asian urban agglomerations could draw lessons from the PRD to design context-specific tourism policies, maintaining competitiveness through dynamic policy adjustment and sectoral adaptability.

Proposes

The main objective of this study is to explore the factors influencing the tourism economy resilience in the Pearl River Delta and provide specific recommendations for enhancing its resilience.

Literature Review

The concept of resilience has evolved across several disciplines, emerging as a framework for understanding tourism. The term “resilience” originally stemmed from the field of mechanical engineering, where it was used to describe a material's ability to withstand deformation under external forces. In the 20th century, ecologist Holling introduced it to the field of ecology to assess the self-defence, recovery, and evolutionary capabilities of ecosystems when subjected to disturbances or shocks (Holling, 1973). Reggiani et al. (2001) were the first to apply resilience theory to economics, defining it as the capacity of an economic system to maintain structural stability and restore equilibrium following shocks.

In tourism, resilience has gained significance as the international tourism industry confronts complex risks and challenges. Scholars generally agree that building a tourism economic system with strong adaptability and shock resistance has become an important pathway to promoting the sustainable development of tourism (Cheung & Li, 2019; Wang et al., 2020). Based on a review of relevant research, this paper defines tourism economic resilience as the ability of a tourist destination to resist, adapt to, and self-organise in response to disruptions. During this process, tourism-specific frameworks, such as Butler's Tourism Area Life Cycle (TALC) model, offer insights into destination evolution. Integrating TALC with resilience theory enhances understanding of how destinations respond to external shocks.

Regarding research on influencing factors of resilience, geographical location has emerged as a key variable in current discussions. Many studies on regional development have long assumed that spatial proximity to core cities leads to automatic spillover benefits within peripheral regions (Qian, 2018). This "trickle-down" perspective is rooted in classic urban diffusion theory, which posits that economic, technological, and institutional advantages naturally diffuse from central to surrounding areas. However, more recent research increasingly questions the universality of this assumption, especially in regions where structural conditions may inhibit the effective absorption of such benefits. This suggests the need for more nuanced analytical tools to evaluate the actual barriers to resilience across different regional contexts.

In this regard, the obstacle degree model is recognised for its efficacy in identifying and quantifying the extent to which various factors impede economic development, thereby facilitating the formulation of targeted strategies to enhance economic efficiency (Zhou et al., 2024). However, existing literature primarily applies this model to domains such as social-ecological systems (Qi et al., 2024), urban systems (Chen et al., 2023), community systems (Liu et al., 2023), and general economic systems (Qiao et al., 2024). Empirical studies specifically focusing on the tourism sector remain limited, leading to notable research gaps. Previous findings indicate that key factors such as regional economic development level, industrial structure configuration, tourism resource endowment (Cai & Xu, 2023), and innovation capacity (Ding & Fan, 2024) directly or indirectly influence tourism economic resilience. These research results not only reveal the basic dimensions of the influencing mechanism of tourism economic resilience but also provide an important theoretical basis and research foundation for this study.

Benefits of Research

The benefits of this research include offering recommendations for promoting regionally balanced development, and strengthening key areas such as travel agencies, education, fiscal expenditure, and workforce quality. These findings can guide policymakers in the PRD and other urban agglomerations facing similar challenges, helping them enhance the sustainability and adaptability of their tourism economies.

Research Methodology

1. Population and Sample

The measurement of tourism economic resilience is a key tool for assessing tourism systems (Li et al., 2022). This study uses a resilience measurement system with three dimensions—resistance and recovery, adaptation and adjustment, and innovation and transformation—comprising 18 indicators. Data were obtained from the Guangdong Yearbook, Guangdong Statistical Yearbook, China City Statistical Yearbook, Guangdong Tourism Statistical Yearbook, and Annual Statistical Bulletin of Guangdong's National Economic and Social Development for 2003–2022 (see Table 1). Indicators X2–X5, X7, and X9–X18 were directly retrieved, while X1, X6, and X8 were calculated as composite indicators from multiple underlying variables not directly available. They aggregate tourism infrastructure components (e.g., hotels, scenic spots, transport facilities) into a single index, capturing aspects of tourism resilience that cannot be observed directly. Indicator weights were determined using the entropy method, and missing data were filled using linear interpolation or the average of adjacent years.

In summary, this study ensures the validity and reliability of its quantitative data by using official statistical yearbooks of Guangdong Province and China. The selected indicators, supported by robust historical data, capture the multidimensional aspects of tourism economic resilience and allow long-term trend analysis. The 2003–2022 period was chosen for several reasons. First, 2004 marks a turning point in China's economic growth, when tourism in the Pearl River Delta expanded and official data became more complete. Second, major policy reforms, including the Guangdong–Hong Kong–Macao Greater Bay Area strategy, influenced tourism development during 2002–2022, providing valuable context for resilience analysis. Third, the COVID-19 pandemic caused severe disruptions, and including data up to 2022 allows assessment of pre- and post-pandemic changes and external shocks on tourism resilience.

2. Instruments

2.1 Entropy Method: The entropy method determines the weight of indexes based on the information contained in the observed values, thereby avoiding biases associated with subjective weighting. This method exhibits high reliability and accuracy in multi-index comprehensive evaluations (Ye et al., 2022). This study employs the entropy method to measure the levels of tourism economy resilience in the Pearl River Delta.

2.2 Obstacle Degree Model: To identify the obstructive factors affecting the resilience of the Pearl River Delta's tourism economy and propose targeted measures for its enhancement, this study employs the obstacle degree model to diagnose the hindering factors (Xu et al., 2019). The obstacle degree ranges from 0 to 1, with higher values indicating more significant obstruction.

2.3 System of Tourism Economic Resilience Evaluation Index System and

Coding: To calculate the barrier impact factors and their obstruction degree in the tourism economy of the Pearl River Delta, this study encodes the influencing factors (Table 1). The table outlines three core dimensions—resistance and recovery, adaptation and adjustment, and innovation and transformation—along with their criteria and indicators, forming a comprehensive framework for quantitative assessment.

Table 1 System of Tourism Economic Resilience Evaluation Index System and Coding

Dimension	Criterion Layer	Index Layer
Resistance and Recover	A1 Tourism Resources Abundance	X1 Tourism resource density
	A2 Tourism Economic Development	X2 Domestic tourism revenue
		X3 International tourism revenue
		X4 Proportion of the tourism industry
	A3 Local Economic Development	X5 Per capita consumption expenditure of urban residents
		X6 Industrial structure
		X7 Proportion of tertiary industry
	A4 Tourist facilities	X8 Road network density
		X9 Total number of travel agencies
		X10 Number of star-rated hotels
Adaptation and Adjustment	B1 Human Resources	X11 Number of people employed in tourism
		X12 Number of employees in the tertiary industry
	B2 Tourism Adjustment Ability	X13 Self-financing level
		X14 Fiscal expenditure
Innovation and Transformation	C1 Talent reserve	X15 Education expenditure as a percentage of GDP
		X16 Number of college students per 10,000 people
	C2 Technical reserve	X17 Scientific research investment level
		X18 Scientific research output level

3. Data Analysis

3.1 Analysis of Obstacle Factors Based on the Temporal Perspective and Dimension Layer

To identify key constraints on tourism economic resilience in the Pearl River Delta (PRD) from 2003 to 2022, this section analysed barrier degrees at four time points—2007, 2012, 2017, and 2022 (Figure 1–4), with a 5-year interval between each. It is primarily aimed at capturing the changes in tourism economic resilience at different stages and reflecting long-term trends related to economic development and external shocks.

From the perspective of city typology, core cities such as Guangzhou, Shenzhen, and Foshan generally show low barrier levels across the four years, reflecting strong foundations and adaptive capacity in tourism economic resilience. In “Resistance and Recovery,” their stable, flat barrier curves indicate solid infrastructure and crisis management. In “Adaptation and Adjustment,” slight yearly fluctuations exist, but overall barriers remain moderately low, suggesting strong responsiveness. The greatest challenge lies in “Innovation and Transformation,” where Foshan shows relatively high barrier levels in some years, indicating that even advanced cities need further improvement in industrial transformation and technological innovation.

In contrast, peripheral cities such as Zhaoqing, Huizhou, Zhuhai, Zhongshan, and Jiangmen generally display higher barrier levels across years and dimensions, reflecting weaker tourism economic resilience. While the gap in “Resistance and Recovery” with core cities is modest, suggesting some infrastructure progress, the “Adaptation and Adjustment” dimension remains high in most years—especially in Zhongshan and Jiangmen—indicating weaker institutional responsiveness. More critically, in “Innovation and Transformation,” cities like Zhuhai, Zhaoqing, and Zhongshan reached peak barrier levels in 2017 and 2022, near or above 0.08, underscoring severe bottlenecks in industrial and technological innovation that hinder resilience improvement.

From a temporal perspective, the average barrier level in “Resistance and Recovery” stayed relatively stable between 2007 and 2022, fluctuating between 0.045 and 0.055. This suggests some improvement in responding to shocks like disasters and health crises, but overall progress is limited. In contrast, “Adaptation and Adjustment” shows an upward trend, peaking in 2022, with most cities recording higher barrier levels than in 2007—indicating delays in institutional reform and flexible governance under complex conditions. “Innovation and Transformation” has remained consistently high, peaking in 2017 with some cities nearing 0.09, making it the most significant constraint. Although there were signs of improvement by 2022, high barriers persist, showing that weak innovation capacity continues to hinder sustainable tourism economic resilience.

In summary, first, core cities such as Guangzhou, Shenzhen, and Foshan generally exhibit low barrier levels across the three dimensions of tourism economic resilience, demonstrating strong foundational and adaptive capacities; in contrast, peripheral cities show higher barrier levels in multiple dimensions, especially in “Adaptation and Adjustment” and “Innovation and Transformation,” which significantly limit their resilience development. Second, in terms of temporal trends, while the “Resistance and Recovery” dimension remains relatively stable, the “Adaptation and Adjustment” dimension has shown a steady increase in barrier levels, and “Innovation and Transformation” remains persistently high—though slightly improved in recent years—indicating that it continues to be the key bottleneck.

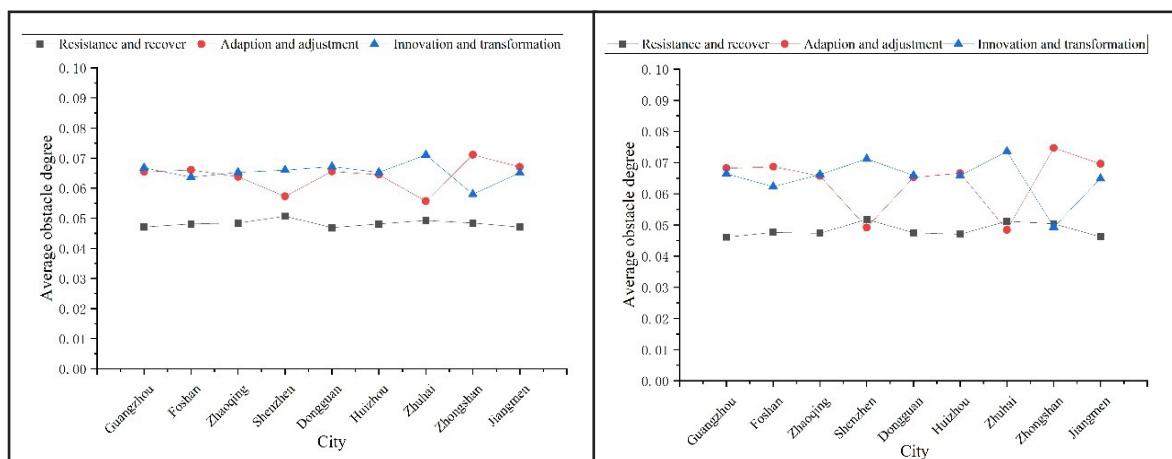


Figure 1 Average obstacle degree of Tourism Economic Resilience Dimensions in the Pearl River Delta in 2007(left) and 2012 (right)

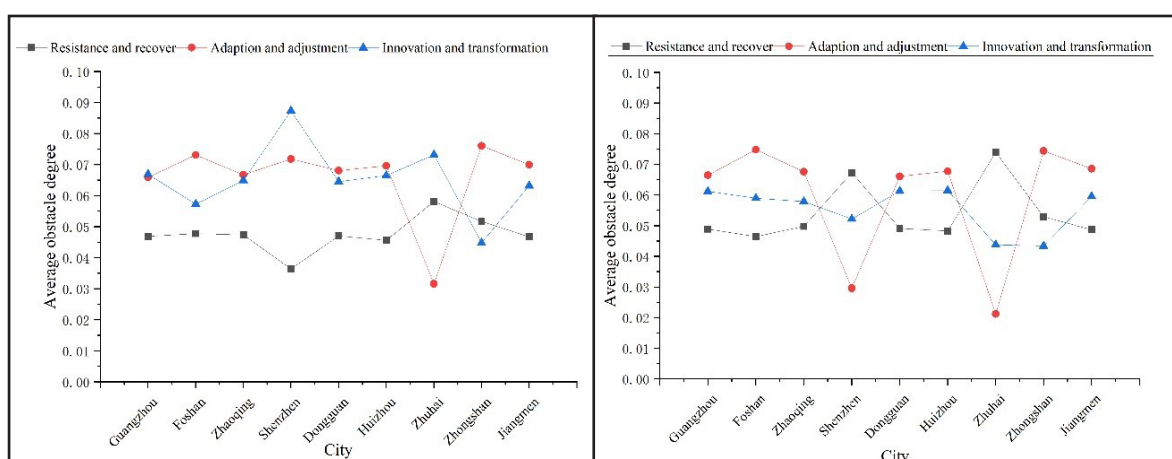


Figure 2 Average obstacle degree of Tourism Economic Resilience Dimensions in the Pearl River Delta in 2017 (left) and 2022 (right)

Source: Constructed by the researcher

3.2 Analysis of Obstacle Factors Based on the Temporal Perspective and Index Layer

This study analyzes barrier indexes from 2007, 2012, 2017, and 2022 (Figure 5), showing that constraints vary across years and cities. In central cities such as Guangzhou and Shenzhen, X9 (travel agencies) generally records low barrier levels, reflecting developed tourism infrastructure. In Guangzhou, X9 declined from 13.00% in 2007 to 11.46% in 2022, indicating stable infrastructure development. X11 (tourism employees) also shows low barriers, suggesting sufficient labor supply. Similarly, X14 (government spending) remains relatively low, reflecting stable fiscal support, while the declining barriers of X15 (education expenditure) highlight progress in education and talent cultivation.

In terms of peripheral cities, in peripheral cities such as Foshan, Dongguan, and Zhuhai, X9 (travel agencies) generally shows higher barriers, reflecting weaker tourism facilities and infrastructure. In Dongguan and Foshan, X9 remains high across years, indicating sustained pressure on infrastructure. X11 (tourism employees) is also a major barrier, particularly in Dongguan and Zhuhai, pointing to labor shortages and market imbalance. X14 (government spending) highlights fiscal and policy support challenges, while X15 (education expenditure), especially in Zhuhai, shows insufficient investment in talent training.

From the perspective of different time periods, across the four timeframes, X9 (travel agencies) was the main barrier for most Pearl River Delta cities (9, 9, 8 times), showing its strong constraint on resilience. X11 (tourism employees) grew in impact over time (1, 3, 4, 6 times), reflecting rising labor-related challenges. X14 (government spending) weakened as a barrier (8, 6, 4, 2 times), shifting from widespread in 2007 to mainly affecting Guangzhou by 2022. X15 (education expenditure) also declined in influence (9, 9, 7, 6 times), indicating its constraint on resilience gradually lessened.

In summary, first, the overall tourism economic resilience of the Pearl River Delta has improved over time, particularly in central cities. However, peripheral cities still require further enhancement of their resilience, especially in areas such as tourism infrastructure, fiscal investment, innovation capacity, and education expenditure. Second, the tourism economic resilience in the Pearl River Delta is constrained by multiple factors. Among them, the total number of travel agencies (X9) > education expenditure (X15) > fiscal expenditure (X14) > number of people employed in tourism (X11). The number of people employed in tourism (X11) increasingly restricts resilience, while fiscal expenditure (X14) gradually weakens its constraint on resilience, and education expenditure (X15) shows a decreasing impact on resilience.

City		2007			2012			2017			2022		
		Resistance and recover	Adaption and adjustment	Adaption and adjustment	Resistance and recover	Adaption and adjustment	Adaption and adjustment	Resistance and recover	Adaption and adjustment	Adaption and adjustment	Resistance and recover	Adaption and adjustment	Adaption and adjustment
Guangzhou	Factor	X9	X14	X15	X9	X14	X15	X10	X14	X17	X9	X4	X18
	Obstacle Degree%	13.00%	11.00%	10.52%	15.76%	11.46%	10.99%	12.79%	12.34%	11.76%	18.14%	8.02%	7.30%
Foshan	Factor	X9	X14	X15	X9	X11	X15	X9	X11	X15	X9	X11	X15
	Obstacle Degree%	9.95%	9.02%	8.20%	10.40%	9.26%	8.14%	11.19%	9.14%	8.35%	11.69%	9.78%	8.10%
Zhaoqing	Factor	X9	X14	X15	X9	X11	X15	X9	X11	X15	X9	X11	X15
	Obstacle Degree%	9.75%	9.08%	8.28%	10.17%	9.30%	8.39%	10.26%	9.32%	8.31%	10.33%	9.46%	8.12%
Shenzhen	Factor	X9	X14	X15	X9	X14	X15	X9	X12	X16	X9	X11	X16
	Obstacle Degree%	11.36%	9.35%	9.11%	12.52%	8.61%	8.54%	14.65%	5.77%	13.03%	15.13%	5.50%	13.73%
Dongguan	Factor	X9	X11	X15	X9	X11	X15	X9	X14	X15	X19	X14	X16
	Obstacle Degree%	10.07%	9.38%	8.30%	10.60%	9.92%	8.28%	11.41%	9.47%	8.46%	11.91%	9.54%	8.25%
Huizhou	Factor	X9	X14	X15	X9	X14	X15	X9	X11	X15	X9	X11	X15
	Obstacle Degree%	9.71%	9.00%	8.23%	9.99%	8.92%	8.06%	10.59%	9.33%	8.16%	10.61%	9.21%	7.84%
Zhuhai	Factor	X9	X14	X15	X9	X14	X15	X9	X14	X15	X9	X12	X15
	Obstacle Degree%	10.66%	9.95%	9.08%	11.25%	10.29%	9.36%	11.76%	10.25%	9.59%	11.56%	9.83%	9.04%
Zhongshan	Factor	X9	X14	X15	X9	X14	X15	X9	X11	X15	X9	X11	X15
	Obstacle Degree%	9.86%	9.10%	8.28%	10.35%	9.34%	8.36%	11.22%	9.65%	9.05%	11.52%	10.20%	8.97%
Jiangmen	Factor	X9	X14	X15	X9	X14	X15	X9	X14	X15	X9	X11	X15
	Obstacle Degree%	9.62%	8.95%	8.15%	10.06%	9.17%	8.31%	10.51%	9.33%	8.44%	10.50%	9.45%	8.29%

Figure 5 Evaluation Results of the Main Obstacle Factors for Tourism Economic Resilience in the Pearl River Delta Cities by Dimension for 2007, 2012, 2017, and 2022 (Source: Constructed by the research)

Discussion and Conclusion

From the perspective of dimensional barriers, this study reaffirms that Guangzhou, Shenzhen, and Foshan exhibit relatively strong resilience, while peripheral cities such as Zhuhai, Zhongshan, and Huizhou face increasing challenges across multiple dimensions. These findings are consistent with earlier studies emphasizing spatial disparities in regional development (Du et al., 2019), yet they also contribute new empirical evidence to debates on the effectiveness of urban spillover effects. Geographically, Zhuhai, Zhongshan, and Huizhou are adjacent to Guangzhou and Shenzhen; however, despite their proximity, these peripheral cities have not effectively benefited from the spillover effects of the core cities. The existing literature showed that this limited diffusion is particularly evident in dimensions requiring advanced capabilities, such as technological innovation and human capital accumulation, echoing findings from urban and regional resilience literature (Zhang et al., 2022). Similar patterns have also been observed outside the PRD. For instance, studies in the Yangtze River Delta and Jing-Jin-Ji regions reveal that peripheral cities often fail to capture the innovation and knowledge spillovers from core metropolitan centers (Song et al., 2023).

This confirms why innovation and transformation capacity is the main obstacle in the Pearl River Delta. The results reveal complex core-periphery dynamics, challenging the assumption that spatial proximity ensures positive spillovers (Qian, 2018). Similar to other city-regions such as the Yangtze River Delta and Jing-Jin-Ji, structural barriers—rather than distance—shape uneven resilience trajectories. Instead of linear diffusion, the findings point to structural factors like technological innovation and human capital as key mediators of urban influence. Thus, geographic proximity alone does not guarantee spillovers, highlighting the need for strategic regional planning and policy coordination. Yet peripheral cities struggle to implement such policies due to limited administrative capacity, fiscal dependence, and difficulties attracting skilled labor. As a result, even sound policies may fail, reinforcing the core-periphery gap (Barahona, 2025). Political coordination also poses challenges, as divergent priorities, protectionism, and competition hinder collaboration, while the strong autonomy of core cities further complicates consensus-building and weakens policy effectiveness.

Regarding the index layer obstacle degree, tourism economic resilience in the Pearl River Delta is constrained by factors. The total number of travel agencies (X9) ranks first, education expenditure (X15) ranks second, the number of people employed in tourism (X11) ranks third, and fiscal expenditure (X14) ranks fourth. The number of people employed in tourism (X11) increasingly restricts resilience, while Fiscal expenditure (X14) gradually weakens its constraint on resilience and Education expenditure.

The identification of the total number of travel agencies (X9) as a primary constraint challenges the traditional assumption that their role is diminishing in the digital era. This supports emerging perspectives in tourism research (Marin–Pantelescu et al., 2019) that emphasize the evolving crucial and intermediary functions of travel agencies in maintaining destination competitiveness and resilience. Cities with a dense network of such agencies demonstrate greater adaptability and market responsiveness, underscoring their strategic importance within the tourism ecosystem.

Addressing disparities in educational expenditure (X15) is vital for enhancing innovation capacity, a key dimension of tourism resilience. This aligns with Du et al. (2019), who found a strong linkage between educational investment and regional innovation output. Our findings reveal that cities with higher educational spending—such as Guangzhou and Shenzhen—exhibit stronger innovation and transformation capabilities compared to cities like Dongguan and Zhuhai. This reinforces the argument that human capital quality, driven by long-term investment in education, is fundamental to resilience.

Fiscal expenditure (X14) also plays a significant role. Between 2007 and 2022, the obstacle frequency associated with government spending declined, suggesting that increased fiscal inputs may be gradually translating into more supportive environments for tourism resilience. This echoes prior findings that sustained public investment can enhance adaptive capacity, especially in times of systemic stress (Hu & Xu, 2022).

The number of people employed in tourism (X11) has become increasingly prominent in the post-pandemic period. While it is traditionally assumed that a larger labor force enhances flexibility and thus resilience (Li et al., 2022), this study finds that although investment in education has continued to grow, the obstacle index associated with X11 has also increased. This indicates that quantity alone is no longer sufficient to support the enhancement of resilience—rather, workforce quality, including skill levels and adaptability, is likely becoming a central factor. As noted by Qin & Chen (2022), diversification and professionalization of the labor market are essential for achieving long-term sustainable tourism development. The growing constraint reflected in X11 suggests a shift in the drivers of tourism economic resilience from a quantity-oriented to a capability-oriented human resource model.

However, as noted in previous analyses, due to increased investment in education, education expenditure (X15) has shown a decreasing obstacle score. Although spending on education is rising, the barrier associated with the number of people employed in tourism (X11) continues to increase, indicating disconnect between educational investment and workforce effectiveness. This divergence highlights a structural gap between the education system and labor market demands, calling for policies that not only expand educational access but also align curricula with industry needs.

In summary, this study contributes to the field in two significant ways. First, by empirically demonstrating the limited spillover effects from core to peripheral cities in the Pearl River Delta, it adds to the theoretical discourse on spatial inequality and regional resilience. These findings question the adequacy of conventional urban diffusion theories and advocate for a more interventionist approach to regional coordination. Second, the multi-level identification of obstacle factors—both at the dimension and index levels—offers a nuanced analytical framework for understanding structural disparities in tourism resilience. This framework advances both academic understanding and provides practical insights for policymakers seeking to enhance tourism sustainability in polycentric urban regions.

Recommendation

1. Promote Regional Balanced Development through Structural Interventions

Bridging the innovation gap between core cities like Guangzhou and Shenzhen and secondary cities such as Zhuhai and Dongguan requires more than spatial proximity. Targeted structural policies are needed to address institutional and capacity disparities, including establishing innovation hubs, supporting startups in peripheral cities, and promoting knowledge-sharing platforms. These measures should be embedded in a broader regional framework that acknowledges core-periphery dynamics and fosters equitable innovation diffusion. Within this context, Guangdong has positioned tourism as a key pillar of the Greater Bay Area Strategy, emphasizing cultural-tourism clusters, cross-border cooperation, and infrastructure connectivity. Aligning local resilience initiatives with these policies can enhance synergies and better integrate peripheral cities into regional tourism development.

2. Strengthen the Role of Travel Agencies as Adaptive Intermediaries

Travel agencies can be enhanced during times of crisis through financial support and by encouraging diversification of services. Given their intermediary role in maintaining market adaptability and resilience, particularly in cities with high agency density, targeted policy support can enhance their function as stabilising actors in the tourism ecosystem. This will reinforce their capacity to contribute to the stability of the tourism industry during disruptive periods.

3. Align Educational Investment with Innovation and Workforce Needs

Increasing investment in education—especially vocational and higher education for tourism professionals—is vital for strengthening innovation capacity. Yet funding alone is insufficient; curricular reforms must better align with labor market needs. Specialized training in emerging trends can help the workforce adapt, enhancing long-term resilience. The Greater

Bay Area framework also stresses talent cultivation and mobility, and leveraging policies for joint training, internships, and cross-border credential recognition can ease workforce bottlenecks and promote regional integration.

4. Leverage Fiscal Expenditure to Enhance Institutional Resilience

Although fiscal expenditure has gradually become less of an obstacle, its strategic use remains vital in supporting institutional capacity-building in peripheral cities. This includes providing financial assistance to small tourism businesses, establishing dedicated crisis response funds, and ensuring that tourism enterprises can recover quickly and sustainably during disruptions. Fiscal policy should be used not only as a buffer during shocks but also as a tool for enabling long-term structural adjustment in lagging regions. In alignment with the Greater Bay Area development agenda, targeted fiscal measures such as special tourism development funds and cross-city financial cooperation platforms can be prioritised to narrow regional disparities and foster collective resilience.

5. Improve Workforce Quality to Address Human Capital Bottlenecks

As the number of tourism workers becomes an increasingly prominent constraint, emphasis should shift from quantity to quality. Investing in skill development programs, encouraging labor market diversification, and enhancing workforce adaptability are essential. This shift reflects a broader transition from labor-intensive to knowledge- and skill-intensive tourism economies, particularly in the context of post-pandemic recovery. Such efforts are especially important in peripheral cities where human capital accumulation remains a key obstacle to resilience.

References

- Barahona, A. (2025). Cities in Transition: Insights from Three Latin American Cities on Urban Growth, Governance, and Sustainable Development. *Scripps Senior Theses*, 2577.
- Bhamra, R., Dani, S. & Burnard, K. (2011). Resilience: the Concept, a Literature Review and Future Directions. *International Journal of Production Research*, 49(18), 5375–5393.
- Cai, X. & Xu, Y. (2023). Spatiotemporal Evolution and Influencing Factors of Tourism Economic Resilience under the Impact of COVID-19 —A Case Study of Coastal Cities in China. *Sustainability*, 15(24), 16668.
- Chen, N., Guo, H. & Xiang, H. (2023). Evaluation of Urban Resilience Level and Analysis of Obstacle Factors: A Case Study of Hunan Province. *Frontiers in Earth Science*, 10, 1033441.
- Cheung, K. S. & Li, L. H. (2019). Understanding Visitor – Resident Relations in Overtourism: Developing Resilience for Sustainable Tourism. *Journal of Sustainable Tourism*, 27(8), 1197–1216.

- Ding, S. & Fan, Z. (2024). Spatiotemporal Evolution and Obstacle Factor Analysis of Coupling Coordination between Economic Resilience and Green, Low – Carbon Development in China. *Sustainability*, 16(24), 11006.
- Du, Z., Zhang, H., Ye, Y., Jin, L. & Xu, Q. (2019). Urban Shrinkage and Growth: Measurement and Determinants of Economic Resilience in the Pearl River Delta. *Journal of Geographical Sciences*, 29(8), 1331–1345.
- Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology, Evolution, and Systematics*, 4, 1–23.
- Hu, X., Li, L. & Dong, K. (2021). What Matters for Regional Economic Resilience amid COVID–19? Evidence from Cities in Northeast China. *Cities*, 120, 103440.
- Li, L., Liu, S., Li, C., Zhang, P. & Lo, K. (2022). What Matters for Regional Economic Resilience amid Multi Shock Situations: Structural or Agency? Evidence from Resource–Based Cities in China. *Sustainability*, 14(9), 5701.
- Li, Q., Guan, H., Feng, Z. & Long, W. (2022). Regional Economic Resilience in the Central–Cities and Outer–Suburbs of Northeast China. *Sustainability*, 14(5), 2844.
- Liu, Y., Huang, Z., Chen, J. & Nie, L. (2023). Diagnosis of the Livelihood Sustainability and Its Obstacle Factors for Poverty–Alleviation–Relocation Residents in Tourism Communities: Data from China. *Sustainability*, 15(7), 6224.
- Marin–Pantelescu, A., Tachiciu, L., Capusneanu, S. & Topor, D. I. (2019). Role of Tour Operators and Travel Agencies in Promoting Sustainable Tourism. *Amfiteatru Economic*, 21(52), 654–669.
- Pang, X., Zhou, Y., Zhu, Y. & Zhou, C. (2023). Exploring the Coordination and Spatial–Temporal Characteristics of the Tourism–Economy–Environment Development in the Pearl River Delta Urban Agglomeration, China. *International Journal of Environmental Research and Public Health*, 20(3), 1981.
- Qi, Z., Kang, J. & You, C. (2024). The Evolution of Resilience and the Obstacles Facing the Tourism Socio–Ecological System (TSES) in Hainan Province. *Journal of Resources and Ecology*, 15(1), 66–76.
- Qian, H. (2018). Knowledge – Based Regional Economic Development: A Synthetic Review of Knowledge Spillovers, Entrepreneurship, and Entrepreneurial Ecosystem. *Economic Development Quarterly*, 32(2), 163–176.
- Qiao, S. Y., Fan, Y. P. & Yin, W. (2024). Spatiotemporal Dynamic Assessment and Obstacle Analysis of Economic Resilience in China’s Marine Fisheries. *Scientific Reports*, 14, 27818.

- Qin, F. & Chen, G. (2022). Vulnerability of Tourist Cities' Economic Systems amid the COVID-19 Pandemic: System Characteristics and Formation Mechanisms — A Case Study of 46 Major Tourist Cities in China. *Sustainability*, 14(5), 2661.
- Reggiani, A., de Graaff, T. & Nijkamp, P. (2001). Resilience: An Evolutionary Approach to Spatial Economic Systems. *Networks and Spatial Economics*, 2, 211–229.
- Song, Q., Zhong, S., Chen, J., Yang, C. & Zhu, Y. (2023). Spatio–Temporal Evolution of City Resilience in the Yangtze River Delta, China, from the Perspective of Statistics. *Sustainability*, 15(2), 1538.
- Wang, J., Huang, X., Gong, Z. & Cao, K. (2020). Dynamic Assessment of Tourism Carrying Capacity and Its Impacts on Tourism Economic Growth in Urban Tourism Destinations in China. *Journal of Destination Marketing & Management*, 15, 100383.
- Xu, Z., Liu, X., Xiao, S., Duan, L., Deng, Q. & Li, J. (2019). Evaluation and Obstacle Factors Study of Water Environmental Carrying Capacity in the Pearl River Delta. *Journal of Environmental Engineering Technology*, 9(1), 44–52.
- Yang, R., Zhang, J., Xu, Q. & Luo, X. (2020). Urban–Rural Spatial Transformation Process and Influences from the Perspective of Land Use: A Case Study of the Pearl River Delta Region. *Habitat International*, 104, 102234.
- Ye, C., Hu, M., Lu, L., Dong, Q. & Gu, M. (2022). Spatio–Temporal Evolution and Factor Explanatory Power Analysis of Urban Resilience in the Yangtze River Economic Belt. *Geography and Sustainability*, 3(4), 299–311.
- Zhang, P., Huang, Y., Pan, S., Chen, W., Zhong, H., Xu, N. & Zhong, M. (2022). Does Resilience Exist in China's Tourism Economy? From the Perspectives of Resistance and Recoverability. *Sustainability*, 14(17), 10641.
- Zhao, K., Huang, H. & Wu, W. (2022). Can the Establishment of State – Level Urban Agglomeration Stimulate Enterprise Innovation? — Taking Yangtze River Delta and Pearl River Delta as an Example. *PLOS ONE*, 17(8), e0273154.
- Zhou, J., Hu, T. F., Wei, Z. & Ji, D. (2024). Evaluation of High–Quality Development Level of Regional Economy and Exploration of Index Obstacle Degree: A Case Study of Henan Province. *Journal of the Knowledge Economy*, 1–33.