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What configurational conditions promote tourism eco-transformation? a fuzzy-set qualitative comparative analysis based on the TOE framework

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Tourism eco-transformation can provide a long-lasting competitive advantage. However, successful transformation is a challenge for both academia and industry. The literature has focused on the net effect of a single factor. Still, we build on the Technology-Organization-Environment framework and propose that tourism eco-transformation does not depend on a single condition but the configurational effect of organization, environment, and technology. We found six conditions that influence eco-transformation in Chinese provinces. The results show that 1) the tourism eco-transformation in China from 2016 to 2019 "declines first and then rises," indicating a "U" shape. Spatial distribution is stable; 2) We can classify the high-level transformation model into four configurational types: technology-pulling organization, proactive organization, environmental stress organization, and comprehensive organization. Not-high-level transformation model can be categorized as comprehensive absence and respectable; 3) There are three critical conditions for tourism external connections, environmental regulation, and tourism ecology promotion. In contrast, digital information level, technology innovation capability, and tourism resource endowment are largely determined based on the specific situation. We explore high-level and not-high-level configurational paths of tourism eco-transformation and gain new theoretical insights. We also guide tourism managers to choose or modify high-level tourism eco-transformation paths based on local characteristics to avoid not-high-level tourism eco-transformation situations.

KEYWORDS

TOE, configurational effect, tourism eco-efficiency, tourism eco-transformation, fsQCA, super-EBM

1 Introduction

Tourism's rapid growth has increased carbon emissions (Lenzen et al., 2018), and the climate crisis is driving tourism eco-transformation (Scott and Gössling, 2022). Travel & Tourism Council (2015) stresses the importance of integrating climate change into development strategies for a low-carbon economy. Tourism eco-transformation (TET) is a common challenge faced by attractions worldwide. Researchers have found that eco-transformation increases regional tourism competitiveness (Rodríguez-Díaz and Pulido-Fernández, 2020) and promotes innovation in tourism enterprises (Pikkemaat et al., 2019). However, TET is still in its infancy (Gössling et al., 2013; Darvishmotevali et al., 2020; Ruan et al., 2022).

Tourism is a complex phenomenon and is considered an integrated adaptive system (McDonald, 2009; Baggio et al., 2010). It consists of interrelated subjects. These subjects learn, adapt, and evolve according to internal and external conditions (Schianetz et al., 2007). TET is part of the tourism system and represents a shift in its behavior (Rastegar, 2022). As a result, tourism environmental performance is enhanced through synergistic interaction between stakeholders in the governance process (Franzoni, 2015; Herrero et al., 2022). The TET process is complex, non-linear, and dynamic (Goeldner and Ritchie, 2007). Local governments often use tourism policies to promote TET (Suno Wu et al., 2021), but they are also affected by multiple external influences, including changes in social, economic, and political environments (Farsari et al., 2011). Meanwhile, the non-linear relationship between TET entities leads to a form of synergy that makes the whole better than the sum of its parts (McDonald, 2009). Furthermore, TET is a plastic concept (Schianetz et al., 2007), making it difficult to understand and implement.

Nevertheless, scholars have explored the influence mechanisms of TET from different perspectives, including environment-led, organization-led, and technology-led. Some scholars believe that environmental regulation significantly impacts TET (Chen et al., 2021; Zha et al., 2021). Chen et al. (2021) demonstrate that environmental regulation can suppress tourism carbon emissions, promote industrial structure upgrading, and promote TET. Scholars have pointed out the impact of technological conditions on TET. Increasing digital information levels reduces information asymmetry and facilitates TET by easing access to information between subjects (Hadjielias et al., 2022; Wang et al., 2022). In the face of environmental and technological uncertainty, technology innovation capability reduces perceived risk and improves resource efficiency (Sarpong et al., 2022). Most scholars believe that environmental regulation and technological conditions indirectly contribute to TET, while tourism organizations promote it directly. Governments enhance tourism endowments, optimize tourism structures, and improve resource allocation efficiency through rational planning (Gunn and Var, 2020).

Meanwhile, managers reach out to neighboring provinces to enhance tourism resources by forming strategic alliances with them (Pham et al., 2021). Accordingly, tourism ecology promotion has been widely adopted by tourism authorities. Losada and Mota (2019) Nieves describes the practice of the Municipality of the Douro of filming "slow tourism". The net effect of a single variable on TET has been examined from various perspectives. But since TET is a complex phenomenon, explaining its complex impact mechanisms seems more significant. An important consideration is to examine variable relationships from a configurational perspective.

Based on these findings, we concluded that the research gaps in TET might be as follows: First, scholars acknowledge that TET is a complex system engineering and have explored the influence mechanisms driving TET from various perspectives. Many studies, however, have focused only on examining the net effect of a single variable on TET rather than considering the configurational effect of the conditional variables. Second, scholars seem interested in studying the mechanisms that drive TET but have paid little attention to how combinations of conditional variables may hinder it. Ragin (2008) states, "In management research, avoiding negative outcomes and promoting positive outcomes are both important". It leads us to ask: what configurational conditions promote and hinder TET?

We developed the TOE (Technology-Organization-Environment) framework to analyze TET based on the existing literature. This framework includes the environmental dimension (environmental regulation), the technological dimension (digital information level, technology innovation capability), and the organizational dimension (tourism external connections, tourism resource endowment, tourism ecology promotion). To further explore the influence mechanism of TET, we used fuzzy set qualitative comparative analysis (fsQCA) based on a configurational perspective. fsQCA assumes that the prior conditions interact rather than are independent (Ragin, 2008; Fiss, 2011; Pappas and Woodside, 2021). By focusing on the configurational effects of the prior conditions, we can better understand the causal mechanisms of TET. fsQCA also allows for multiple analytical possibilities (Pappas and Woodside, 2021). It can test several configurations associated with the same outcome for adequacy. So, We can use it to reveal the types and paths of TET and analyze the causal asymmetry between high-level and not-high-level of TET. Undesired output Super-EBM and Getis-Ord Gi* were also used in our research. The former measures the level of TET. In contrast, the latter aims to characterize the spatial distribution of TET.

Our study may contribute to the following: 1) We propose a comprehensive analytical framework for TET. 2) We reveal multiple paths that lead to high-level and not-high-level TET

and provide evidence against "one-size-fits-all" tourism land management. 3) We propose an alternative approach to determining tourism performance: "Super-EBM + fsQCA." It allows us to investigate the complex causal relationships between conditions and tourism performance.

2 Literature review

2.1 Tourism eco-transformation

TET has not yet formed a unified concept, focusing on Strategic Faction (Pan et al., 2018) and Innovation Faction (Bramwell and Lane, 2012). The Strategic Faction focuses on policy, regulation, and management (Urry, 2005); the Innovation Faction concentrates on products and services, management, and technological innovation (Bramwell and Lane, 2012). In this paper, TET is the goal of the tourism government to guide stakeholders to carry out eco-innovation (technology innovation, management innovation) to realize the transformation from rough tourism development mode to intensive tourism development mode, expressed explicitly as the improvement of tourism performance.

TET has a multi-level positive impact on tourism sites. Due to the climate crisis, scholars are increasingly concerned about tourism's carbon emissions (Lenzen et al., 2018; Scott and Gössling, 2022). At the macro level of analysis, TET curbs carbon emissions. Local governments often develop policy frameworks to achieve TET (Suno Wu et al., 2021). Tourism destinations can reduce carbon footprints with effective destination carbon management (Gössling et al., 2015). As tourism destinations get more competitive, TET is seen as a way to increase their competitiveness (Capacci et al., 2015; Goffi et al., 2019; Kuo et al., 2022). Capacci et al. (2015) points out that "Blue Flags" (one of the eco-labels) open up an environmental niche. It has increased the flow of tourism to the Italian Riviera and improved competitiveness. According to Goffi, sustainable tourism can boost competitiveness in developing countries (Goffi et al., 2019). On a micro-level analysis, TET improves the environmental performance of hotel companies. In Andalusian hotels, García-Pozo et al. (2016) shows that eco-innovation practices increase labor productivity; Aboelmaged (2018) concludes that environmental orientation and eco-innovation together contribute to hotel performance. As a result, TET could positively impact tourist destinations and businesses.

According to the PDCA (Plan-Do-Check-Action) principle, Tourism Performance Evaluation is vital in managing tourism sites (Herrero et al., 2022). Several approaches have been used to characterize tourism performance evaluation, including the life cycle approach (Herrero et al., 2022), the dynamic stochastic Frontier model (Assaf and Tsionas, 2015), and tourism eco-efficiency (Gössling et al., 2005). Tourism eco-efficiency reflects how the economy and the environment interact. In addition, it is easy to use, making it a good tool for assessing tourism performance (Peng et al., 2017; Sun and Hou, 2021). Peng et al. (2017) measures Huangshan Park's eco-efficiency over four periods; Zha et al. (2021) measures Chinese tourism's eco-efficiency from 2005 to 2015. We also used tourism eco-efficiency to characterize TET.

Even so, how TET is achieved is unclear (Gössling et al., 2013). TET involves multiple stakeholders (Buckley, 2012), such as local tourism governments (Bramwell and Lane, 2010), businesses (Pan et al., 2018), and tourists (Lin et al., 2022), and requires a comprehensive weighing of public and private interest objectives. Moreover, TET is non-linear and emergent, making it even harder to implement. There are two main paths of implementation: the government-led path and the enterprise-led path. Tourism companies often use eco-label and digital technologies to achieve transformation (Botero and Zielinski, 2020; Herrero et al., 2022). However, scholars are more likely to recommend macro-regulation by local tourism governments to assist enterprises' transformation. TET needs authorities to provide policies and planning procedures to support and manage tourism (Bramwell and Lane, 2012). Poor government leadership on Danish beaches has contributed to tourists' lack of ecological awareness (Andersen et al., 2018). Despite the non-linear nature of TET, scholars have not figured out how to promote it. We need to examine mechanisms from a holistic perspective.

2.2 Theoretical model: Technology-Organization-Environment framework and tourism eco-transformation

TOE was proposed by Tornatzky (Tornatzky et al., 1990) and applied to explain how organizations adopt green technology. (Zhang et al., 2020). Scholars consider eco-innovation to be an essential path for TET (Alegre and Berbegal-Mirabent, 2016; Sakdiyakorn and Sivarak, 2016), including Technology Innovation (Fuchs et al., 2010) and Management Innovation (Del Chiappa and Baggio, 2015). Resource Dependence Theory suggests that TET requires critical conditions. We introduce the TOE framework to the field of TET, exploring the configurational effect of conditions between organization, environment, and technology.

2.2.1 Technical conditions

2.2.1.1 Digital information level

Digital information level is an essential tool to improve tourism environmental performance (Peng et al., 2017; Shu et al., 2022) and promote tourism towards sustainability (Filipiak et al., 2020). Information theory holds that digital technology development can reduce information asymmetry between tourists, businesses, and tourism authorities (Wang et al., 2022) and enhance the strategic agility of organizations (Hadjielias et al., 2022). Wang et al (2022) argues that digital finance can improve resource allocation efficiency by increasing tourism demand and promoting tourism entrepreneurship.

Hadjielias et al. (2022) further explained that digital technology could enhance tourism organizations' strategic agility, including customer, partnering, and operational agility. In terms of value creation, the digital information level is conducive to changing digital consumer behavior, unlocking potential markets, and increasing tourism infrastructure utilization. Hadjielias et al. (2022) also believes that digital technology can create value in delivery. Marques and Borba (2017) sees digital information technology significantly influencing creative urban tourism. Additionally, Talwar et al. (2022) noted that digital information facilitates tourists' acceptance of virtual reality as sustainable tourism. Therefore, we consider environmental regulation to be one of the conditions for TET.

2.2.1.2 Technology innovation capability

Technology innovation capability means the potential of a region to create and transfer knowledge (Loureiro and Nascimento, 2021). Successful transformation requires that tourism governments rely on knowledge stores to face the problems associated with technological uncertainty and environmental uncertainty. It reduces perceived risk for tourism governments and businesses (Verreynne et al., 2019; Sarpong et al., 2022). It is reflected in reduced seasonal fluctuations in tourism and improved organizational performance (Martín et al., 2014; Bhat and Sharma, 2022). Puertas Medina et al. (2022) studied the accommodation sector from 2015–2019 in the Spanish coastal region. She found the ability to innovate with technology effectively reduced seasonal fluctuations in the accommodation sector and thus achieved higher efficiency levels. Bhat and Sharma (2022) points out that hospitality's technological innovation is directly related to corporate environmental performance. In the Yangtze River Delta, Gan demonstrates that technical innovation capacity positively impacts sustainable tourism development. This relationship, however, varies by region (Gan et al., 2022). Therefore, we believe that technological innovation capability is one of the conditions for TET.

2.2.2 Organizational conditions

2.2.2.1 Tourism ecology promotion

Local tourism governments widely adopt tourism ecology promotion as a form of social marketing due to its "low cost and quick results" (Losada and Mota, 2019; Tkaczynski et al., 2020). In implementing the tourism ecology promotion strategy, local authorities are fulfilling the green aspirations of tourists and residents (Nistoreanu et al., 2020) and raising environmental awareness in tourist areas. Therefore, ecology promotion promotes pro-environmental behavior (Tkaczynski et al., 2020) and enhances customer loyalty (Cai et al., 2021). In addition, green tourism images can motivate green tourism behavior (Line et al., 2017). Specifically, Losada and Mota (2019) notes that the Municipality of Douro promotes sustainability through the filming of 'slow tourism,' and Minoli et al. (2015) points out that using Eco-labels by tourist authorities increases competitiveness. Cai et al. (2021) believes green B&B promotion strategies can increase tourist loyalty. Therefore, we believe that tourism ecology promotion is one of the conditions for TET.

2.2.2.2 Tourism external connections

Tourism external connections indicate the exchange of material and information flows between tourist destinations. It reflects the extent to which the destination government maintains a cooperative strategy with foreign provinces and municipalities. In social capital theory, external connections can be viewed as resources (Field, 2005). Tourism alliances and community members can provide natural, financial, and human resources on a larger scale through scale economies, knowledge sharing, and marketing collaboration (Pham et al., 2021). In particular, Pham et al. (2021) points out that tourism enterprises can improve their resilience to external shocks by building social networks. Additionally, Kofler et al. (2018) points out that tourism tends to collaborate across segments, which can help them collaborate and innovate. We, therefore, consider tourism external connections to be one of the conditions for TET.

2.2.2.3 Tourism resource endowment

Tourists choose a destination because of its tourism resources (Crouch, 2011). These resources profoundly influence the destination's success in the tourism market (Goeldner and Ritchie, 2007). Governments typically use policies and planning to enhance tourism resource allocation efficiency and achieve resource-intensive development by influencing the quality and quantity of core resources and attractions. Therefore, we believe that tourism resource endowment is one of the conditions for TET.

2.2.3 Environmental conditions

2.2.3.1 Environmental regulation

According to contingency theory, tourism organizations' strategies and actions are influenced by the environment in which they are located (Fernández-Robin et al., 2019). Environmental regulation does not directly affect tourism enterprises. However, it is transmitted through the value chain to the governments and enterprises of tourism places, creating external pressure and indirectly promoting eco-transformation. Scholars have demonstrated the role of environmental regulation in achieving environmental sustainability in tourism (Peng et al., 2017; Kornilaki et al., 2019). Chen et al. (2021) classifies environmental regulation into supervisory management, market incentives, command and control, and public participation, which show different effects on carbon emissions from tourism. High-intensity environmental regulation can also reduce tourism's carbon footprint. Erdoğan et al. (2022) states that improved transportation environmental technologies eliminate the harmful effects of international tourism on environmental quality. We, therefore, consider environmental regulation as one of the conditions for tourism TET.

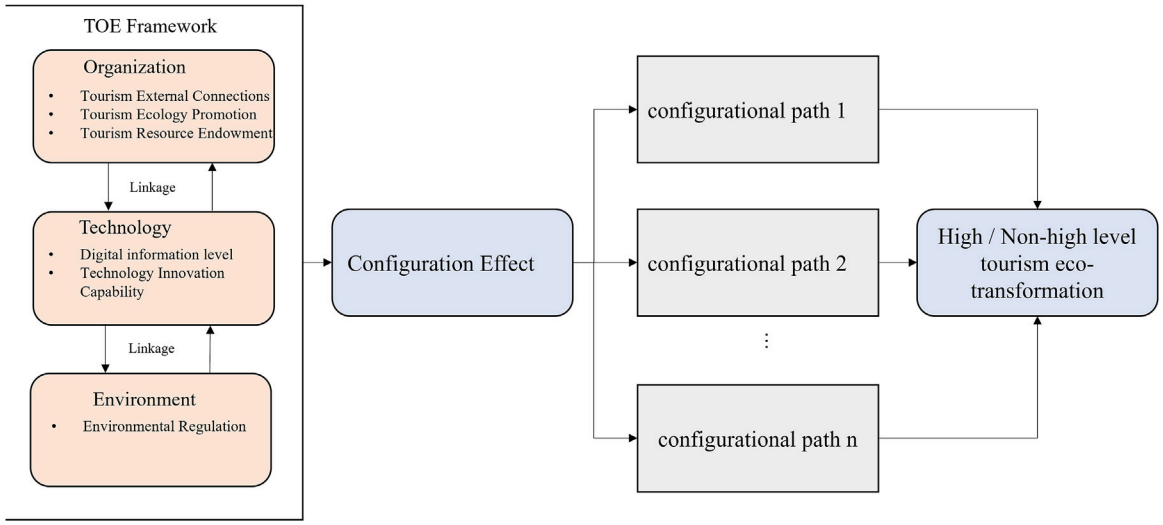

FIGURE 1
TET configurational framework.

2.3 Configurational framework

TET has been examined from multiple perspectives, but research has generally focused on the net effect of a single factor. Accordingly, we explore the influence mechanism from a configuration perspective. The TOE configurational framework is developed, and we argue that TET depends on environmental, organizational, and technological factors acting together. The theoretical model is shown in Figure 1.

3 Methodology

3.1 Research method

3.1.1 Super-EBM model

Assume that the determination of TET has k = 1, ..., K Decision Making Units (DMU), DMU k input I factors x_i (i = 1, ..., I), producing N desired outputs y_n (n = 1, ..., N) and Z undesired outputs y_n (n = 1, ..., N) and Z undesired outputs b_z (z = 1, ..., Z). Pastor and Lovell (2005) proposed a global reference method that enables inter-period comparability of efficiency or inefficiency of the same decision unit and avoids the phenomenon of no feasible solution. The global reference TET possibility set PPS (Production Possibilities Set) is as follows.

$$PPS^T\left\{\begin{array}{l}(x^t,y^t,b^t)\mid\sum_{t=1}^{T}\sum_{j=1}^{K}\lambda_j^t x_{ji}^t\leqslant x_i^t;\sum_{t=1}^{T}\sum_{j=1}^{K}\lambda_j^t x_{jn}^t\geqslant y_n^t\\ \sum_{t=1}^{T}\sum_{j=1}^{K}\lambda_j^t b_{jz}^t\leqslant b_z^t;\sum_{t=1}^{T}\sum_{j=1}^{K}\lambda_j^t=1;\lambda\geqslant 0\end{array}\right\}\quad(1)$$

Where: (x_t, y_t, b_t) denotes the optimal solution of the model; x_{ji}^t, y_{jn}^t, b_{jz}^t denotes the ith input factor, the nth desired output, and the zth undesired output of the jth decision unit, respectively.x_i^t, y_n^t, b_z^t is greater than 0. λ_j^t denotes the weight, and increasing the constraint of λ = 1 indicates Variable Return-to-Scale (VRS), and removing the constraint of λ = 1 The constraint of removing λ = 1 indicates Constant Return-to-Scale (CRS).

We choose the CRS hypothesis considering that the factors of production, such as tourism fixed assets in a particular province, will not change significantly. Under the CRS assumption, the global reference undesired super epsilon-based measure (Super-EBM) efficiency measure model with the following equation.

$$\begin{aligned}\gamma^* &= \min\frac{\theta-\varepsilon_x\sum_{i=1}^{m}\frac{\omega_i^- s_i^-}{x_{ik}}}{\varphi+\varepsilon_y\sum_{r=1}^{s}\frac{\omega_r^+ s_r^+}{y_{rk}}+\varepsilon_b\sum_{t=1}^{p}\frac{\omega_t^{b-} s_t^{b-}}{b_{tk}}}\\ \text{s.t.}&\sum_{j=1}^{n}x_{ij}\lambda_j+s_i^-=\theta x_{ik},i=1,\ldots\text{m}\\ &\sum_{j=1}^{n}y_{rj}\lambda_j-s_r^+=\varphi y_{rk},r=1,\ldots s\\ &\sum_{j=1}^{n}b_{tj}\lambda_j+s_t^{b-}=\varphi b_{tk},t=1,\ldots p\\ &\lambda_j\geq 0,s_i^-,s_r^+,s_t^{b-}\geq 0\end{aligned}\quad(2)$$

where it is assumed that there are n decision units DMU_j (j = 1,2,...,n); each DMU_j has m inputs x_{ij} (i = 1,2,...,m); s desired outputs y_{rj} (r = 1,2,...,s); p undesired output b_{tj} (t = 1,2,...,p); λ is the linear combination coefficient of DMU; x_{ik}, y_{rk} and b_{tk} are the

input, desired output and undesired output of DMU_j to be measured, respectively. s_i^-, s_r^+, s_t^{b-} are the relaxation amounts of the i-th input, the r-th desired output and the t-th undesired output, respectively; $\omega_i^-, \omega_r^+, \omega_t^{b-}$ are the weights of the i-th input, the r-th desired output and the t-th undesired output indicators, respectively; θ, φ are the efficiency values under the radial condition; ε indicates the importance of the non-radial part in the calculation of efficiency values. γ^* is the result of the efficiency calculation, and the larger value indicates the higher relative efficiency of the decision unit DMU.

3.1.2 Getis-Ord Gi*

Getis-Ord Gi^* can identify high-value and low-value clusters in the spatial region and is used to reveal the spatial distribution pattern of hot and cold regions. Getis-Ord Gi^* index is normalized to Z value. The formula is.

$$Gi^* = \frac{\sum_{j=1}^{n} W_{i,j} - \bar{X}\sum_{j=1}^{n} W_{i,j}}{S\sqrt{\frac{n\sum_{j=1}^{n} W_{i,j} - \left(\sum_{j=1}^{n} W_{i,j}\right)^2}{n-1}}}, \bar{X} = \frac{\sum_{j=1}^{n} X_j}{n}, S = \sqrt{\frac{\sum_{j=1}^{n} X_j^2}{n} - \left(\bar{X}\right)^2} \quad (3)$$

Where:X is the attribute value of spatial element j; W_i, W_j is the spatial weight between elements i and j; n is the total number of spatial elements; X is the mean value of spatial elements; S is the standard deviation of spatial elements.

3.1.3 fsQCA

fsQCA is a configurational approach based on Set theory and fuzzy algebra (Ragin, 2008) and is suitable for studying complex causal relationships and configurational effects of organizational strategies (Fiss, 2011). We used fsQCA 3.0 (www.compasss.org). The following steps need to be completed: The first stage is data calibration. Specify three essential qualitative anchors (full membership, cross-over point, and full non-membership), with calibration values ranging from [0, 1] to fuzzy fractions; the second stage is necessity analysis. fsQCA utilizes Boolean algebra, which estimates indexes of consistency and coverage to analyze the necessity. For the necessity analysis, the consistency index is based on the following formula (Ragin, 2008):

$$Consistency\left(X_i \geq Y_i\right) = \frac{\sum[\min(X_i, Y_i)]}{\sum(Y_i)} \quad (4)$$

Coverage index is calculated as follows (Ragin, 2008):

$$Coverage\left(X_i \geq Y_i\right) = \frac{\sum[\min(X_i, Y_i)]}{\sum(X_i)} \quad (5)$$

Where: X_i is the calibrated antecedent condition, and Y_i is the calibrated outcome condition for unit i.

The third stage is the construction of the truth table. The truth table provides all the logical configurations. The number of rows retained depends on the consistency cutoff and frequency threshold. Finally, the configurations are determined by using Boolean minimization and the Quine-McCluskey algorithm. Ragin (2008) defines the corresponding consistency and coverage indexes for sufficiency analysis as follows.

$$Consistency\left(X_i \leq Y_i\right) = \frac{\sum[\min(X_i, Y_i)]}{\sum(X_i)} \quad (6)$$

$$Coverage\left(X_i \leq Y_i\right) = \frac{\sum[\min(X_i, Y_i)]}{\sum(Y_i)} \quad (7)$$

Where: X_i is the calibrated antecedent condition, and Y_i is the calibrated outcome condition for unit i.

3.2 Cases

China's government departments are implementing eco-transformation strategies "from the top down." As a "government-guided" tourism industry, China's tourism sector is seeking a TET path, and provinces are already making progress. The degree of transformation in each province is uneven, but the main goal is the same, which satisfies the fsQCA requirement of "maximum similarity" and "maximum heterogeneity" of the cases (Ragin, 2008). To avoid COVID-19 perturbations, we chose 2016–2019 as the research period. To summarize, we selected 30 provinces in China (excluding Hong Kong, Macau, Taiwan, and Tibet) from 2016 to 2019 as cases of TET.

3.3 Indicator selection and description

3.3.1 Tourism eco-transformation

TET describes the transformation of tourism economic activities' production mode (crude growth → intensive growth), expressed as improving tourism environmental performance (Herrero et al., 2022). Therefore, we use tourism eco-efficiency as a proxy variable for TET. Currently, academia does not have a standardized indicator for measuring eco-efficiency. In selecting an indicator, we consider the input-output process of tourism place development, together with available data.

3.3.1.1 Input indicators

Workforce, fixed assets, and land are considered primary factors of production for tourism economic activity (Kapelko and Oude Lansink, 2017). Tourism is a labor-intensive industry. Its economic activity is greatly affected by the workforce. In addition, the accuracy of tourism workforce statistics varies from year to year, which leads to high fluctuations in the data. Therefore, we choose the tertiary sector workforce (Sun and Hou, 2021). Fixed assets are essential for building auxiliary tourism facilities. The fixed assets input is calculated by adding the number of star-rated hotels, the number of travel agencies, and the number of weighted scenic spots (Wang et al., 2020).

TABLE 1 TET input-output indicators and data sources.

Secondary indicators	Specific target	Data resources
Workforce input	Number of the tertiary sector workforce	*China Statistical Yearbook*
Fixed assets input	Number of star-rated hotels	*China Tourism Statistics Yearbook; Provincial Statistical Yearbook*; *Provincial Statistical Bulletin*
	Number of travel agencies	
	Number of weighted scenic spots	
Tourism energy input	Tourism energy consumption	See Supplementary Appendix A1 for details on the author's self-test
Economic benefits	Total Tourism Revenue	*China Tourism Statistics Yearbook*
Social benefits	Total number of visitors received	*China Tourism Statistics Yearbook*
Tourism Carbon Emissions	Tourism Carbon Emissions	See Supplementary Appendix A1 for details on the author's self-test

Another input indicator we selected is tourism energy consumption, a critical component of tourism activities (Nepal et al., 2019). The land indicator, however, was not considered since the tourism satellite account does not include it in its statistics (Zha et al., 2020).

3.3.1.2 Desired output indicators

Tourism aims to satisfy the needs of tourists and create social and economic benefits. Economic benefits are the ideal output indicator. We apply total tourism revenue for representation (Zha et al., 2020). To eliminate the effect of price fluctuations, we use the CPI (Consumer Price Index) and select 2016 as the base year (Peng et al., 2017; Zha et al., 2020). Based on existing literature, we consider the total number of visitors received as a proxy variable for social benefits (Wang and Wang, 2021). Although visitor satisfaction is a desired output indicator, it was not considered due to its various measurement difficulties.

3.3.1.3 Undesired output indicators

Studies have shown that tourism carbon emissions can accurately reflect the impact of tourism development on the ecological environment (Sun, 2016). Thus, tourism carbon emissions are considered undesired output indicators (see Supplementary Appendix A1).

As a result of the above considerations, Workforce, Fixed Assets, and tourism energy consumption are regarded as input indicators, economic benefits and social benefits are regarded as desired output indicators, and tourism carbon emissions are regarded as undesired output indicator (see Table 1).

3.3.2 Technical conditions

Technology innovation capability: We applied the regional innovation capability characterization technology innovation capability from the China Regional Innovation Capability Evaluation Assessment 2019 (https://www.most.gov.cn/zxgz/cxdc/cxdcpjbg/).

Digital information level: We use the China Digital Development Index Report 2019 to represent the digital information level of each province.

3.3.3 Organizational conditions

Tourism external connections: we combine the gravity model with the degree centrality of tourism external connections in social network analysis (See Supplementary Appendix A2 for details on the author's self-test).

Tourism ecology promotion: Baidu indexes assess the government's response to emergencies (Li et al., 2022). We used the Baidu index (https://index.baidu.com/) to indicate tourism ecology promotion efforts. The keywords were "eco-tourism," "low carbon economy," "green consumption," and "sustainable development." "and the period is 2016–2019.

Tourism resource endowment: We draw on existing research and combine World Natural Heritage, World Cultural Heritage, World Heritage - Mixed Property (https://zh.unesco.org/), National AAAAA level tourist attraction (China Tourism Statistics Yearbook), national tourism park of China ("the list of scenic spots and scenic spots issued by the State Council") and National Geopark (http://www.geopark.cn/). We weighted their numbers to characterize tourism resource endowment.

3.3.4 Environmental conditions

Environmental regulation: Salamon (1989) pointed out that it is more comprehensive and objective to measure environmental regulation's intensity in terms of pollution control results. We selected industrial wastewater emissions, industrial SO_2 emissions, and industrial soot emissions (China Statistical Yearbook, Provincial Statistical Yearbook). We weighted these three components to find the environmental regulation levels of different provinces.

4 Results

4.1 Time series analysis of provincial tourism eco-transformation in China

We use a global reference undesired output Super-EBM model to measure TET in Chinese provinces from 2016 to 2019 (see Supplementary Appendix A3). During 2016–2019,

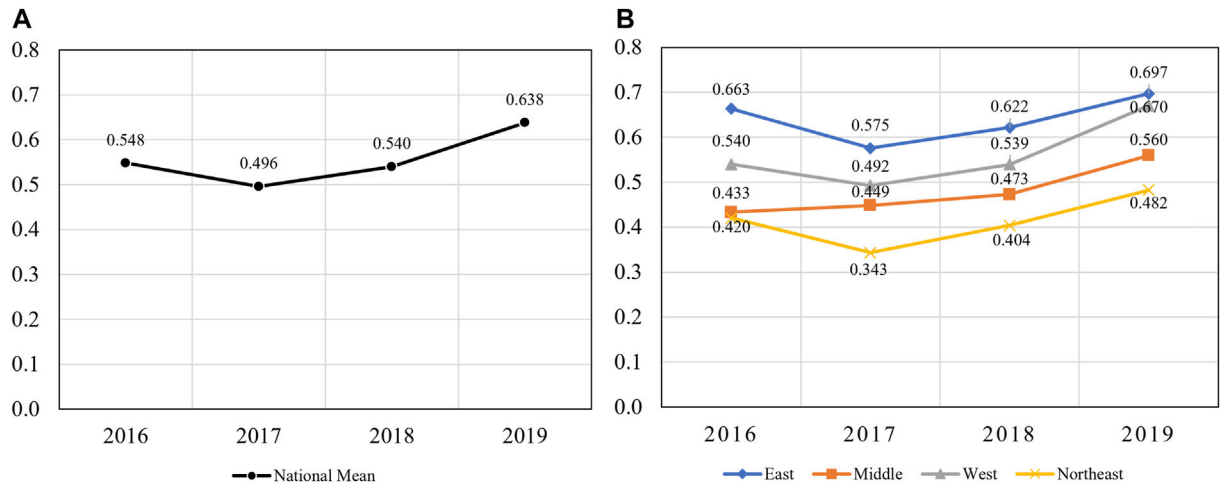

FIGURE 2
TET values of Chinese provinces. Note: **(A)** the average of national TET, **(B)** east, central, west and northeast China, the division is based on (https:// www.stats.gov.cn/ztjc/zthd).

the TET in China showed an upward trend (Figure 2A), increasing from 0.548 in 2016 to 0.638 in 2019, an increase of 16.4%. Specifically, TET decreases initially, then increases, forming a U-shape. The year 2017 represents the turning point. According to the People's Republic of China's National Bureau of Statistics classification criteria, China is divided into Eastern, Central, Western, and Northeastern regions (https://www.stats.gov.cn/ztjc/zthd). TET growth trends in the east, central, west, and northeast are consistent with the national mean (Figure 2B), which also shows an upward trend. From the spatial distribution analysis, East > West > Central > Northeast. Eastern regions have rich tourism resources, a mature technical structure, and an advanced management model. As a result, TET leads the remaining three regions. Since implementing the western development strategy, the west region's tourism economic structure is becoming more and more reasonable. In addition, dividends appear, and the TET is significantly higher than the center and northeast. Despite the apparent upward trend in the central region, there is still room for improvement. In the northeast, the tourism industry structure needs to be optimized, and workers are leaving, which means the TET is falling behind the other three.

4.2 Spatial distribution of provincial tourism eco-transformation in China

Using Getis-Ord Gi* in ArcGIS10.8, Z-values are divided into cold, sub-cold, sub-hot, and hot regions. Below are the hot and cold spots for TET from 2016–2019. Combining Figure 3, we can see that: 1) From the quantitative analysis, the number of hot points (6→7) and the number of sub-cold provinces (8→9) gradually increase, and the number of cold points tends to decrease (8→6). Moreover, the number of sub-hot points is unchanged (8→8). TET appears to be improving in each province of China, and there is a heightened spatial convergence between provinces. 2) From the analysis of spatial distribution changes, in 2016 and 2019, hot points and sub-cold points are concentrated east of the Hu Line, while cold points are concentrated west of the Hu Line. It indicates that China's geographical environment and tourism economic development have certain zonality, and the regional spatial distribution of TET shows stability and continuity characteristics.

4.3 Antecedent conditions calibration based on fsQCA

Based on existing studies (Hartmann et al., 2022) and considering the characteristics of the case data distribution, we use a direct method for calibration. Quantile values of 75%, 50%, and 25% are used as thresholds for full membership, crossover point, and full non-membership, assuming no singularities. All conditions were calibrated as in Table 2.

4.4 Necessity conditions analysis

Before performing a sufficient solutions analysis, it is necessary to check the necessity of each condition one by one. We combine mainstream fsQCA studies to test whether a single condition (including its non-set) constitutes a necessary condition for high (not-high) TET. When a condition is always present in fsQCA, it becomes the necessary condition of the outcome (Ragin, 2008; Fiss, 2011). The consistency index is used as an essential test for necessity conditions. When the Consistency index is more significant than 0.9,

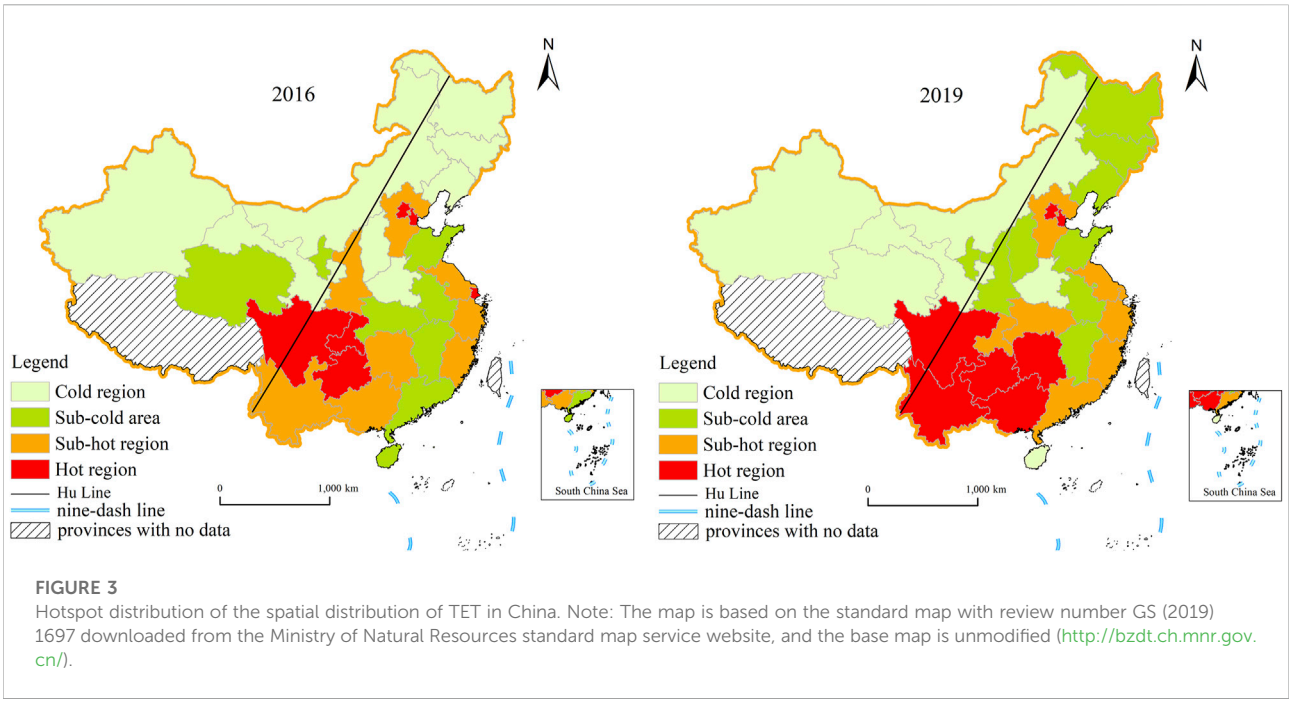

FIGURE 3
Hotspot distribution of the spatial distribution of TET in China. Note: The map is based on the standard map with review number GS (2019) 1697 downloaded from the Ministry of Natural Resources standard map service website, and the base map is unmodified (http://bzdt.ch.mnr.gov.cn/).

TABLE 2 Calibration and Descriptive Statistics of antecedent condition.

Fuzzy set	Calibration			Descriptive statistics			
	Fully In	Crossover	Fully out	Mean	SD	Max	Min
TET	0.539	0.490	0.409	0.484	0.143	0.725	0.183
digital information level	5.803	5.762	5.688	5.781	0.097	6.019	5.648
environmental regulation	3.820	3.583	3.436	3.593	0.338	4.194	2.511
technology innovation capability	3.302	3.135	3.047	3.237	0.304	3.974	2.815
tourism external connections	0.244	0.216	0.188	0.217	0.078	0.394	0.034
tourism resource endowment	2.045	1.934	1.815	1.934	0.301	2.488	0.888
tourism ecology promotion	5.541	5.349	5.167	5.287	0.487	6.083	3.838

the condition is the resulting necessity condition (Ragin, 2008; Fiss, 2011). Table 3 shows the necessity analysis results of high-level and not-high-level of TET analyzed using fsQCA 3.0 software. As seen in Table 3, the level of consistency for all conditions is less than 0.9. Consequently, none of the conditions listed have independent explanatory powers.

4.5 Sufficient solutions analysis

In contrast to necessity analysis, sufficiency analysis examines the sufficiency of results generated by multiple configurational conditions. Sufficient solutions analysis involves the analysis of true tables. Its purpose is to examine cases with specific condition combinations and assess whether they lead to the same results (Ragin, 2008). The true table lists all possible combinations of conditions. Our study involves 6 antecedent conditions, so there are 64 possible combinations (i.e., 2^6). We identify all combinations of conditions with at least 1 case to reduce the true table. Setting case cutoff to 1 is recommended for medium samples (Schneider and Wagemann, 2012). Then, we set the consistency cutoff to reduce the true table further. We employ 0.8 as the consistency cutoff, which is higher than the recommended value of 0.75 (Ragin, 2008). We set the PRI (Proportional Reduction in Inconsistency) to 0.7 to reduce the contradictory relationship between configurational conditions. It is higher than the 0.5 suggested by Greckhamer (Greckhamer et al., 2018). Supplementary Appendices 4A, 4B provide details about the

TABLE 3 Necessity analysis of single conditions.

Condition	High-level of TET		Not-high-level of TET	
	Consistency	Coverage	Consistency	Coverage
digital information level	0.699	0.687	0.460	0.406
~ digital information level	0.396	0.449	0.646	0.658
environmental regulation	0.655	0.698	0.437	0.418
~ environmental regulation	0.454	0.473	0.685	0.641
technology innovation capability	0.684	0.682	0.488	0.437
~ technology innovation capability	0.435	0.486	0.644	0.647
tourism external connections	0.804	0.760	0.405	0.344
~ tourism external connections	0.307	0.365	0.718	0.767
tourism resource endowment	0.672	0.658	0.486	0.427
~ tourism resource endowment	0.415	0.473	0.611	0.626
tourism ecology promotion	0.692	0.690	0.436	0.391
~ tourism ecology promotion	0.389	0.434	0.654	0.656

Note: ~ means Not-high (logical operator).

TABLE 4 Configurational conditions strongly related to TET.

Antecedent condition	High-level of TET						Not-high-level of TET		
	H1	H2	H3	H4	H5	H6	L1	L2	L3
DIL	●		⊗	●	●		⊗	⊗	
TIC	●	⊗	⊗	●	●			⊗	●
ER		⊗	●	●	●	●	⊗	⊗	⊗
TEC	●	●	●		●	●	⊗	⊗	⊗
TRE	⊗	●	⊗	●		●	⊗		⊗
TEP	⊗	●	●	●	●		⊗	⊗	⊗
consistency	1	0.965	0.815	0.951	0.962	0.919	0.977	1	1
coverage	0.121	0.153	0.115	0.352	0.349	0.317	0.259	0.207	0.252
unique coverage	0.046	0.085	0.051	0.057	0.041	0.012	0.087	0.035	0.063
Solution coverage				0.615				0.399	
Solution consistency				0.913				0.981	
Typical cases	Tianjin, Sichuan	Yunnan, Fujian	Guangxi	Zhejiang, Guangdong, Jiangsu, Beijing, Sichuan	Jiangsu, Zhejiang, Beijing, Chongqing, Sichuan	Jiangsu, Zhejiang, Beijing, Sichuan, Hunan	Heilongjiang, Ningxia	Ningxia, Xinjiang	Hainan, Qinghai

Note: ●indicates the condition exists, ⊗indicates the condition is missing, blank space indicates that the presence or absence of the condition does not affect the result

True table. Finally, we use Boolean minimization and the Quine-McCluskey algorithm to determine configurational conditions.

As shown in Table 4, the consistency of any configurational condition is above the threshold value of 0.8. The high-level of configurational condition solution consistency is higher than 0.9.

These conditions constitute sufficient explanations for TET. Further, coverage refers to the explanatory power of the configurational condition, which reflects the empirical relevance or importance of the configuration (Ragin, 2008). It is similar to R-square in regression (Fiss, 2011). In our study, six configurations explained 61.5% of the cases. Based on the not-high-level configurational conditions, solution consistency was 0.981, and solution coverage was 39.9%. For the convenience of writing, we use the abbreviations of 6 conditions to represent (digital information level (DIL); technology innovation capability (TIC); environmental regulation (ER); tourism external connections (TEC); tourism resource endowment (TRE); tourism ecology promotion (TEP)).

4.6 Analysis of high-level of tourism eco-transformation

1) Technology-pulling organization: H1 (DIL*TIC*TEC*~TRE*~TEP), indicating low tourism resource endowment and government ecological promotion, but favorable technology conditions have enabled tourism places to connect with other provinces for eco-transformation.

The lack of tourism resources is not conducive to informing tourists (Gnoth, 1997; Gössling, 2017). However, technological innovation provides a knowledge store for tourism governments, and the high digital information level reduces the difficulty for tourists to access information. In addition, it facilitates the decision-making, coordination, and control systems utilized by tourism destination governments (Buhalis and Law, 2008). As a result, tourist destination governments establish tourism alliance strategies with foreign provinces (Brandão et al., 2019). In alliances, members can easily access each other's natural and material resources (Pham et al., 2021). According to social capital theory, effective external connectivity is also a resource (Poder, 2011; Pham et al., 2021). It can compensate for the lack of tourism resources and make a destination more resilient (Pham et al., 2021). We find that technological conditions have a profound impact on TET, and studies have also shown that digital technologies, such as the level of digital finance and blockchain technology, can optimize the allocation of tourism resources and thus improve allocation efficiency (Erol et al., 2022; Wang et al., 2022).

This configurational type covers 12.1% of the cases, represented by Tianjin and Sichuan provinces. For example, the Tianjin Municipal Bureau of Culture and Tourism has joined forces with Unicom to deepen the development of "Internet + Tourism," enhancing the tourism industry's digital information and strengthening tourism technology innovation. Also, the Tianjin Cultural Tourism Bureau has actively promoted cultural tourism investment. It includes strengthening project docking and establishing cultural tourism projects with many provinces.

Proposition 1: Tourism's technical conditions can effectively attract the government's external connections and compensate for losses in resource endowment and ecology promotion.

2) Organizational proactive drive: H2 (~ER*~TIC*TEC*TRE*TEP), indicating that macro-environmental regulation is weak and technology innovation capability is limited. However, the government of the tourism area promotes ecology, exploits tourism resources, and establishes strategic links with nearby provinces, promoting eco-transformation.

Unlike the configurational condition H1, H2 is more dependent on organizational effort. Based on Dynamic Capabilities Theory (Eisenhardt and Martin, 2000), the government's initiatives to integrate, construct, and allocate internal and external resources will likely lead to improved environmental performance and eco-transformation of tourism sites. It remains consistent with the current literature (Domingues et al., 2015; Camilleri, 2016). Several studies have shown that tourism organization efforts significantly impact performance (Reid et al., 2008; Domingues et al., 2015; Camilleri, 2016; Prima Lita et al., 2020), and our results reinforce the importance of local governments in promoting TET.

The configurational type covers 15.3% of the cases, representing Fujian Province and Yunnan Province. For example, deep in China's interior, Yunnan Province has less developed technical conditions. The provincial government advocates for the development of green and low-carbon tourism models in the "14th Five-Year" Tourism Development Implementation Plan, demonstrate green development for tourism enterprises such as attractions and B&B inns and educates tourists about eco-tourism. Tourism authorities rely on Bai culture to develop national and provincial tourism resorts. It has led to strategic alliances with neighboring provinces to share tourism resource elements and contribute to the Great Shangri-La Tourism Loop.

Proposition 2: When the regional technical conditions are backward, the government should take the initiative to use tourism resources fully, promote the concept of eco-tourism and pay attention to external connections.

3) Environmental stress organization: H3 (~DIL*~TIC*ER*TEC*~TRE*TEP), indicating the province is technologically backward and tourism resources are limited. However, the high intensity of environmental regulation pressure forces the tourism place government to respond, such as strengthening ecology promotion and increasing tourism foreign economic interaction.

Contrary to H1 and H2, H3 emphasizes environmental regulation. Environmental regulation can positively influence

tourism enterprises and scenic spots to practice pro-environmental behavior, reduce tourism carbon emissions, and improve environmental performance (Peng et al., 2017; Chen et al., 2021). Macro-environmental regulation may drive the implementation of ecology promotion and external connections by tourism authorities. Both ecology promotion and external connections can positively influence TET, in line with existing research findings. It is also consistent with the contingency theory that the environment may influence tourism organizational behavior (Rodríguez-Díaz and Pulido-Fernández, 2020).

The configurational type covered 11.5% of the cases. The representative case is Guangxi. To compensate for poor technical conditions, Guangxi emphasizes two-way interactions between "organization and environment," increasing investment in environmental protection on the one hand. From 2013–2019, Guangxi invested 100 billion yuan in promoting the development of the ecological economy and green industry; on the other hand, the provincial government paid attention to the construction of major tourism projects and critical projects for investment.

Proposition 3: When faced with inadequate technical factors and tourism resource endowments, the government ought to pay attention to environmental regulation, promote eco-tourism, and take initiatives in guiding tourism projects.

4) Comprehensive drive type: H4 (DIL*TIC*ER*TRE*TEP); H5 (DIL*TIC*ER* TEC*TEP); H6 (TIC*ER*TEC*TRE). H4, H5, and H6 all involve organizational, technological and environmental factors in the TOE framework, and are therefore named comprehensive drive type. It constitutes the mainstream path for high-level of TET.

H4, H5, and H6 embody the phenomenon of "independently reaching the same conclusion." Tourism resource endowment, external connections, and digital information level all exist in different configurations, but they all promote high-level of TET. Our findings demonstrate the equivalence principle proposed by Woodside. The equality principle states that a sufficient model is not necessary for an outcome to achieve a high score (Woodside, 2014). Technology innovation capability and environmental regulation are effective drivers of TET, in line with the literature. The remaining conditions are volatile and require consideration of the overall nature of the portfolio. It is also consistent with the complexity of TET (Goeldner and Ritchie, 2007; Schianetz et al., 2007).

The coverage of these three configurational conditions is greater than 30%, and the representative cases are Zhejiang, Beijing, etc. Take Zhejiang Province as an example. Zhejiang Province relies on technology innovation capability and attaches importance to digital technology scene application. As a result, digital technology ecology will help turn tourism resources into flows through leveraging technological development.

Proposition 4: Emphasizing the configurational effects of organizational, technological, and environmental factors is more conducive to flat TET.

4.7 Analysis of not-high-level of tourism eco-transformation

1) Comprehensive absence: L1 (~DIL*~ER*~TEC*~TRE*~TEP), L2 (~dil*~tic*~er*~tec*~tep), L1 indicates that technology innovation capability is backward, environmental regulation pressure is weak, and tourism resource endowment is insufficient. L2 indicates low digital information levels, low pressure of environmental regulation, and low level of organizational effort. All the above are not conducive to eco-transformation.

The TOE framework's lack of environmental, technical, and organizational elements was not conducive to developing TET. Essentially, it reaffirms Resource Dependence Theory's argument that TET requires key conditions (Hillman et al., 2009). The absence of digital information level, environmental regulation, tourism external connections, and tourism ecology promotion may lead to not-high-level of TET. At not-high-level, we also find the phenomenon of the equivalence principle between configurational paths (Woodside, 2014).

L1 and L2 cover 27.7% and 24.9% of cases, respectively; the typical cases in L1 are Ningxia and Heilongjiang provinces; the typical cases in L2 are mainly in Ningxia and Xinjiang. Most of these cases are located in western and northeastern China, and the conditions to promote TET are seriously lacking. According to Hillman, Withers, & Collins (2009), there should be certain essential critical conditions for TET.

Proposition 5: The absence of organizational, technical, and environmental factors may be detrimental to eco-transformation

2) Respectable: L3 (tic*~er*~tec*~tre*~tep), which indicates that although the technological innovation capability is strong, the government of the tourism area has made low efforts and has not applied it to the field of tourism scenarios, which is not conducive to transformation.

Although technology innovation capability may increase tourism productivity (Nguyen et al., 2021), we find that high-level of technology innovation capability do not effectively drive TET. Even so, this echoes the view that tourism phenomena are complex and need to be contextualized. Tourism authorities can take the initiative to combine technological innovation capabilities with real-life scenarios (Mendoza-Moheno et al., 2021).

This configuration covers 25.2% of the cases, and the representative cases are Qinghai and Hainan. Hainan Province, located in the east of China, has shown a high

capacity for technological innovation due to spillover effects from Guangdong Province. However, tourism activities in Hainan Province are still based only on natural resources and do not combine tourism scenarios with technological innovation.

Proposition 6: Regional science and technology innovation is capable, but inappropriate government application to the tourism scene is equally detrimental to transformation.

4.8 Horizontal analysis of antecedent conditions

We conducted a horizontal analysis to examine the degree of importance of antecedent conditions. A comprehensive comparison of condition combinations showed that environmental regulation was prominent in the configuration of high-level transformation (e.g., H3, H4, H5, and H6). In contrast, the not-high-level transformation configuration has low environmental regulation strength (e.g., L1, L2, and L3), indicating that environmental regulation is vital for transformation. It is in line with Chen and Erdoğan's view that environmental regulation can exert external pressure on tourism sites, thereby curbing carbon emissions and driving TET (Chen et al., 2021; Erdoğan et al., 2022). Correspondingly, tourism external connections appear in H1, H2, H3, H5, and H6. The paths of not-high-level transformation all have low external connections strength. It is in line with Pham and Kofler's view (Kofler et al., 2018; Pham et al., 2021). Tourism ecology promotion is similar to the above. Our findings reaffirm Nistoreanu and Cai's view that ecology promotion increases resident and tourist loyalty, which drives TET (Nistoreanu et al., 2020; Cai et al., 2021). However, in contrast to existing research, we found that the province can achieve high-level transformation regardless of digital information level, technological innovation capability, and tourism resource endowment. This result is consistent with Fiss's assumptions about the configuration approach: "conditions that produce high-level are not necessarily the antithesis of conditions that produce not-high-level" (Fiss, 2011). Therefore, Tourism authorities should effectively combine digital information level, technology innovation capability, and tourism resource endowment with other conditions.

4.9 Robustness checks

There are four common ways to test robustness: increasing the case consistency cutoff, improving the PRI consistency, adding or removing cases, and adding other conditions (Chen and Tian, 2022). For robustness testing, We can select one of the four robustness tests. In this paper, we raise the case consistency cutoff from 0.800 to 0.815 while all configurational conditions remain unchanged. In the not-high-level transformation, the configurational conditions did not change. As a result, the research results remained robust.

5 Conclusion

Based on the TOE configuration framework, we examined 30 Chinese provinces' TET paths from 2016–2019 using fsQCA.

Firstly, China's TET has been increasing from 2016 to 2019. Mainly, it shows a "U"-shaped pattern of falling and rising. Spatial patterns are stable, with hot spot areas and sub-cold spot areas concentrated east of Hu Line and cold spot areas concentrated west of Hu Line. Secondly, we found that the presence of a single condition is not sufficient to predict the effect of TET. From a configurational perspective, high-level and not-high-level TET can be achieved in various ways. In conjunction with the TOE framework, we have identified four high-level paths, namely the "technology-pulling organization," the "organizational proactive drive," the "environmental stress organization," and the "comprehensive drive." Two not-high-level paths were also identified: "comprehensive absence" and "respectable."Third, tourism external connections, environmental regulation, and tourism ecology promotion are the key conditions to promote TET, but digital information level, technology innovation capability, and tourism resource endowment depend on the situation.

6 Discussion

6.1 Theoretical implications

Firstly, we propose a conceptual framework for analyzing TET, referred to the TOE framework. It is based on a summary of existing research results, including environmental (Fernández-Robin et al., 2019), organizational (Crouch, 2011; Brandão et al., 2019; Losada and Mota, 2019), and technological factors (Losada and Mota, 2019; Shu et al., 2022). Scholars can utilize this framework to analyze TET generally and expand the application of TOE theory.

We can use the TOE framework to explain the phenomenon of "divergent findings." Various studies may report contradictory findings regarding the same influencing factor. For example, scholars suggest enhancing technological innovation capability can drive TET (Erol et al., 2022; Sarpong et al., 2022). We found, however, that the condition produced mutually exclusive results across tourism locations. Our study added context to explain scenarios in which the same variable leads to different conclusions, gaining valuable theoretical insight. It echoes Goeldner's call for "complex tourism scenarios to lead to non-linear relationships between variables" (Goeldner and Ritchie, 2007).

Secondly, we examine TET's conditional variables from a configurational perspective. In other words, we're looking at

how different influences can affect TET together. Previous studies have demonstrated from a single dimension that TET may be related to the organization, technology, and environment, respectively (Goeldner and Ritchie, 2007; Reid et al., 2008; Peng et al., 2017; Kornilaki et al., 2019; Tkaczynski et al., 2020; Sarpong et al., 2022). However, these three factors are limited in how they are interconnected. Our work fills this gap.

Additionally, existing TET studies tend to assume that causality is symmetrical (Peng et al., 2017; Ji and Wang, 2022). However, Fiss (2011) argues that conditions (or combinations of conditions) that explain an outcome may differ from those that don't. We argue that the "dilemma" and the "way out" of TET are not always symmetrical. Avoiding negative and promoting positive outcomes in management research is equally important. Our work discusses the configurational paths that produce high and not-high-level of TET.

Finally, we propose an alternative method of analyzing the determinants of tourism performance called "Super-EBM + fsQCA." We can then conduct a fine-grained exploration of causal relationships between conditional variables and tourism performance. In the management field, the two-stage analysis of DEA + fsQCA has been gradually used (Amara et al., 2020; Prokop et al., 2021). To our knowledge, scholars have yet to use fsQCA to examine tourism performance determinants.

6.2 Managerial implications

The local tourism administration should formulate TET strategies in a system-coordinating manner. The local government can holistically integrate all the elements of TOE theory to enhance synergistic integration between them. A critical factor in H1 is digital information level and technology innovation capability (Peng et al., 2017; Loureiro, 2019; Shu et al., 2022), but local governments will also need to reach a consensus with neighboring provinces on tourism alliances to compensate for the lack of resources and other factors. On the other hand, in H3, tourism sites have poor technical conditions, but environmental regulations are essential in connecting them to the outside world and launching ecological campaigns (Chen et al., 2021). As a result, when local governments implement TET policies, they can take a holistic approach coupled with the development model and specific configuration combinations.

Secondly, we propose four configurations with high TET and two configurations with not-high TET, which can provide tourism place governments with options in responding to environmental changes. However, managers need to choose the appropriate development model according to the characteristics of the tourism area. Specifically, the promotion of TET differs between eastern, central, and western China. Tourism authorities should determine the development paths for different regions based on their organizational, environmental, and technical conditions. For instance, those cities in the middle and west need to deal with low technology and a lack of innovative resources. They need to give full play to the government's initiative, boost publicity and improve strategic cooperation among provinces to promote TET, whereas, in the eastern regions, they can make use of factor allocation. It echoes the view of scholars who oppose the "one-size-fits-all" approach to managing tourism sites (Goeldner and Ritchie, 2007).

Finally, although these conditions are not necessary for TET, tourism ecology promotion, external connections, and environmental regulation are essential factors that contribute to its promotion (Minoli et al., 2015; Brandão et al., 2019; Chen et al., 2021). Regional governments can enhance communication and technology flow among provinces and cities by forming regional tourism alliances and circuits. We should also intensify the promotion of sustainable tourism and eco-tourism. New tourism scenarios, such as digital scenarios, can be used to promote eco-tourism knowledge. Considering digital information level, technology innovation capability, and tourism resource endowment, combining the remaining conditions and focusing on application scenarios is necessary.

6.3 Limitations and future research

Despite some limitations, the research provides opportunities for further research. Firstly, we discuss TET among provinces based on a Chinese scenario, which may provide a valuable reference for managing tourist sites in developing countries. However, individual administrative units in developed countries continue to face the issue of TET. We still need to examine our findings based on the contexts of different countries and broaden the research context to improve their generalizability. Secondly, we have studied the configurational effects of organization, environment, and technology on TET, which pertain to the macro scale. However, we have not yet examined individual-level factors such as green aspirations and tourism preferences among tourism site residents. By combining the questionnaire data, scholars can compensate for the lack of microscopic scale. Then, scholars can broaden the scope of their research topics by exploring urban clusters, economic zones, or country-based alliances. Finally, as far as research methodology is concerned, we examine the static configurational effects of TET from a cross-section. Future studies may incorporate time-varying factors to explore the dynamics of TET. Thus, we use fsQCA to detect synergistic effects between TOE factors and TET, but the results do not

indicate how strong the effects are. Other methods in future studies could measure it.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Author contributions

CW contributed to conception and design of the study. CW and YZW organized the database. CW performed the statistical analysis. CW wrote the first draft of the manuscript. CW, CWW, HMZ, and QJZ wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fenvs.2022.1012856/full#supplementary-material

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