Volume 3, Issue 4, 2025

Print ISSN: 2959-992X
Online ISSN: 2959-9938

# TRENDS IN SOCIAL SCIENCES AND HUMANITIES RESEARCH

# Trends in Social Sciences and Humanities Research

Volume 3, Issue 4, 2025

Published by Upubscience Publisher

**Trends in Social Sciences and Humanities Research**
**Print ISSN: 2959-992X Online ISSN: 2959-9938**
**Email: info@upubscience.com**
**Website: http://www.upubscience.com/**

# Table of Content

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3156**

# PEAK PREDICTION OF NATURAL GAS CONSUMPTION IN CHINA UNDER MULTI SCENARIO SIMULATION

HongBing Li[1,2], Ke Liu[2], Qin Liu[1,2*]
[1]*College of Resources and Environment, Aba Teachers College, Wenchuan 623002, Sichuan, China.*
[2]*College of Engineering, Sichuan Normal University, Chengdu 610101, Sichuan, China.*
*Corresponding Author: Qin Liu, Email: lq20160305@163.com*

**Abstract:** As a crucial energy source during the green and low-carbon transition period of the energy sector, understanding the evolution patterns of natural gas consumption is of paramount importance for constructing a modern energy system, safeguarding China's energy security, and achieving the "dual carbon" goals. This paper identifies population, affluence, technological advancement, industrial structure, and energy consumption structure as the primary factors influencing China's natural gas consumption. It employs the VIF test to examine multicollinearity among these factors and introduces the Ridge Regression method to mitigate the risks posed by multicollinearity. By solving the undetermined coefficients of the extended Stochastic Impacts by STIRPAT model, it overcomes the potential forecasting risks inherent in the model. The ADF test is utilized to assess the stationarity of variables, ensuring the reliability of the forecasting results from the extended STIRPAT model. Based on scenario analysis, this study explores the trends in China's natural gas consumption. The findings are as follows:(1) The extended STIRPAT model, constructed on the basis of factors such as population, affluence, technological advancement, industrial structure, and energy consumption structure, demonstrates high prediction accuracy and serves as an effective forecasting tool for analyzing the evolution trends of natural gas consumption.(2) Optimizing China's population growth rate, facilitating high-quality economic development, promoting the green and low-carbon development process, and driving high-quality development of the industrial structure are conducive to accelerating the peak of natural gas consumption in China and reducing its overall consumption volume.(3) By accelerating the comprehensive adoption of a green and low-carbon development model, China's natural gas consumption is projected to reach its peak around 2035, with a peak range of approximately $4620\times10^8 m^3 \sim 5160\times10^8 m^3$, an average annual growth rate dropping to below 0.3%, and a foreign dependency ratio ranging from 39% to 45%.(4) By expediting the implementation of pro-natality policies, appropriately regulating industrial development, and optimizing the energy mix, China's natural gas consumption is expected to plateau during the 2040-2045 period, with a peak consumption level between $6500\times10^8 m^3 \sim 7500\times10^8 m^3$, an average annual growth rate of natural gas consumption slowing down to 2.2%-2.9%, and a foreign dependency ratio reaching 55%. By 2050, China's natural gas consumption is anticipated to stabilize at around $6000\times10^8 m^3$.

**Keywords:** Natural gas consumption; Influencing factors; STIRPAT model; Scenario analysis; Peak prediction

## 1 INTRODUCTION

The report of the 20th National Congress pointed out that promoting green and low-carbon economic and social development is a key link to achieving high-quality development. Low-carbon high-quality development is a fundamental strategy for achieving the "dual carbon" goals in China's modernization. Natural gas, as a low-carbon, safe, and efficient fossil energy source, has become the optimal choice to support the restructuring and layout optimization of the energy system. The Energy Production and Consumption Revolution proposes that by 2030, the proportion of natural gas consumption will reach 15%, and the main body of energy increment will shift to clean energy. In 2023, China's natural gas consumption accounted for about 8.5%, which is still a significant gap compared to the world average of 24%. This signals that China's natural gas consumption still holds considerable growth potential in the future. Understanding the changing trends of China's natural gas consumption under different development scenarios is of critical importance for national energy transition planning and decision-making.

Current research by domestic and international scholars on natural gas consumption forecasting primarily focuses on two aspects: analysis of influencing factors and methodological studies for predictions. Relatively abundant research outcomes have been achieved in identifying influencing factors for natural gas consumption, with notable examples including: WANG Jianliang et al. [1] applied grey relational analysis to identify energy consumption structure, GDP, and urbanization rate as core determinants of natural gas demand in eastern and central China; LI Hongbing et al. [2] integrated grey relative correlation analysis with stepwise regression to pinpoint urbanization rate and economic development as effective explanatory variables for natural gas consumption in the Sichuan-Chongqing region in China. While grey relational analysis demonstrates strong quantitative identification capabilities for correlating multiple variables with observed values [3], its results may exhibit significant deviations when handling datasets containing anomalous values. Chai Jian et al. [4] established a structural model of natural gas consumption with factors such as economic behavior and supply capacity, and analyzed the differences in regional driving factors of natural gas consumption using the Bayesian methods. While Bayesian approaches effectively reduce subjectivity in factor selection,

their computational complexity process and high data requirements pose challenges for practical implementation. Building on this, some scholars have introduced the LMDI (Logarithmic Mean Divisia Index) decomposition model into natural gas consumption studies for factor analysis. The LMDI method offers advantages such as robustness in handling zero values. GAO Jian et al. [5] decomposed natural gas consumption drivers into nine effects using the LMDI model: spatial expansion, pipeline network density, population density, residential gas penetration rate, energy consumption elasticity, natural gas substitution, economic growth, and pipeline scale; Raza et al. [6] employed the LMDI method to examine drivers of decoupling in natural gas consumption share, energy intensity, economic structure share, GDP per capita, and population; Liu et al. [7] identified economic, demographic, and production factors as key variables influencing long-term natural gas consumption forecasts. In summary, existing studies have identified five potential influencing factors for China's natural gas consumption: population size, affluence level, technological advancement, industrial structure, and energy consumption structure.

In terms of forecasting methodologies for natural gas consumption, LI Hongbing et al. [8] applied the energy consumption elasticity coefficient to project China's natural gas demand at 1.18 – 1.25 billion tonnes of standard coal equivalent by 2030. However, the energy consumption elasticity coefficient method carries significant uncertainties in its predictions. Given this limitation, MU Xianzhong et al. [9] developed a system dynamics model to forecast natural gas consumption. The system dynamics model fails to adequately account for multicollinearity among factors. To address this limitation, LI Hongbing et al. [10] employed stepwise regression to analyze multicollinearity and developed a stepwise regression Cobb-Douglas (C-D) production function to forecast natural gas consumption. Subsequently, Li et al. [11] constructed a stepwise regression double-log demand function model to examine the evolving trends in China's natural gas consumption. Traditional models exhibit limited capability in handling uncertain information. To address this deficiency, scholars have integrated grey system theory into forecasting frameworks. The following notable advancements are included. WANG et al. [12] developed a fractional inverse cumulative grey model to forecast natural gas consumption in Commonwealth of Independent States (CIS) countries from 2022 to 2025. LI Hongbing et al. [13] established a GM(1,N) model based on validated influencing factors for predictive analysis. WU et al. [14] employed a Grey-Bernoulli model to predict natural gas demand in the US, Germany, UK, China, and Japan. MA et al. [15] proposed a wavelet kernel grey system model for consumption forecasting. ZHANG et al. [16] created an FPDGM(1,1) (Fractional Partial Differential Grey Model) to project China's natural gas consumption. LIU et al. [17] applied discretization techniques to develop a discrete fractional-order grey model with time power terms, predicting China's 2025 consumption will reach 439.14 billion cubic meters. ES Huseyin Avni [18] introduced a novel grey seasonal forecasting model for monthly natural gas consumption predictions in Turkey. Forecasting accuracy serves as a key criterion for evaluating model performance. To further enhance prediction precision, scholars have developed hybrid models for natural gas consumption forecasting. Some notable examples are as follows. HE Runming et al. [19] constructed an optimal combination model for consumption projections. Pala Zeydin[20] proposed a multi-hybrid modeling framework. WEI et al. [21] implemented a white-box hybrid model integrating Principal Component Analysis (PCA), Wavelet Packet Multiscale Analysis (WPMA), and Multiple Linear Regression (MLR). Manowska Anna et al. [22] established a hybrid model of ARIMA and LSTM artificial neural network to predict natural gas consumption. Hybrid models typically improve forecasting accuracy and reduce the sum of squared prediction errors. However, the aforementioned studies heavily rely on model accuracy, exhibiting limitations in addressing future uncertainties. To overcome this constraint, scholars have introduced scenario analysis into natural gas consumption forecasting. Scenario analysis, which considers the development trends of multiple situations, can effectively enhance the validity and credibility of the forecasting model when integrated into it. Representative studies are as follows. ZHENG Xiaoqiang et al. [23] utilized the LEAP (Low Emissions Analysis Platform) model under three substitution scenarios, projecting China's natural gas consumption to peak in 2041, 2045, and 2048 under respective assumptions. DUAN Hongbo et al. [24] explored the medium-to-long-term evolution trends of China's natural gas consumption across three defined policy scenarios.

In summary, while scholars have yielded substantial insights into both influencing factor analysis and predictive modeling of natural gas consumption, existing research exhibits notable gaps: ①Factor Analysis Limitations: Few studies conduct comprehensive and in-depth analysis of multicollinearity issues among influencing factors; ②Modeling Shortcomings: Rare efforts systematically perform stationarity testing on raw data or integrate factor decomposition with multi-scenario forecasting frameworks. Building upon these foundations, this study will select population size, affluence level, technological advancement, industrial structure, and energy consumption structure as potential determinants. It will employs ridge regression to assess data stationarity and address multicollinearity issues. Integrating with scenario analysis, it will develop an extended STIRPAT (Stochastic Impacts by Regression on Population, Affluence, and Technology) model to project China's natural gas consumption peak under differentiated pathways. These methodological innovations aim to provide actionable references for advancing China's Dual Carbon Goals (carbon peaking by 2030 and carbon neutrality by 2060).

## 2 CONSTRUCTION OF THE EXTENDED STIRPAT MODEL

The STIRPAT prediction model considers factors such as economy, affluence level, and technological advancement, and adds random factors to effectively eliminate the impact of proportional changes in factors on the distortion of analysis results, making up for the shortcomings of the IPAT model. It has been widely applied in empirical studies[25]. The generalized model expression is:

$$I_t = aP_t^b A_t^c T_t^d u \tag{1}$$

In Equation (1): $I_t$ represents environmental pressure data in the $t$-th year; $a$ denotes the constant term; $P_t$、$A_t$、$T_t$ correspond to population size, affluence level, and technological advancement in the $t$-th year, respectively; $b$、$c$、$d$ are the elasticity exponents for each respective variable; $u$ signifies the random error term.

There are numerous factors influencing natural gas consumption. In addition to population, affluence level, and technological advancement, industrial structure and energy consumption structures also significantly impact natural gas consumption. Based on this, we incorporate population, affluence level, technological level, industrial structure, and energy consumption structure into the predictive model, constructing an extended STIRPAT model. The factors in the extended STIRPAT model are defined as follows:

1) Population factor is represented by the total permanent population at year-end, denoted as variable P;
2) Affluence level factor is measured by per capita GDP, denoted as variable A;
3) Technological advancement factor is represented by energy consumption intensity, denoted as variable T;
4) Industrial structure factor is measured by the proportion of secondary industry composition [2], denoted as variable Y;
5) Energy consumption structure factor is measured by the share of natural gas in primary energy consumption [8], denoted as variable Z.

The general expression for establishing the extended STIRPAT model for natural gas consumption forecasting is as follows:

$$NGC_t = aP_t^b A_t^c T_t^d Y_t^f Z_t^g u \tag{2}$$

In it, $NGC$ represents natural gas consumption; $a$ is the constant term; $P$、$A$、$T$、$Y$、$Z$ are the driving force coefficients of the variables $b$、$c$、$d$、$f$、$g$; $u$ is the random error term; and $t$ denotes the time in the $t$-th year.

From Equation (2), the extended STIRPAT model is nonlinear. To simplify the solving process, we apply a logarithmic transformation to Equation (2), converting it into a linear model:

$$\ln NGC_t = \ln a + b\ln P_t + c\ln A_t + d\ln T_t + f\ln Y_t + g\ln Z_t + \ln u \tag{3}$$

In it, $b$、$c$、$d$、$f$、$g$ serve as the driving force coefficients of the variables $b$、$c$、$d$、$f$、$g$, reflecting the change in natural gas consumption caused by a variation in one variable while holding others constant.

## 3 PREDICTION AND ANALYSIS OF CHINA'S NATURAL GAS CONSUMPTION PEAK

### 3.1 Data Description

The data on China's natural gas consumption, population, affluence level, technological advancement, industrial structure, and energy consumption structure from 2000 to 2022, as selected in this study, are collated and calculated from publicly available sources including *China Statistical Yearbook*, *China Natural Gas Development Report (2022 Edition)*, and *China Natural Gas Development Report (2023 Edition)*. The relevant data are summarized in Table 1.

**Table 1** Relevant Data on Natural Gas Consumption and Influencing Factors in China

| Year | Natural Gas Consumption ($10^8 m^3$) | Population (10,000 persons) | Affluence Level (yuan/person) | Technological Advancement (ton/10,000yuan) | Industrial Structure (%) | Energy Consumption Structure (%) |
|---|---|---|---|---|---|---|
| 2000 | 245.03 | 126743 | 7912.08 | 1.47 | 45.54 | 2.2 |
| 2001 | 274.30 | 127627 | 8686.49 | 1.40 | 44.79 | 2.4 |
| 2002 | 291.84 | 128453 | 9475.64 | 1.39 | 44.45 | 2.3 |
| 2003 | 339.08 | 129227 | 10634.16 | 1.43 | 45.62 | 2.3 |
| 2004 | 396.72 | 129988 | 12450.40 | 1.42 | 45.90 | 2.3 |
| 2005 | 466.08 | 130756 | 14325.84 | 1.40 | 47.02 | 2.4 |
| 2006 | 573.32 | 131448 | 16693.94 | 1.31 | 47.56 | 2.7 |
| 2007 | 705.23 | 132129 | 20441.56 | 1.15 | 46.88 | 3.0 |
| 2008 | 812.94 | 132802 | 24039.14 | 1.00 | 46.97 | 3.4 |
| 2009 | 895.20 | 133450 | 26115.98 | 0.96 | 45.96 | 3.5 |
| 2010 | 1080.24 | 134091 | 30734.30 | 0.88 | 46.50 | 4.0 |
| 2011 | 1341.07 | 134916 | 36166.22 | 0.79 | 46.53 | 4.6 |
| 2012 | 1497.00 | 135922 | 39624.20 | 0.75 | 45.42 | 4.8 |
| 2013 | 1705.37 | 136726 | 43368.72 | 0.70 | 44.18 | 5.3 |
| 2014 | 1870.63 | 137646 | 46754.94 | 0.67 | 43.09 | 5.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2015 | 1931.75 | 138326 | 49799.62 | 0.63 | 40.84 | 5.8 |
| 2016 | 2078.06 | 139232 | 53608.01 | 0.59 | 39.58 | 6.1 |
| 2017 | 2393.69 | 140011 | 59426.47 | 0.55 | 39.85 | 6.9 |
| 2018 | 2817.09 | 140541 | 65410.17 | 0.51 | 39.69 | 7.6 |
| 2019 | 3059.68 | 141008 | 69961.65 | 0.49 | 38.59 | 8.0 |
| 2020 | 3339.89 | 141212 | 71776.27 | 0.49 | 37.84 | 8.4 |
| 2021 | 3772.96 | 141260 | 81356.15 | 0.46 | 39.29 | 8.8 |
| 2022 | 3746.95 | 141175 | 85723.90 | 0.45 | 39.92 | 8.4 |

### 3.2 Development of the Extended STIRPAT Model for China's Natural Gas Consumption Forecasting

Simultaneously incorporating numerous influencing factors into the prediction model, the potential problem of multicollinearity between factors inevitably leads to the risk of distorted prediction results [8]. To diagnose collinearity issues among the influencing factors, a Variance Inflation Factor (VIF) test was applied. A VIF value exceeding 10 indicates significant multicollinearity for a given variable. The multicollinearity test results for China's natural gas consumption influencing factors are presented in Table 2. According to Table 2, there is a potential multicollinearity relationship between various factors. Simply incorporating these influencing factors into the STIRPAT extended model at the same time can lead to overfitting of the STIRPAT extended model and a risk of distortion in the predicted results.

**Table 2** VIF Test Results

| Influencing Factors | $\ln P$ | $\ln A$ | $\ln T$ | $\ln Y$ | $\ln Z$ |
|---|---|---|---|---|---|
| VIF | 36.113 | 63.186 | 285.746 | 5.194 | 364.987 |

To accurately estimate the coefficients of the extended STIRPAT model and avoid estimation distortion, this study introduces ridge regression, a method capable of addressing multicollinearity and reducing data overfitting. The ridge regression approach is applied to fit the extended STIRPAT model for natural gas consumption forecasting, enabling precise coefficient estimation and mitigating the risk of distorted prediction results. Ridge regression stabilizes coefficient estimation by shrinking the coefficients of the extended STIRPAT model. The ridge regression estimates of the coefficients are presented in Table 3.

Analysis of Table 3 reveals that the ridge regression method has improved the underlying multicollinearity issues among the factors. All factors passed the P-value test, confirming that the coefficient estimates of the extended STIRPAT model are statistically significant. The coefficient of determination ($R^2$) for the ridge regression estimates is 0.986, indicating that the extended STIRPAT model explains 98.6% of the variations in China's natural gas consumption. This demonstrates a strong overall fit of the model and highlights the high reliability of its prediction results.

**Table 3** Results of undetermined coefficients for ridge regression estimation

| Variable | B | Std.Error | t | P | $R^2$ | Adjusted $R^2$ | F |
|---|---|---|---|---|---|---|---|
| $\ln a$ | -89.979 | 6.957 | -12.933 | 0.000*** | 0.986 | 0.982 | 239.184 |
| $\ln P$ | 8.366 | 0.598 | 13.991 | 0.000*** | | | |
| $\ln A$ | 0.102 | 0.011 | 8.945 | 0.000*** | | | |
| $\ln T$ | -0.526 | 0.031 | -16.838 | 0.000*** | | | |
| $\ln Y$ | 0.887 | 0.382 | 2.323 | 0.033** | | | |
| $\ln Z$ | 0.440 | 0.023 | 18.773 | 0.000*** | | | |

Note：***、**、*denote statistical significance at the1%, 5% and 10% level, respectively.

From the driving force coefficients of various factors, the coefficient for energy consumption intensity (representing technological level, T) is -0.526, indicating that energy consumption intensity has a negative effect on changes in natural gas consumption. Holding other factors constant, a 1% increase in energy consumption intensity leads to a 0.526% decrease in natural gas consumption. This demonstrates that advancements in technology effectively mitigate China's natural gas demand. The driving force coefficients for population (P), affluence level (A), industrial structure (Y), and energy consumption structure (Z) are 8.366, 0.102, 0.887, and 0.440, respectively, signifying positive contributions to natural gas consumption. Specifically: A 1% increase in population corresponds to an 8.366% rise in natural gas consumption; A 1% increase in affluence level (per capita GDP) corresponds to a 0.102% rise in natural gas consumption; A 1% increase in industrial structure corresponds to a 0.887% rise in natural gas consumption; A 1% increase in energy consumption structure corresponds to a 0.440% rise in natural gas consumption, assuming other variables remain unchanged. The established linear form of the extended STIRPAT model for China's natural gas consumption forecasting is expressed as follows:

$$\ln NGC_t = -89.979 + 8.366 \ln P_t + 0.102 \ln A_t - 0.562 \ln T_t + 0.877 \ln Y_t + 0.44 \ln Z_t \quad (4)$$

Convert equation (4) into a nonlinear form yields:

$$NGC_t = e^{-89.979} P_t^{8.366} A_t^{0.102} T_t^{-0.562} Y_t^{0.877} Z_t^{0.44} \quad (5)$$

In it, $e$ is the natural constant, approximately equal to 2.718.

When non-stationary data series lack cointegration relationships, the linear form of the extended STIRPAT model for China's natural gas consumption forecasting may exhibit spurious regression, severely compromising the model's prediction accuracy. To address this, the Augmented Dickey-Fuller (ADF) test [26] is employed to assess the stationarity of the data series. If a unit root is detected in a data series, it indicates non-stationarity; conversely, the absence of a unit root confirms stationarity. To further validate the reliability of the extended STIRPAT model's predictions, ensure the robustness of parameter estimates, and avoid spurious regression, the ADF test is applied to evaluate the stationarity of all variable data series. The ADF test results are presented in Table 4.

According to Table 4, the data sequences of each variable have passed the P-value test, and the AIC values of each variable are relatively low, confirming the stationarity of variables in the extended STIRPAT model. These variables can thus be incorporated into the extended STIRPAT model for forecasting China's natural gas consumption.

**Table 4** ADF Test Results

| Variable | Order of Differencing | t | P | AIC | Critical Values | | | Stationarity |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1% | 5% | 10% | |
| $\ln NGC$ | 2 | -6.232 | 0 | -66.596 | -4.223 | -3.189 | -2.73 | Stationary |
| $\ln P$ | 2 | -4.849 | 0 | -122.021 | -3.809 | -3.022 | -2.651 | Stationary |
| $\ln A$ | 2 | -4.987 | 0 | -10.548 | -3.833 | -3.031 | -2.656 | Stationary |
| $\ln T$ | 2 | -4.269 | 0.001 | -51.158 | -3.833 | -3.031 | -2.656 | Stationary |
| $\ln Y$ | 0 | -3.688 | 0.004 | -85.692 | -4.069 | -3.127 | -2.702 | Stationary |
| $\ln Z$ | 0 | -3.581 | 0.006 | -65.946 | -4.069 | -3.127 | -2.702 | Stationary |

### 3.3 Scenario Parameter Settings

The future trend of China's natural gas consumption is influenced by multiple uncertainties, and the peak time and value of natural gas consumption may vary in different scenarios. scenarios. This study establishes two overarching scenarios —Baseline Mode and Low-Carbon Mode— by comprehensively considering trends in China's population dynamics, affluence level, technological advancement, industrial restructure, and energy consumption structure. These scenarios simulate the future development paths of influencing factors under distinct conditions, with their combinations yielding eight distinct development sub-scenarios (see Table 5). In Baseline Mode, the future growth rates of influencing factors are calibrated based on targets specified in relevant national policy documents. In the Low-Carbon Mode, to align with China's dual carbon goals, parameters are adjusted as follows compared to the Baseline Mode: accelerated optimization of the energy consumption structure; heightened technological advancement effects; moderated growth rates for population, affluence level, and industrial structure.

**Table 5** Different Development Scenario Settings

| Scenario | Population | Affluence Level | Technological advancement | Industrial Structure | Energy Consumption Structure |
|---|---|---|---|---|---|
| Baseline Scenario | Baseline | Baseline | Baseline | Baseline | Baseline |
| Scenario1 | Low-Carbon | Low-Carbon | Baseline | Low-Carbon | Baseline |
| Scenario2 | Low-Carbon | Baseline | Low-Carbon | Baseline | Low-Carbon |
| Scenario3 | Baseline | Baseline | Baseline | Low-Carbon | Baseline |
| Scenario4 | Baseline | Baseline | Low-Carbon | Low-Carbon | Baseline |
| Scenario5 | Baseline | Baseline | Low-Carbon | Baseline | Baseline |
| Scenario6 | Baseline | Baseline | Low-Carbon | Baseline | Low-Carbon |
| Scenario7 | Baseline | Low-Carbon | Baseline | Low-Carbon | Baseline |

Parameter Settings for Baseline and Low-Carbon Modes of Influencing Factors are as follows.

Population Factor: China's population grew from 1.267 billion in 2000 to 1.412 billion in 2021 (a 1.11-fold increase), exhibiting a fluctuating growth pattern. During the 14th Five-Year Plan period (2021 – 2025), China will undergo a critical demographic shift, entering its first phase of negative population growth [27]. The annual average growth rate is projected to decline to approximately 0.2%, with the population reaching a peak plateau of around 1.431 billion. Subsequently, the growth rate will gradually decrease, and China's population is expected to sustain negative growth from 2026 to 2050, with the annual average growth rate slowing to -0.2%. By 2050, the population is forecast to drop to approximately 1.368 billion (0.97 times the 2021 level), while the annual average growth rate declines from 1.79% (2000 – 2021) to -0.11% (2022 – 2050). Based on these projections: population growth rate in baseline mode can be set to -0.2‰ to 1.4‰. and population growth rate in low-carbon mode can be set to -4 ‰ to -0.25 ‰.

Affluence Level Factor: The affluence level, a critical indicator of socioeconomic development, is predominantly

influenced by national economic performance. China's GDP growth rate declined from 8.5% in 2000 to 3% in 2022, before rebounding to 5.2% in 2023. The national economy has transitioned from a scale-and-speed-driven phase to a structural adjustment phase and is now entering a high-quality development phase[10]. Future economic growth is projected to moderate. Based on these trends: the per capita GDP growth rate in baseline mode can be set to 4.5%. and the per capita GDP growth rate in the low-carbon mode can be set to 3.5%.

Technological Level Factor: Technological advancement serves as a critical indicator reflecting China's energy utilization efficiency and ecological conditions. Since the introduction of the dual carbon goals, China's energy utilization technology has progressively improved, enhancing energy efficiency and further ameliorating the ecological environment. Drawing on the historical trajectory of energy consumption intensity in developed nations and aligned with t*he Guiding Opinions on Fully and Accurately Implementing the New Development Philosophy to Achieve Carbon Peaking and Carbon Neutrality*, energy consumption intensity is projected to decline significantly. However, further substantial reductions will become increasingly challenging once intensity reaches a certain threshold [10]. Based on these insights: the rate of decrease in energy consumption intensity for technological level in baseline mode can be set to -0.5% to 2%, and the rate of decrease in energy consumption intensity for the low-carbon mode can be set to -0.5% to 2.5%.

Industrial Structure Factor: In response to national policies such as energy conservation, emissions reduction, and the dual carbon goals, China's industrial sector has undergone continuous optimization and adjustment, maintaining a commitment to technological innovation, green development, and industrial upgrading. The proportion of energy-intensive industries has steadily declined. Based on these trends: the annual reduction rate of energy-intensive industries' share in baseline mode can be set to 1.65% and the annual reduction rate of energy-intensive industries' share in the low-carbon mode can be set to 1.7%.

Energy Consumption Structure Factor: The optimization of energy consumption structure is reflected by the share of natural gas consumption in primary energy. As a critical component in building China's modern energy system, natural gas's transitional role has become increasingly prominent in the short-to-medium term, though its long-term transitional significance is expected to gradually diminish. While China' s natural gas consumption has risen annually, its growth rate has shown a declining trend. According to *the 14th Five-Year Plan for a Modern Energy System* and *the Energy Production and Consumption Revolution Strategy (2016 – 2030)*, natural gas is projected to account for 15% of primary energy consumption by 2030, with its share continuing to grow. Based on these projections: the growth rate of natural gas consumption proportion in the baseline mode of energy consumption structure can be set to 2.5%, and the growth rate of natural gas consumption proportion in the low-carbon mode of energy consumption structure can be set to 3%.

### 3.4 Scenario-Based Forecast and Analysis of China's Natural Gas Consumption Peak

By incorporating the development trends of influencing factors under different scenarios into the extended STIRPAT model for China's natural gas consumption forecasting, the prediction results across scenarios are illustrated in Figure 1 and Table 6. Analysis of Figure 1 and Table 7 reveals distinct evolution patterns of China's natural gas consumption under various development scenarios, with specific details as follows:

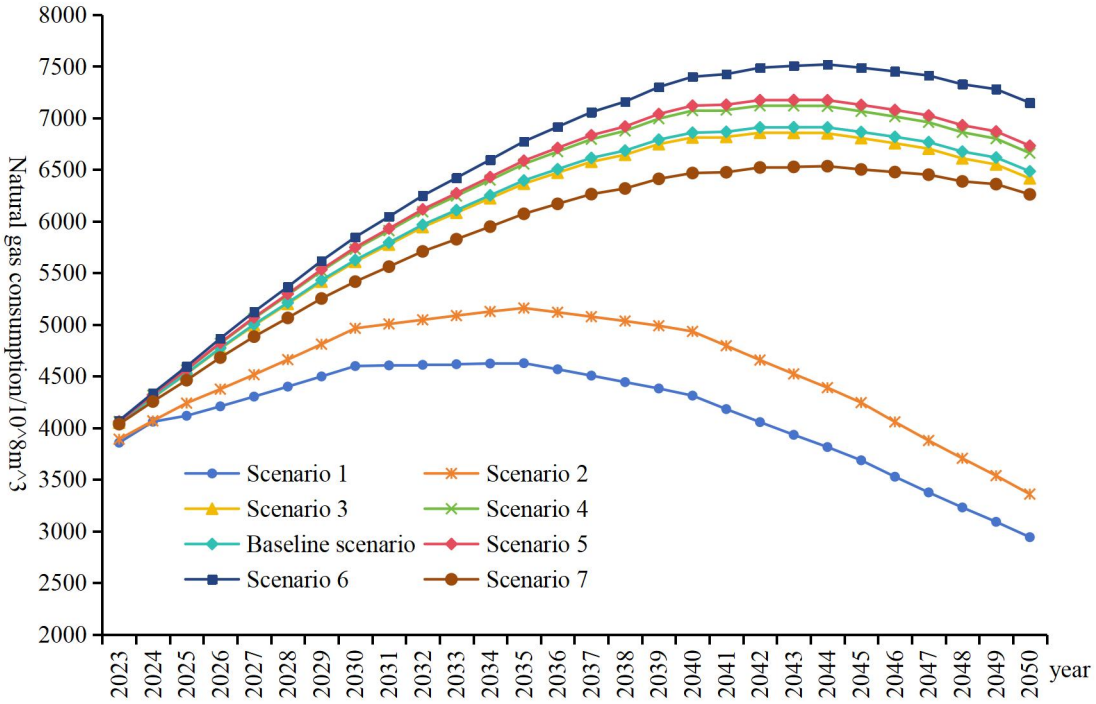


**Figure 1** Future Natural Gas Consumption Trends in China under Different Scenarios

**Table 6** Peak Time and Peak Value of Natural Gas Consumption in China

| Scenario | Peak Year | Peak/$10^8m^3$ | Scenario | Peak Year | Peak/$10^8m^3$ |
|---|---|---|---|---|---|
| Baseline Scenario | 2043 | 6910.61 | Scenario1 | 2035 | 4626.32 |
| Scenario2 | 2035 | 5159.83 | Scenario3 | 2042 | 6856.86 |
| Scenario4 | 2042 | 7118.79 | Scenario5 | 2043 | 7174.59 |
| Scenario6 | 2044 | 7518.39 | Scenario7 | 2044 | 6533.55 |

Under the Baseline Mode, where population, affluence level, technological advancement, industrial structure, and energy consumption structure follow their baseline development trends, China's natural gas consumption is projected to peak in 2043 at approximately 6,910.61 × $10^8$ $m^3$. Between 2040 and 2045, natural gas consumption will remain in a plateau phase, with the annual growth rate declining from 12.46% (2000–2022) to 2.58% (2023–2043). Subsequently, from 2044 to 2050, consumption is expected to decrease at an annual negative growth rate of -0.71%, dropping to $6483.93\times10^8 m^3$ by 2050.

In scenario 1, the technological advancement and energy consumption structure follow the baseline development trend, while the population, affluence level, and industrial structure follow the low-carbon development trend. China's natural gas consumption will reach its peak in 2035, with a peak of approximately $4626.32\times10^8 m^3$. The average annual growth rate of natural gas consumption will decrease from 12.46% from 2000 to 2022 to 0.16% from 2023 to 2035. From 2036 to 2050, China's natural gas consumption will decline at an average annual growth rate of -2.79%, and by 2050, natural gas consumption will decrease to $2941.36\times10^8 m^3$.

Under Scenario 2, where affluence level and industrial structure develop according to baseline trends while population, technological advancement, and energy consumption structure follow low-carbon development trajectories, China's natural gas consumption is projected to peak in 2035 with a peak volume of approximately $5159.83\times10^8 m^3$. The annual growth rate of natural gas consumption will decline from 12.46% during 2000-2022 to 0.25% during 2023-2035. Subsequently, from 2036 to 2050, China's natural gas consumption is expected to decrease at an average annual rate of -2.65%, ultimately declining to $3358.09\times10^8 m^3$ by 2050.

Under Scenario 3, where population, technological advancement, energy consumption structure, and affluence level according to baseline trends while industrial structure follows a low-carbon development trajectory, China's natural gas consumption is projected to peak in 2042 with a peak volume of approximately $6856.86\times10^8 m^3$. The annual growth rate of natural gas consumption will decline from 12.46% during 2000-2022 to 2.67% during 2023-2042. Subsequently, natural gas consumption will enter a plateau phase from 2043 to 2045. From 2043 to 2050, China's natural gas consumption is expected to decrease at an average annual rate of -0.66%, ultimately declining to $6415.36\times10^8 m^3$ by 2050.

Under Scenario 4, where population, energy consumption structure, and affluence level according to baseline trends while technological advancement and industrial structure follow low-carbon development trajectories, China's natural gas consumption is projected to peak in 2042 with a peak volume of approximately $7118.79\times10^8 m^3$. The annual growth rate of natural gas consumption will decline from 12.46% during 2000-2022 to 2.85% during 2023-2042. Subsequently, natural gas consumption will enter a plateau phase from 2043 to 2046. From 2043 to 2050, China's natural gas consumption is expected to decrease at an average annual rate of -0.66%, ultimately declining to $6660.42\times10^8 m^3$ by 2050.

Under Scenario 5, where population, industrial structure, energy consumption structure, and affluence level according to baseline trends while technological levels follow a low-carbon development trajectory, China's natural gas consumption is projected to peak in 2043 with a peak volume of approximately $7118.79\times10^8 m^3$. The annual growth rate will decline from 12.46% during 2000-2022 to 2.75% during 2023-2043, with natural gas consumption remaining in a plateau phase from 2040 to 2045. Subsequently, from 2044 to 2050, China's natural gas consumption is expected to decrease at an average annual rate of -0.71%, ultimately declining to $6731.62\times10^8 m^3$ by 2050.

Under Scenario 6, where population, industrial structure, and affluence level according to baseline trends while technological advancement and energy consumption structure follow low-carbon development trajectories, China's natural gas consumption is projected to peak in 2044 with a peak volume of approximately $7518.39\times10^8 m^3$. The annual growth rate will decline from 12.46% during 2000-2022 to 2.83% during 2023-2044. Subsequently, from 2045 to 2050, China's natural gas consumption is expected to decrease at an average annual rate of -0.72%, ultimately declining to $7147.53\times10^8 m^3$ by 2050.

Under Scenario 7, where population, technological advancement, and energy consumption structure develop according to baseline trends while industrial structure and affluence level follow low-carbon development trajectories, China's natural gas consumption is projected to peak in 2044 with a peak volume of approximately $6533.56\times10^8 m^3$. The annual growth rate will decline from 12.46% during 2000-2022 to 2.21% during 2023-2044. Subsequently, from 2045 to 2050, China's natural gas consumption is expected to decrease at an average annual rate of -0.61%, ultimately declining to $6260.56\times10^8 m^3$ by 2050.

It is not difficult to observe that the peak time and amount of China's natural gas consumption peak vary across different

scenarios. It can be predicted that with China's accelerating population decline, the rapid rise of renewable energy replacing fossil fuels, and the comprehensive implementation of green low-carbon development, China's natural gas consumption is likely to peak around 2035, with the peak volume estimated between $4600\times10^8 m^3 \sim 5200\times10^8 m^3$ [28].If China's negative population growth is alleviated, energy efficiency is improved, energy structure transformation is continuously promoted, industrial structure is constantly optimized and adjusted, and natural gas has a long-term role as a transitional energy, it is predicted that China's natural gas consumption will peak in 2040-2045 [23], with the volume ranging between $6500\times10^8 m^3 \sim 7500\times10^8 m^3$. This aligns broadly with the findings of *the World and China Energy Outlook* report by CNPC Economics & Technology Research Institute and the consensus among scholars regarding China's natural gas consumption peaking [29-30].

From the baseline scenario and Scenario 5, both project a peak year of 2043 for China's natural gas consumption. However, Scenario 5 yields a higher peak volume about $263.98\times10^8 m^3$ than that of the baseline, indicating that low-carbon technological advancements effectively stimulate natural gas consumption growth, underscoring technology as a critical driver. Comparing Scenario 1 and Scenario 2, both scenarios predict a peak in 2035, yet Scenario 2 exhibits a peak volume approximately $533.51\times10^8 m^3$ higher than that of Scenario 1. Similarly, in Scenarios 6 and 7, the peak occurs in 2044, with Scenario 6's peak volume exceeding Scenario 7's by around $984.84\times10^8 m^3$. This suggests that the combined low-carbon development of technological levels and energy consumption structure exerts a stronger driving effect on natural gas consumption growth than the joint influence of affluence and industrial restructuring. Analyzing Scenario 1 versus Scenario 7 and Scenario 2 versus Scenario 6, it is clear that low-carbon population development effectively reduces natural gas consumption growth, advancing the peak by nearly a decade. This highlights the significant impact of demographic factors on China's natural gas consumption trends. Between Scenarios 3 and 4, both project a peak in 2042, but Scenario 4's peak volume surpasses Scenario 3's, demonstrating that the synergistic low-carbon development of technology and industrial structure drives natural gas consumption more effectively than industrial restructuring alone. Comparing Scenarios 4 and 5, low-carbon industrial restructuring reduces consumption growth and accelerates peak timing. Conversely, between Scenario 5 and 6, low-carbon energy consumption structure development delays the peak period and promotes consumption growth.

### 3.5 Further Discussion

To further validate the reliability of the results, a comparative analysis was conducted between the natural gas consumption data for 2023 and 2024 released by China's National Bureau of Statistics and the predictions derived from this study. In 2023 and 2024, China's natural gas market maintained stable growth, with consumption reaching 394.53 billion cubic meters and 426.05 billion cubic meters, respectively. As shown in Table 7, the absolute errors between the predicted values under all eight scenarios and the actual observed values for 2023 and 2024 remain below 5%. This demonstrates that the scenario assumptions in this study are reasonable and that the predictions exhibit high accuracy. The constructed extended STIRPAT model is therefore validated as a robust tool for forecasting trends in China's natural gas consumption.

**Table 7** Analysis of Predicted and Actual Natural Gas Consumption in China from January to September 2024 and 2023

| | Actual | Scenario 1 | Scenario 2 | Scenario 3 | Scenario4 | Baseline Mode | Scenario 5 | Scenario6 | Scenario7 |
|---|---|---|---|---|---|---|---|---|---|
| 2023 Natural Gas Consumption/$10^8$m$^3$ | 3945.30 | 3856.29 | 3889.83 | 4049.61 | 4060.52 | 4051.15 | 4062.06 | 4070.77 | 4035.67 |
| Mean Absolute Percentage Error/% | | 2.25 | 1.42 | 2.64 | 2.92 | 2.68 | 2.95 | 3.18 | 2.29 |
| 2024 Natural Gas Consumption/$10^8$m$^3$ | 4260.5 | 4058.99 | 4067.84 | 4291.88 | 4315.04 | 4295.14 | 4318.32 | 4336.85 | 4254.87 |
| Mean Absolute Percentage Error/% | | 4.72 | 4.52 | 0.74 | 1.28 | 0.81 | 1.36 | 1.79 | 0.13 |

With the high-quality and rapid development of China's economy and the continuous advancement of carbon peaking policies, China's natural gas consumption and imports have grown rapidly, leading to a persistent expansion of the supply-demand gap and a year-on-year increase in external dependence[31]. The future natural gas supply-demand relationship in China is expected to remain tight. Scholars predict that China's natural gas production will peak between 2035 and 2045, with peak production levels within this range[32]. Under optimistic scenarios, China's external dependence on natural gas is projected to reach 39%, while pessimistic estimates suggest it could rise to 55%. To ensure national energy security, it is imperative to vigorously implement the Seven-Year Action Plan for oil and gas reserve expansion and production enhancement, establish a diversified natural gas import system, and improve a multi-level natural gas storage mechanism [33].

## 4 CONCLUSION

This study identifies population, affluence level, technological advancement, industrial structure, and energy

consumption structure as key factors influencing China's natural gas consumption. By employing the VIF test to address multicollinearity among variables and introducing the ridge regression method to eliminate its effects, the parameters of the extended STIRPAT model were determined. Scenario analysis was further applied to explore peak natural gas consumption trends in China. The main conclusions are as follows:

(1) The extended STIRPAT model, incorporating factors such as population, affluence level, technological advancement, industrial structure, and energy consumption structure, demonstrates high predictive accuracy and reliability. This model can serve as an effective tool for analyzing the evolution of natural gas consumption in other regions.

(2) As China transitions into a high-quality development stage, characterized by continuous improvements in energy efficiency and industrial restructuring, natural gas will retain its critical role as a transitional energy. China's natural gas consumption is projected to enter a peak plateau phase between 2040 and 2045, with consumption levels ranging from $6500\times10^8 m^3 \sim 7500\times10^8 m^3$.

(3) To facilitate the peaking of natural gas consumption, China must optimize population growth, strengthen measures aligned with the "dual carbon" goals, prioritize breakthroughs in core renewable energy technologies, accelerate the commercialization and adoption of renewable energy innovations, and advance the green and low-carbon transformation of its energy system. Concurrently, efforts should focus on increasing natural gas reserves and production, boosting R&D investments and technological innovation in critical sectors, establishing diversified natural gas import and storage mechanisms, cultivating new quality productive forces in the energy sector, and constructing a modern energy system to safeguard national energy security.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## ACKNOWLEDGMENTS

The authors are grateful to anonymous for their helpful and constructive comments on this paper. The relevant works done are supported by Sichuan Science and Technology Program (No. 2023NSFSC1038) in China.

## REFERENCES

[1] J L Wang, N Li. Influencing factors and future trends of natural gas demand in the eastern, central and western areas of China based on the grey model. Natural Gas Industry, 2020, 40(2): 149–158.

[2] H B Li, J J Zhang. A new natural gas demand forecasting model and its application in the Sichuan-Chongqing area. Natural Gas Industry, 2021, 41(4): 167–175.

[3] M Han, H B Li, K Liu. Analysis and forecast of China's energy demand under the "Dual Carbon" goal. Ecological Economy, 2024, 40(11): 31–37.

[4] J Chai, Y J Zhao, T Liang, et al. Dynamic analysis and forecast of industry heterogeneity of natural gas consumption by Chinese non-resident users based on a new integrated analysis and forecasting model framework. Journal of Systems Science and Mathematical Sciences, 2022, 42(2): 318–336.

[5] J Gao, X C Dong. Stimulating factors of urban gas consumption in China. Natural Gas Industry, 2018, 38(3): 130–137.

[6] M Y Raza, B Q Lin. Future outlook and influencing factors analysis of natural gas consumption in Bangladesh: An economic and policy perspectives. Energy Policy, 2023, 173: 113379.

[7] J Y Liu, S X Wang, N Wei, et al. Natural gas consumption forecasting: A discussion on forecasting history and future challenges. Journal of Natural Gas Science and Engineering, 2021, 90: 103930.

[8] H B Li, J J Zhang. Analysis of influencing factors of natural gas demand and forecast of future demand. Operations Research and Management Science, 2021, 30(9): 132–138.

[9] X Z Mu, G H Li. Study on natural gas consumption forecast and influence factors in China based on system dynamics model. Journal of Engineering Studies, 2018, 10(1): 56–67.

[10] H B Li, J J Zhang. China's energy consumption structure and forecast on natural gas demand. Ecological Economy, 2021, 37(8): 71–78.

[11] H B Li, M Han. Forecast of China's natural gas demand based on the double-logarithmic model with stepwise regression method. Energy Sources Part A – Recovery Utilization and Environmental Effects, 2023, 45(3): 8491–8506.

[12] H P Wang, Z Z Zhang. A novel grey model with fractional reverse accumulation for forecasting natural gas consumption. Computers & Industrial Engineering, 2023, 179: 109189.

[13] H B Li, M Han, K Liu, et al. Forecast of urban natural gas demand trend in China. Petroleum and New Energy, 2024, 36(3): 6–13.

[14] W Q Wu, X Ma, B Zeng, et al. A novel grey Bernoulli model for short-term natural gas consumption forecasting. Applied Mathematical Modelling, 2020, 84: 393–404.

[15] X Ma, H F Lu, M D Ma, et al. Urban natural gas consumption forecasting by novel wavelet-kernelized grey system model. Engineering Applications of Artificial Intelligence, 2023, 119: 105773.

[16] J Zhang, Y P Qin, H Q Duo. The development trend of China's natural gas consumption: A forecasting viewpoint based on grey forecasting model. Energy Reports, 2021, 7: 4308–4324.
[17] C Liu, W Z Wu, W L Xie, et al. Forecasting natural gas consumption of China by using a novel fractional grey model with time power term. Energy Reports, 2021, 7: 788–797.
[18] H A Es. Monthly natural gas demand forecasting by adjusted seasonal grey forecasting model. Energy Sources Part A-Recovery Utilization and Environmental Effects, 2020, 43(1): 54–69.
[19] H R He, F P Wang, H B Li, et al. China's predicting natural-gas demand based on an optimal combination mode. Natural Gas Technology and Economy, 2021, 15(6): 50–57.
[20] Z Pala. Comparative study on monthly natural gas vehicle fuel consumption and industrial consumption using multi-hybrid forecast models. Energy, 2022, 263(c): 125826.
[21] N Wei, L H Yin, C Li, et al. Forecasting the daily natural gas consumption with an accurate white-box model. Energy, 2021, 232: 121036.
[22] A Manowska, A Rybak, A Dylong, J Pielot. Forecasting of natural gas consumption in Poland based on ARIMA-LSTM hybrid model. Energies, 2022, 14(24): 8597.
[23] X Q Zheng, L L Qian. Scenario analysis on China's gas consumption based on LEAP model. Natural Gas Technology and Economy, 2023, 17(1): 87–92.
[24] H B Duan, X Tang, K P Ren, et al. China's middle- and long-term pathways of natural gas consumption: Based on a multi-model comparison framework. Natural Gas Industry, 2021, 41(2): 193–201.
[25] L L Li, T T Xu, F Y Li, et al. Gravity center evolution paths and growth factor decomposition of residential natural gas consumption in China. Journal of Natural Resources, 2017, 32(4): 606–619.
[26] Y Niu, H P Li, Y H Liu, et al. Overview of feature screening methods for ultra-high-dimensional data. Chinese Journal of Applied Probability and Statistics, 2021, 37(1): 69–110.
[27] G Yang. China's population changes and major transition during the 14th Five-Year Plan period. Journal of Beijing University of Technology (Social Sciences Edition), 2021, 21(1): 17–29.
[28] Z Wang, Y H Kong, M Y Li. Research on the supply security of China's natural gas under the new situation. Natural Gas and Oil, 2023, 41(1): 1–7.
[29] F Gao, B L Liu, M L Li, et al. Global natural gas development trend and enlightenment. China Petroleum Exploration, 2022, 27(6): 13–21.
[30] P F Song, C Zhang, J G Hou, et al. Technology development and carbon emission reduction forecast of natural gas chemical industry under carbon constraints. Low-Carbon Chemistry and Chemical Engineering, 2023, 48(2): 71–77.
[31] L L Yang. Study on high-quality development strategy of oil and gas industry in China under the concept of new quality productive forces. China Mining Magazine, 2024, 33(5): 32–38.
[32] A L Jia, G Cheng, W Y Chen, et al. Forecast of natural gas supply and demand in China under the background of “Dual Carbon Targets”. Petroleum Exploration and Development, 2023, 50(2): 431–440.
[33] H B Li, Y Luo, M Han, et al. Security evaluation and suggestion of natural gas supply & demand in China. World Petroleum Industry, 2024, 31(5): 1–9.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3157**

# IN WHAT WAYS MIGHT INTANGIBLE CULTURAL HERITAGE CONTRIBUTE TO THE PROMOTION OF CHINESE CULTURAL IDENTITY? -- BASED ON THE DISCOURSE INVESTIGATION OF OVERSEAS SHORT VIDEOS ON MAZU CULTURE

Pei Tang[1], Shuo Zhu[2*]
[1]*Department of Culture and Communication, Putian University, Putian 351100, Fujian, China.*
[2]*School of Management, Putian University, Putian 351100, Fujian, China.*
*Corresponding Author: Shuo Zhu, Email: 281854250@qq.com*

**Abstract:** The "Mazu Belief" has been designated as China's first intangible cultural heritage in the religion category. A comprehensive analysis of the discourse among communicators and users of 226 Mazu culture short videos on the TikTok reveals a deliberate effort by communicators to reinforce the connection between overseas Chinese and China. This effort is manifested through the dissemination of "the common belief in Mazu culture" with the objective of fostering a sense of unity and belonging among the Chinese nation. The high-frequency keywords in the user discourse of the short videos exhibit a strong overlap with those of the communicators, thereby forming a key discourse with beliefs in Mazu culture. The conclusion indicates that the overseas short videos of Mazu culture provide a communication paradigm of intangible cultural heritage for forging the sense of Chinese national community through the path of "empathetic narrative and synergistic communication".
**Keywords:** Meizhou island; The Mazu Culture; Overseas short video

## 1 INTRODUCTION

Intangible cultural heritage constitutes a significant component of fine traditional Chinese culture. It is frequently intricately intertwined with specific national festivals, ritual practices and custom, which elicit common national sentiments and a sense of belonging among individuals. Intangible cultural heritage can function as tourist destination symbols, thereby attracting visitors[1]. Concurrently, Intangible cultural heritage can facilitate cooperation and exchange among overseas Chinese communities, thereby reinforcing their cultural identity. It can be posited that Intangible cultural heritage exerts a substantial, cohesive influence on both Chinese nation and overseas Chinese communities. In particular, Intangible cultural heritage has been demonstrated to play a pivotal role in the process of cultural preservation and promotion of Chinese cultural identity by facilitating the transmission of history, fostering emotional connections, and catalyzing development. Intangible cultural heritage serves as a unifying force, transcending the boundaries of ethnic groups to foster a shared cultural heritage. It functions as an emotional bond, a foundational value, and a practical conduit, thereby contributing to the advancement of Chinese cultural identity. Ma culture is characterized by a pronounced sense of inclusiveness and openness. This cultural symbol is not only emblematic of China's coastal regions but also boasts a substantial following among overseas Chinese communities. Annually, Mazu cultural festivals and Mazu temple fairs are held around the world, attracting the participation of many overseas Chinese. These activities have been shown to enhance the understanding and identification of overseas Chinese communities with Chinese culture, as well as to promote exchanges and integration between different ethnic groups and regions. This provides a robust foundation for the promotion of Chinese cultural identity.
Secondly, an examination of discourse practices in short videos abroad concerning Mazu culture, as they relate to Chinese cultural identity.

## 2 THE PRACTICE OF CHINESE CULTURAL IDENTITY DISCOURSE IN OVERSEAS SHORT VIDEOS ABOUT MAZU CULTURE

Technology is defined as the production and dissemination of discourse. Prior to the contributions of McLuhan and Innes, the materiality of the medium existed in a state of obscurity. Kittler, drawing upon the perspectives of McLuhan, Innes, Shannon's information theory, and Foucault's discourse analysis, ultimately the concept of Aufschreibesysteme[2] serves to expand the materiality of the medium into the materiality of communication. Specifically, Shannon's information theory is principally "based on the Shannonian theory of sources, channels, reception, as well as input, transmission, and output of information"[3]. In contrast, Foucault underscored that the content of discourse, rather than the thoughts or reflections of the speakers, is of paramount importance[4]. He argued that what systematically organizes discourse from the outset is of greater significance. In this manner, Kittler offered an examination of the technical substance of "Aufschreibesysteme" . Peters conceptualizes this "Aufschreibesysteme" as a "substrate for the cultivation of all other media"[5].
The advent of Internet technology has precipitated a transformation in traditional media, such as newspapers and television, towards a digital format. In this context, “brief video content has attained a notable degree of popularity

among media outlets and their users”[6]. This popularity can be attributed to the ability of these brief videos to deliver new information with expediency, catering to the diverse informational needs of individuals in a timely manner. In the context of the digital era, short videos have emerged as a significant medium for the international communication of Mazu culture. The utilization of Internet technology has rendered short videos a prominent medium for information input, transmission, and output, as well as for discourse rules such as "everyone can have a voice" and "the communicators and the users can fully interact" . The manner in which information is input, transmitted, and output, as well as the principles of discourse, such as the notion that all individuals have the capacity to speak and that communicators and users can engage in full interaction, are evidently distinct from those observed in traditional media, such as television. The materiality of short videos has been shown to lead to a change in the way Mazu culture is practiced, and its discourse practice of Chinese cultural identity unfolds in the "Aufschreibesysteme" of the communicators and the users.

The present study focuses on the discourse of Mazu culture in short videos created for overseas audiences. The researcher collected a total of 487 Mazu culture overseas short videos on the TikTok overseas platform from February 20, 2024, to February 20, 2025. After eliminating duplicated content and selecting representative content, 226 Mazu culture overseas short videos were selected for analysis. The discourse production of Mazu culture short videos is examined in terms of the communicator's discourse and the user's discourse respectively.

### 2.1 The Production of Discourse by Short Video Communicators

Initially, the titles of 226 brief videos underwent lexicographic processing, and subsequently, the top 30 keywords of the Mazu culture overseas short video, including "Mazu," "Pilgrimage," "blessing," among others, were obtained. The top 30 keywords based on social network analysis Methods by SPSSAU. Finally, the high-frequency keyword network structure of overseas short video titles and contents related to Mazu culture was obtained.

Firstly, the prevailing folk belief among Chinese communities worldwide posits that Mazu culture serves as a pivotal conduit in the interaction between Chinese communities. The global Chinese diaspora shares analogous beliefs and ceremonies surrounding Mazu. The ceremonial attire, musical compositions, and choreographed performances exhibit shared cultural elements. These common ceremonies constitute a pivotal component in the transmission of Mazu culture. Through these ceremonies, individuals can enhance their comprehension and acknowledgment of Mazu culture. The following investigation sought to determine the most frequently used and central keywords in the title content of A-Ma culture overseas short videos. The analysis of the high-frequency keyword network structure of the title content of the aforementioned videos revealed that the terms "Mazu," "cross-strait," and "compatriot" were the most frequently used and central keywords. The terms "Mazu," "cross-strait," and "compatriot" are the top three keywords in terms of frequency and degree of centrality. These terms are the centerpiece of the cultural exchange and emotional connection of the Chinese diaspora's Mazu beliefs. This phenomenon indicates a deliberate effort on the part of communicators to fortify the connections between the motherland and the Chinese diaspora through the medium of short videos showcasing Mazu culture in foreign countries. The more commonalities the general Chinese diaspora has in material aspects such as lifestyle, language and script, interests and demands, and economic development, and especially in spiritual aspects such as attitudes, emotions, and values, the easier it is to develop a sense of belonging to and identification with Chinese culture[7]. In the context of Mazu faith, the Chinese diaspora exhibits a notable degree of uniformity in their spiritual inclinations, particularly concerning their devotion to Mazu[8].

Secondly, the cultural practice of blessing, a shared heritage of the Chinese diaspora worldwide, finds expression in Mazu culture. This tradition is characterized by its focus on the pursuit of blessings through ceremonies and rituals. These practices reflect not only the aspirations of individuals for a better life but also the spiritual qualities and cultural heritage of the Chinese nation. The centrality of high-frequency keywords such as "blessing" and "Pilgrimage" is also emphasized, and the discourse of Mazu praying for blessings by Chinese diaspora has been incorporated into Chinese culture by disseminators. The practice of blessing constitutes an integral facet of China's rich cultural heritage, serving not only as a manifestation of faith and cultural legacy but also as a conduit for articulating collective sentiments and seeking solace. Furthermore, it functions as a medium for individuals to articulate their shared sentiments and seek solace. The cultural practice of bestowing blessings reflects the Chinese diaspora's profound love for life and their collective aspiration for a hopeful future. This positive and uplifting spiritual trait is emblematic of the universal pursuit of "blessing" among the Chinese populace. The Chinese populace partakes in the blessing rituals of Mazu culture, including "giving blessings," and "Pilgrimage." These rituals utilize common symbols of blessing culture, which play a pivotal role in the promotion of Chinese cultural identity.

Thirdly, high-frequency keywords such as "song and dance," "parade," "activities," and "folklore" fully reflect the integration and development of folk activities of the Chinese diaspora with Mazu culture. Therefore, it can be posited that folkloric pursuits serve as a pivotal conduit for the transmission of Mazu culture. The organization of folk activities by Global Chinese is a notable aspect of their cultural expression. These activities include collective sacrifices and round-the-border patrols, which are performed on occasions such as Mazu's birthdays or ceremonies. The significance of these practices lies in their ability to facilitate a deeper understanding of the connotations and the significance of Mazu culture among participants. The collective participation of global Chinese in Mazu folklore activities has been demonstrated to foster enhanced cohesion and a sense of belonging among this demographic. These activities contribute to the cultural enrichment of Chinese society and facilitate exchanges and mutual assistance among its members.

Fourthly, the high-frequency words "Putian," "Meizhou," and "Ancestral Temple" reflect the cultural homogeneity and

spiritual ties of the Mazu Ancestral Land Culture. Mazu culture, originating from Meizhou Island in Putian, Fujian Province, is a salient example of marine culture, embodying the traditional virtues and humanistic spirit of the Chinese nation. The spirit of "virtue, goodness, and love" in Mazu's beliefs is highly compatible with the concepts of "solidarity, unity, tolerance, and interdependence" in Chinese culture. Consequently, the cultural heritage of the Mazu ancestral land has emerged as a pivotal spiritual bond, fostering a sense of unity among Chinese individuals both within the nation and in global communities. The exchange and dissemination of Mazu culture has been demonstrated to enhance the sense of identity and belonging of overseas Chinese to their homeland. Furthermore, it has been shown to promote the exchange and mutual understanding of Chinese and foreign cultures. The cultural exchanges that occur within the Mazu ancestral land serve to transcend the conventional boundaries of space and time, thereby fostering a sense of Chinese cultural identity, with the ancestral land serving as the pivotal nexus for these cultural interactions.

### 2.2 An Examination of the Discourse Production of Users of Short Videos

The researcher then proceeded to compile the comments of overseas Mazu video users into a list of words to identify the top 25 high-frequency keywords. These keywords were then regarded as the nodes of the discourse construction of overseas Mazu video users. To obtain the network structure of high-frequency keywords in the discourses of overseas Mazu video users, the researcher conducted a social network analysis through SPSSAU. An analysis of the data revealed a high degree of overlap between the most frequently used keywords in overseas short videos about Mazu and those used by the disseminators of these videos. The most notable of these keywords were "Mazu," "Miaozhou," and "belief." A close examination of the social network structure reveals that the terms "Mazu," "Meizhou," "faith," and "cross-strait" occupy a central role in both the communicator's discourse and the user's discourse of overseas Mazu short videos.

In order to further explore the key discourse surrounding Mazu cultural beliefs, the study obtained three clusters following the analysis of high-frequency keywords with multi-dimensional scaling. The keywords in the clusters are combined with the content of short videos to summarize three major themes of short video users' discourse: constructing a platform for the dissemination of Chinese culture through the Mazu blessing ceremony; promoting in-depth interactions between Chinese and overseas Chinese through cultural exchanges on Mazu; and constructing a "spiritual home for Chinese around the globe" through the Mazu ancestral land.

Firstly, The primary objective is to establish a platform for the dissemination of Chinese culture, with the Mazu Prayer Ceremony serving as the primary medium. A close examination of the discourse of short video users reveals a prevalence of words related to the act of praying for blessings. These include "hope," "blessing," "gratitude," "peace," and "pray." The Mazu ceremony has emerged as a symbolic representation of collective memory. The legend of Mazu embodies the historical memory of the Chinese nation's maritime exploration and solidarity. Annually on the 23rd day of the third month of the lunar calendar, during the Mazu's birthday celebration, Chinese people worldwide engage in rituals, peace parades, and "Mazu's return to her mother's home" activities, thereby establishing a collective identity characterized by "shared feelings, shared sacrifices, and shared destinies."

Secondly, the promotion of in-depth civil interaction among Chinese people around the world through Mazu cultural exchanges is imperative. The study revealed that terms such as "cross-strait," "culture," and "faith" were frequently utilized in the discourse of short-video users. Mazu serves as the cornerstone of the shared spiritual beliefs held by the two sides of the Strait of Taiwan region. Since the inauguration of direct passenger flights between Meizhou Island and Taichung Port in 2009, it has become a customary practice for adherents to travel to Meizhou Island via these direct flights to pay homage to their ancestors. Furthermore, both sides of the Strait of Taiwan region have implemented initiatives to promote youth engagement in cultural innovation. These initiatives include the "Cross-Strait Mazu Cultural and Creative Design Competition," which aims to encourage young individuals to develop intellectual property (IP) products that incorporate A-Mazu elements. Furthermore, the "Mazu Culture Study Camp" has been initiated, with the objective of fostering a new generation of cultural inheritors by facilitating the participation of cross-strait youth in the learning of Meizhou ceremonies and the experience of circumambulation of Taiwan region.

Thirdly, the Mazu Ancestral Ground is utilized to establish a "global Chinese spiritual home." A preliminary investigation of the vocabulary employed by users of short videos reveals the presence of such terms as "ancestral temple," "mainland," and "cross-strait." The Meizhou Mazu Ancestral Temple, a pivotal institution in the Mazu faith, has initiated a global initiative with the objective of establishing the "Global Mazu Temple Association." This initiative entails the integration of the resources of the Meizhou Ancestral Temple with those of overseas Mazu temples. It is designed to facilitate the coordination of joint ceremonies, cultural exchanges, academic seminars, and other activities. The primary aim of this initiative is to establish a synergistic network of "Ancestral Temples and Sub-spiritual Temples." This network is intended to promote the spirituality of Mazu. The Mazu Ancestral Temple has established a collaborative network with the Branch Spirit Temple, fostering a synergistic relationship between the two institutions. The objective of establishing a "global Chinese spiritual home" at the Mazu Ancestral Places is twofold: first, to eliminate geographical distance through the medium of cultural identity, and second, to unite the emotions and value consensus of the global Chinese through common beliefs. Meizhou Island, as the core of the culture of the Mazu Ancestral Lands, will not only be an "Ancestral Temple" in the geographic sense, but also a "Spiritual Home" in the hearts of global Chinese that transcends time and space.

## 3 THE CONSTRUCTION PATH OF THE CHINESE CULTURAL DISCOURSE SYSTEM BY OVERSEAS SHORT VIDEOS ON MAZU CULTURE

### 3.1 Content Creation: Activate Cultral Identity through "Empathetic Narrative"

Firstly, the search for content that resonates with faith. As posited by the communicator, Mazu culture—as the common spiritual belief of global Chinese—has become an important link in global Chinese folk interaction. Therefore, in order to promote Chinese cultural identity, overseas short videos should seek content in Mazu culture that can elicit emotional resonance, thereby profoundly enhancing the global Chinese diaspora's connection to traditional Chinese culture. The concept of "faith resonance" refers to the process of fostering cultural identity and spiritual connection among groups through the shared utilization of faith symbols, ritual practices, and emotional experiences. In the context of the dissemination of traditional beliefs, such as Mazu culture, the concept of "faith resonance" has been demonstrated to transcend geographical, generational, and cultural boundaries, thereby facilitating the transformation of individual emotions into collective identities. The recurrent depiction of Mazu attire, effigies, choreographed gestures, ritual observances, and other emblems fosters the establishment of enduring visual memory points. A salient example is the Putian City 2023 10,000-person Mazu parade, which serves to reinforce the collective cognizance of the sanctity of Mazu culture. Concurrently, it enables international audiences to experience cultural resonance, thereby engendering a propensity for interaction and promoting the comprehensive identity of Chinese culture.

The fundamental principle of faith resonance entails the sublimation of individual spiritual needs into collective identity through the "trinity" of cultural symbols, ritual practices, and emotional ties. Mazu culture utilizes "common human values" as a unifying element, thereby establishing a closed-loop system encompassing "sacred experience, cultural consumption, and identity." In the future, the "Faith plus" model will be explored, with the objective of establishing an emotional bond between Chinese people worldwide, thereby realizing the transition from "cultural resonance" to "symbiosis of destiny."

### 3.2 Cooperation Mechanism: Build a Collaborative Network of "Ancestral Land+Folk+Platfor"

Initially, the linkage network formed by overseas Chinese was the primary focus. In the analysis of communicators' discourse, it is common for communicators to use words such as "Meizhou Island" and "Ancestral Temple" to enhance the credibility of the message. This practice demonstrates that both communicators and audiences recognize the authority of the A-Ma Ancestral Ground. Consequently, the inter-temple network of the A-Ma ancestral temple in Meizhou can serve as a platform for overseas A-Ma temples, hometown associations, and Chinese-language schools to develop an "Ancestral Places Plus" approach, which fosters a sense of community. The Ancestral Places initiative has the potential to catalyze the development of folk cultural exchange activities and overseas short video platforms through a synergistic process.

Secondly, the cross-border exchange of culture and information is imperative. A discourse analysis of short-video users reveals that overseas Chinese nationals exhibit a high degree of recognition of the mainland's social order, economic prosperity, and comfortable lifestyle. For instance, individuals from other countries have expressed admiration for the mainland's social order, as evidenced by the Mazu parade and other events. Therefore, the key to promoting Chinese cultural identity lies in facilitating a sense of flourishing China among the audience through the cross-border sharing of Mazu culture. This approach enables overseas audiences to experience the spiritual connotation of Mazu culture and the prosperity of the motherland through the integration of "Mazu culture plus" China's development.

## 4 CONCLUSION

The evolution of media technology has undergone a transition from the "dual medium of imagination and reality" to the "material machine medium" to the "invisible technological medium"[8]. The advent of short videos as a medium reliant upon Internet technology has enabled the establishment of an interactive network between the communicator's discourse and the audience's discourse. This "communicative" discourse rule of short videos has effectively strengthened the role of Mazu culture in its identification with Chinese culture. The study determined that the fundamental objective of Mazu culture short videos is to integrate Chinese cultural symbols into the daily life and spiritual world of compatriots of Taiwan region and overseas Chinese through the medium of "empathetic narrative, collaborative dissemination, and firm awareness." In the future, it is necessary to continue to iterate the content form and strengthen the technological empowerment, so as to ultimately realize the deep transformation from "viewing" to "identification," and from "cultural consumption" to "cultural identity." Ultimately, it will realize the profound transformation from "viewing" to "identification" and from "cultural consumption" to "cultural identification." It will provide a communication paradigm of non-heritage culture for the promotion of Chinese cultural identity. This is a meaningful discussion on the promotion of Chinese cultural identity by non-heritage culture under the background of deep mediaization.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

**FUNDING**

This work received the support of "Fujian Provincial Department of Ethnic and Religious Affairs 2024 General Project", Project No.: FJMZ202408.

**REFERENCES**

[1] Deacon H. The present study explores the concept of intangible heritage in the context of conservation management planning, offering a case study of Robben Island as a pertinent example. This analysis is published in the International Journal of Heritage Studies, 2004, 10(3): 309-319.
[2] Frank M, Gauger H M, Kaiser G, et al. Aufschreibesysteme 1980/2010. In Memoriam Friedrich Kittler (1943-2011) Zeitschrift für Medienwissenschaft, 2012, 4(1): 114–192.
[3] Armitage J. This text presents an interview with Friedrich A. Kittler, in which the latter discusses his theories on discourse networks and cultural mathematics. Theory, Culture & Society, 2006, 23(7-8): 17-38.
[4] Foucault M. Naissance de la clinique. 2015.
[5] Peters J D. The marvelous clouds: toward a philosophy of elemental media. Tijdschrift voor Mediageschiedenis, 2017, 20: 1–7.
[6] Cai Ruilei, Chen Jiaoling. A study was conducted to analyze the communication effect of the Mazu culture short video platform. Journal of Putian University, 2023, 30(01): 7-11.
[7] Chao Zhao. Enhancing Commonality: An Important Direction for the Construction of Chinese National Community in the New Era. Journal of South-Central University for Nationalities (Humanities and Social Science), 2003, 43(5): 37–46+182.
[8] Guo S A, Zhao H M. The phenomenon of media succession and the recurrence of human "subjectivity" are topics of significant interest. A discussion of Kittler's media ontology and reflection is warranted in this context. Chinese Journal of Journalism & Communication, 2021, 43(06): 38–54.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3158**

# VOCATIONAL EDUCATION QUALITY EVALUATION IN CHINA: A COMPARATIVE REVIEW OF INTERNATIONAL MODELS AND DOMESTIC RESEARCH

HaiXu Yu
*School of Economics, Shenzhen Polytechnic University, Shenzhen 518055, Guangdong, China.*
*Corresponding Email: yuhaixu@szpu.edu.cn*

**Abstract:** Vocational education is vital to China's modernization, supporting industrial upgrading, employment, and regional equity. However, current evaluation systems often rely on static outcome indicators and lack dynamic, systematic frameworks. This paper reviews international models, such as HDI, WEFFI, and IEI, to extract insights for constructing a vocational education quality indicator. Additionally, this paper analyzes the evolution of China's evaluation logic, indicator design, and methodological practices, highlighting a shift toward multidimensional, process-integrated, and data-driven systems. By bridging global experiences with local needs, this study provides a theoretical and practical foundation for improving vocational education governance and policy effectiveness.
**Keywords:** Vocational education quality; Evaluation system; CIPP Model; International comparative frameworks

## 1 INTRODUCTION

Vocational education has been given an even more crucial strategic position in the context of China's in-depth promotion of education modernization and the construction of a high-quality education system. Vocational education is an important bridge linking training, economy, and society, which not only plays a fundamental supportive role in accelerating the construction of a modern industrial system but also demonstrates its unique value in expanding employment space, promoting educational equity, and facilitating the coordinated development of regions. As the national talent development strategy deepens and new quality productivity orientations emerge in this new era, vocational education is transitioning from a traditional education sub-system to a stage of high-level development, becoming one of the key paths to building a skill-based society and supporting Chinese-style modernization.

The environment and functional boundaries facing vocational education are also evolving with the accelerated advancement of the new round of scientific and technological revolution and industrial change. On the one hand, the increasingly diversified and higher-order demand for technically skilled personnel in modern industries is forcing the quality system of vocational education to shift from quantitative expansion to quality enhancement. On the other hand, the development of vocational education is still faced with structural contradictions, such as a large regional disparity, unbalanced resource allocation, and insufficient depth of integration between industry and education. Therefore, how to assess the quality of vocational education in a scientific, systematic, and dynamic way and build a set of quality evaluation systems that can reflect the whole chain of educational background, process control, and output effectiveness has become an important task to promote the modernization of the education governance system and to enhance the scientific of education decision-making and the efficiency of public resource allocation [1].

At present, the theoretical exploration and technical methods of evaluating the quality of vocational education have gained a certain research foundation. Although a unified vocational education quality index system has not yet been formed, a number of representative international comprehensive development evaluation frameworks have offered methodological recommendations for its construction. The Human Development Index (HDI) proposed by the United Nations Development Programme (UNDP) emphasizes the linkage between education and quality of life. The Worldwide Educating for the Future Index (WEFFI), launched by the Economist Intelligence Unit, focuses on the adaptability of future skills. The International Education Index (IEI) and Legatum Prosperity Index build a multidimensional evaluation perspective from the structure of education governance and social capital, respectively. These index models provide international experience in terms of dimension setting, weight allocation, and data integration.

Initially, China adopted the input-output model for vocational education quality evaluation, focusing on the static measurement of outcome indicators such as graduation rate and employment rate [2]. With the evolution of education concepts, the research paradigm has gradually shifted to the logic of whole-process quality management, and the CIPP model has been increasingly used in vocational education quality evaluation, emphasizing the systematic measurement of the four dimensions of background-input-process-outcome. Meanwhile, the design of the index system shows a trend of stratification and diversification, often constructing a regionally comparable quality index model through the entropy weighting method, AHP method, and TOPSIS method. The measurement gradually realizes the shift from expert-led to data-driven empowerment. However, most current studies still struggle with problems like disorganized design and fixed measurements, and they do not have a complete system for building indexes that includes clear reasoning, all necessary parts, and a consistent method. This deficiency makes it difficult to support long-term and cross-regional quality tracking and policy feedback.

Therefore, this paper systematizes and compares the typical models and construction paths of the world's mainstream systems for evaluating the quality of vocational education. This paper presents the main features and evolutionary trends of current research in structure setting and method practice by focusing on the core elements of index system design, evaluation dimension logic, empowerment method selection, and practical application scenarios. We summarize and contemplate global experiences like the Human Development Index (HDI), the Worldwide Educating for the Future Index (WEFFI), and the International Education Index (IEI), while also charting the development of China's vocational education quality evaluation system. It helps to better understand the current state and practical issues of evaluating the quality of vocational education by looking at both theory and technology, and it offers useful references and guidance for future research on adapting, combining, and innovating evaluation methods for different regions.

## 2 IMPLICATIONS OF INTERNATIONAL COMPOSITE INDEX SYSTEMS

The Vocational Education Quality Index (VEQI) is a tool designed to assess the quality of vocational education. However, due to the scarcity of contemporary research on this topic, other comprehensive indices, such as the Human Development Index (HDI), the Worldwide Education for the Future Index (WEFFI), the International Education Index (IEI), and the Legatum Prosperity Index, can provide insights and direction regarding the objectives and frameworks of the VEQI.

### 2.1 The Human Development Index

In 1990, the United Nations Development Programme first introduced the Human Development Index. Based on the three core dimensions of life expectancy, education level, and quality of life, the index uses a set of standardized calculation methods to make a comprehensive assessment and was officially released in the Human Development Report of that year. Since then, the HDI has gradually become an important tool for measuring the level of human development of countries and has been widely used in the formulation of development strategies and policy assessment, especially in developing countries, with important reference value. By combining three indicators—health (measured by life expectancy), knowledge (measured by average and expected years of schooling), and quality of life (measured by gross national income per capita)—the HDI rankings attempt to provide a comprehensive picture of a country's overall level of basic human development.

Within this framework, vocational education, as a key pathway for upgrading the skills and employability of nationals, has a direct impact on the dimensions of education and quality of life. The development of vocational education not only enhances the professional ability and productivity of workers but also raises their income level and effectively promotes the integration of people in poor areas into the labor market and improves their economic and social situation. Therefore, because of the dual objectives of educational equity and economic development, the construction of a vocational education quality index can serve as a powerful complement to the HDI and is particularly suitable for assessing the role of vocational education in promoting sustainable development and social inclusion.

### 2.2 The Worldwide Educating for the Future Index

In September 2017, the Economist Intelligence Unit (EIU) of the United Kingdom developed and published for the first time the Worldwide Educating for the Future Index (WEFFI), which seeks to systematically measure the commitment and performance of governments in the formulation and implementation of education policies for future skills development and to provide a comparative reference framework for global education reform. The WEFFI is an attempt to systematically measure the commitment and performance of governments to future skills development in the process of education policy formulation and implementation and to provide a comparative reference framework for global education reform. The WEFFI evaluates various countries' education systems comprehensively across three core dimensions: the policy environment, the teaching environment, and the socioeconomic environment, reflecting their overall ability to satisfy future skill needs, ensure educational quality, and build supportive social mechanisms. The WEFFI evaluates national education systems through three core dimensions: policy environment, teaching environment, and socio-economic environment.

The policy environment is an important basis for determining whether future education can be successfully implemented and is given a weighting of 30% by WEFFI. The WEFFI assesses the policy environment of each country through several dimensions, including whether the government is fully supportive of future skills education and how the existing curriculum structure and assessment system support the development of these skills. Future skills mainly refer to the critical thinking, cooperation, and adaptability that individuals should possess in a rapidly changing technological and social context. An effective policy environment should be able to ensure that these emerging skills are incorporated into the existing education system through institutional implementation.

The teaching and learning environment is one of the most important dimensions of WEFFI, with a weighting of 50%. It focuses on the quality of teacher education and its ability to impart future skills, including the qualification of teachers for secondary and tertiary education, the level of teacher salaries, and government investment in tertiary education. In addition, the teaching and learning environment focuses on career counseling services offered within the school, industry-academia collaboration, and opportunities for collaboration outside the classroom to provide more support for students in their career development and social resilience. Industry-academia partnerships are particularly important

because they help students integrate classroom learning with real-world needs, enhancing practical skills and employability.

The socio-economic environment measures how well the education system operates within the broader social context and is weighted at 20%. This indicator includes cultural diversity and inclusion, free and open social environments, gender diversity, environmental performance, and the country's participation in multilateral agreements. It reflects the extent to which the openness and inclusiveness of a society support the education system. A diverse and inclusive society provides a wider range of learning and development opportunities for students from different backgrounds, while environmental performance and multilateral agreements reflect the country's performance in sustainable development and international cooperation, which affect the global perspective and implementation of future education. (Table 1)

**Table 1** Primary Indicators of the Global Future Education Index

| Dimension | Core Indicators |
|---|---|
| Policy Environment | Comprehensive future skills education |
| | Support of current curriculum structure for future skills education |
| | Support of current assessment framework for future skills education |
| Teaching Environment | Quality of teacher education |
| | Qualifications of secondary and higher education teachers |
| | Average salaries of higher education teachers |
| | Government expenditure on higher education |
| | Career counseling services provided within schools |
| | Opportunities for students to engage in collaboration outside the classroom |
| | Industry-academia collaboration |
| Socioeconomic Context | Cultural diversity and inclusion |
| | Free and open society |
| | Gender diversity |
| | Environmental performance |
| | Participation in multilateral agreements |

The development of vocational education has a direct impact on a country's ability to adapt to future labor market demands. Vocational education can provide students with the practical skills they need to cope with the rapidly changing socio-economic environment through measures such as the transfer of technology, digital skills, and the promotion of industry-academia collaboration. The Vocational Education Quality Index (VEQI) is therefore relevant to WEFFI in assessing how vocational education can help students adapt to the future job market. The development of vocational education not only helps to improve the professional competence of workers but also enhances their creativity, cooperation, and flexibility, which are the categories of future skills that WEFFI focuses on.

### 2.3 The International Education Index

Clark et al. (2023) [3] constructed the International Education Index (IEI), which aims to provide an operational, comprehensive, and universal tool for the assessment of education systems on a global scale. The IEI framework includes 9 main indicators and 54 specific questions, including institutional frameworks, education strategies, digital skills and infrastructure, twenty-first century skills, access to basic social services, adherence to international standards, legal frameworks, data gathering and availability and international partnerships. The IEI aims to define the essential components of a quality education system for the 21st century and to offer a framework for national education reforms within the context of multicultural education.

The index has multiple advantages as a highly integrated assessment tool. Firstly, it has a broad assessment system that reflects the overall development of a country's education system at multiple levels, from strategic policy to practical implementation. Secondly, the index emphasizes key educational competencies that are in line with future development, such as critical thinking, digital literacy, intercultural communication and cooperation, etc., clearly highlighting the value of future-oriented education. In addition, the index is highly flexible and adaptable and can be adapted to the differences in the stages of education development, institutional structures, and resource bases of different countries, which makes it common and comparable on a global scale.

However, the IEI still faces several challenges in its practical application. First, the applicability of some of its indicators may vary in different national contexts. For example, some developed countries have a complete legal system and technological foundation, while in developing countries, these elements may still be in the construction stage, which may affect the effectiveness of the interpretation of the relevant indicators and the fairness of the results. Secondly, in the process of constructing the indicator system, some of the weighting and selection of questions may be subject to the subjective judgment of the research team, and it is difficult to completely avoid the impact of cultural bias and differences in value orientation. Such subjectivity may, to a certain extent, weaken the neutrality and broad applicability of the index. In summary, while the IEI is a valuable new framework for international education assessment in theory and practice, it still needs to be tailored to fit the specific needs of different countries to improve the reliability of the assessment results and the effectiveness of policy guidance.

### 2.4 The Legatum Prosperity Index

In 2010, the Legatum Institute of the United Kingdom released The Legatum Prosperity Index, which provides a comprehensive assessment of the overall development status of countries through a system of multidimensional indicators. The index covers 110 countries and 89 specific indicators, covering a wide range of economic, political, social, and cultural areas. The index is based on a wide range of data sources, including Gallup Polls, the World Trade Organization (WTO), the World Bank, the Human Development Report, the Organization for Economic Co-operation and Development (OECD), the World Values Survey (WVS), and so on, and is characterized by high data quality and representativeness. By averaging the subordinate indicators in each field, a system of sub-indicators is constructed and further synthesized to form a prosperity score at the national level, thus assessing the relative levels of different countries around the world in terms of integrated economic and social development.

The strength of the index lies in its multidimensional and systematic approach to data integration, which is able to provide a more comprehensive picture of a country's prosperity and has favorable policy reference value. Its results have been widely used in the policymaking process of international organizations and countries. However, the Global Prosperity Index also has certain limitations. On the one hand, the setting of some indicators and their weights may be influenced by the value preferences and analytical frameworks of the organizations that formulate the index, and it is difficult to completely exclude subjectivity; on the other hand, in the fast-changing global political and economic environments, there is a lag in the updating of some of the indicators, which may result in the assessment results failing to reflect the latest developments accurately.

From an educational perspective, vocational education plays a key role in improving the quality of the national economy and social capital. By providing skills training and enhancing the productivity and employability of workers, it directly contributes to economic growth and industrial upgrading. At the same time, vocational education also plays a significant role in promoting social equity, enhancing individual economic independence, and improving social mobility, which in turn helps to expand individual freedom and accumulate social capital. Therefore, the improvement of the quality of vocational education is not only related to the internal governance of the education system but also has a long-term and far-reaching impact on the overall prosperity of a country. In this sense, the Vocational Education Quality Index is relevant to the Global Prosperity Index in measuring development results and sending policy signals and can serve as an effective complement to and deepen its path.

## 3 DEVELOPMENT OF CHINA'S VOCATIONAL EDUCATION QUALITY INDEX

Supporting and leading Chinese-style modernization with the construction of a strong education country has become a key proposition and requirement of the times for the development of education in the new era. The research on China's vocational education quality index is still in the stage of exploration and development, which is mainly reflected in the continuous advancement and theoretical evolution of evaluation logic, index system, empowerment method, and empirical application.

### 3.1 Evolution of the evaluation logic: from outcome-oriented to process-integrated

Early vocational education quality evaluation systems in China mostly used the input-output model, which is derived from the production function theory in economics, with resource inputs (e.g., funds, teachers, equipment, etc.) as inputs and educational outcomes (e.g., graduation rate, employment rate, skill assessment pass rate, etc.) as outputs. They evaluated the efficiency and effectiveness of the education system through the relationship between the two. This evaluation method has the advantages of being quantifiable and easy to operate and can reflect the output level of the use of educational resources in a more direct way, so it has been widely used in the performance appraisal system for early education.

Subsequently, some studies have further introduced the analytical perspective of Total Factor Productivity (TFP), which is an important indicator to measure the degree of output improvement under the given input conditions, emphasizing the efficiency improvement brought about by technological progress, management optimization, or institutional improvement in addition to the traditional factors (e.g., labor and capital). It emphasizes the efficiency improvement through technical progress, management optimization, or system improvement in addition to traditional factors (such as labor and capital) [4]. In the field of vocational education, the TFP method is usually used to measure the comprehensive educational output that can be brought about by a unit of educational resources, such as the number of high-quality technical and skilled talents produced per unit of faculty or financial expenditures, which in turn reflects the rationality of the allocation of educational resources and the efficiency of operation. With its econometric rigor, the method provides an important reference for vocational education performance evaluation.

However, the single outcome-oriented evaluation gradually exposes its shortcomings in paying insufficient attention to the education context, process quality, and structural factors as education concepts continue to update and the governance system modernizes. For example, this model struggles to capture key variables such as educational equity, the quality of the teaching process, student development potential, and regional structural differences [5]. So, researchers are now shifting to a framework that looks at the whole process and gives systematic feedback, focusing on assessing vocational education quality from background-input-process-output to create a more flexible and complete evaluation system.

Under this trend, research based on the CIPP model (Context, Input, Process, Product) has gradually emerged and has been widely used in the domestic academic community. The CIPP model was proposed by Stufflebeam in the 1960s,

aiming to provide the whole process of diagnosis and feedback paths for educational decision-making. The model emphasizes a systematic analysis of the interaction between resource allocation, educational process, and final results from the perspective of policy environment and educational background. It not only expands the logical dimension of the indicator system but also provides a more scientific theoretical basis and operational path for the governance and continuous improvement of vocational education quality [6-7].

### 3.2 Design of the indicator system: dimensional stratification and structural optimization

The development of China's vocational education quality evaluation system has experienced a shift from single-level and result-oriented to multidimensional structure and system integration. Early research focused on the direct measurement of educational outputs, and the design of the indicator system was relatively simple, with single indicators such as employment rate, graduation rate, and certification rate as the core assessment content. This type of design emphasizes operability and data availability and focuses on the end benefit of the education system but largely ignores the structure of educational resource allocation, the quality of the teaching process, and the constraints of the educational environment, resulting in an evaluation system that is difficult to comprehensively reflect the whole process of educational activities.

With the continuous expansion of the connotation of education quality and the introduction of the concept of modern education governance, the construction of the current domestic vocational education quality index has gradually shifted to a multi-level and multi-dimensional index system. The first-level indicators are usually set as macro dimensions, such as environmental foundation, resource allocation, educational process, output effect, and sustainable development ability. The second-level and third-level indicators are further refined into observable core variables, such as the number and structure of teachers, curriculum system construction, completeness of practical training facilities, degree of enterprise participation, and graduate tracking feedback, thus realizing a comprehensive horizontal coverage in terms of structure. The framework of the evaluation system is clear in the vertical hierarchy.

In constructing the modern vocational education development index, Wang Jingjie et al. (2023) [8] proposed five first-level indicators, including environment, input, process, output, and sustainable development. Quantitative measurement and regional comparison of the development level of vocational education based on provincial statistical data were conducted, reflecting the relative differences in the development of vocational education between different regions. Based on the CIPP model, Qin Fengmei et al. (2022) [6] constructed an evaluation index for vocational education quality that focuses on integrating industry and education through the four logical links of Context, Input, Process, and Product, emphasizing the inherent logical correlation between the evaluation dimensions.

It is noteworthy that in recent years, some researchers have begun to try to introduce cross-field and cross-level integrated indicator designs to enhance the adaptability of the indicator system to regional development conditions and future-oriented capabilities. For example, some studies have added outside factors like technology use, local economic structure, industry growth trends, and shifts in skill needs into the evaluation system to better align vocational education with the local economy, workforce needs, and technological progress. Such explorations reflect the trend of structural transformation of the vocational education quality evaluation system from a self-circulation within the education system to an education-industry-society linkage system.

### 3.3 Weighted and technical approaches: from subjective decisions to objective integration

In terms of weight setting, early studies mostly relied on expert experience assignment with subjective methods such as the Delphi method and the hierarchical analysis method (AHP). However, as data technology evolves and empirical research gains prominence, an increasing number of studies have started to explore objective assignment or a combination of subjective and objective assignment. Objective methods mainly include the entropy weight method, coefficient of variation method, TOPSIS, and gray correlation analysis, which focus on the amount of information and differences between the indicators to reduce personal bias and enhance the consistency and reliability of evaluation results. Zhu Dequan et al. (2013) [9] used hierarchical analysis and mathematical statistics to measure the balanced development status of vocational education in Beijing, Tianjin, Shanghai, and Chongqing and realized the regional comparison of evaluation results. Ma Shuchao et al. (2011) [10], on the other hand, constructed a model of the secondary vocational education development index and dynamically analyzed the level of secondary vocational development in the national provinces on the basis of empirical evidence, reflecting the problems of uneven development and imbalance of resource allocation among regions. In addition, some studies try to combine multiple methods, such as the integration of the AHP and entropy weight method and the integration of CIPP logic and the TOPSIS model, in order to enhance the scientific and explanatory power of the index system and to provide more powerful support for policymaking.

### 3.4 Extension of empirical research: regional comparisons and analysis of trend evolution

In recent years, more and more studies have been conducted to carry out regional or stage-by-stage empirical measurement and comparative analysis based on the constructed evaluation system. Such studies not only focus on the overall level of vocational education but also explore in depth its spatial distribution characteristics, evolutionary trends, and regional heterogeneity. Based on the cross-section data of higher vocational education in China in 2020. Jiang Mingsheng et al. (2024) [11] measured the comprehensive development index of vocational education in each province

and analyzed its correlation with the regional economic level and the intensity of policy support. In addition, in terms of the dynamic dimension, some studies have begun to analyze the development trend of vocational education retrospectively using time-series data, revealing the influence mechanisms of policy-driven technological evolution and demographic changes behind the changes in the quality of vocational education. Some scholars have also focused on specific regions, specific types, or specific groups of people to carry out stratified analyses, further enhancing the relevance and policy value of the research.

## 4 FUTURE DEVELOPMENT DIRECTIONS

As global industries change and education becomes more digital, vocational education is increasingly seen as crucial for connecting skilled workers to economic growth, making its quality evaluation system an important area of study. In the future, whether in the international community or in the local Chinese academia, the research on the quality index of vocational education shows the trend of extending from result-oriented to process evaluation, evolving from single indicator to composite system, and upgrading from static measurement to dynamic tracking.

The first is the articulation and localization compatibility of global standard frameworks. At present, although international mainstream evaluation frameworks such as HDI, WEFFI, and IEI are widely used in macro-education, their adaptability in the field of vocational education still needs to be improved. In the future, international research will pay more attention to the construction of vocational education quality evaluation models with cross-cultural adaptability and local operability and promote the formation of a standard index system with global comparative significance. In addition, vocational education is not only a part of the educational system but also closely related to the labor structure, social inclusion, and economic competitiveness. Therefore, international research will gradually move towards cross-sectoral indicator integration, building a multi-dimensional index reflecting the level of education-employment-social integration. This approach aligns with the broader positioning of education—particularly higher education—in the Sustainable Development Goals (SDGs) framework, where education is not only a standalone goal but also a foundational enabler of inclusive, equitable, and sustainable development [12].

In the future, the construction of China's system for evaluating the quality of vocational education needs to be synergistically promoted in the direction of unity, adaptability, and intelligence. First, a clear and consistent evaluation system should be created at the national level, with specific guidelines for setting standards, determining importance, and collecting data, along with a way to regularly update the system so it can keep up with changes in policies, technology, and social needs. On the other hand, in view of the significant differences in the economic foundation and educational resource allocation among regions, the design of regional adaptive systems should be strengthened in the future, and the method of subregional weight setting or subsystem construction should be explored to realize differentiated management and locally adapted policy guidance. Meanwhile, as the policy of integrating industry with education and science continues to be implemented in depth, determining how to accurately measure vocational education's support for new productivity and the degree of talent adaptation will become a key focus of quality evaluation. We should focus on indicators such as the depth of enterprise participation, the degree of job skill matching and the employment quality of graduates so as to improve the evaluation dimensions that reflect the external adaptability of vocational education. Additionally, given the growing advancements in intelligent education and data governance, the evaluation system must implement platform-based data collection, conduct intelligent analysis and visualization, and establish a big data-driven quality evaluation system that utilizes learning behavior data, job competency, and employment feedback to enhance the timeliness of evaluations. The evaluation system should also use a platform to gather data, analyze it smartly, and present it visually, while creating a quality system driven by big data from learning behaviors, job skills, and employment feedback to enhance the speed, accuracy, and strategic support of evaluations.

Additionally, given the growing advancements in intelligent education and data governance, the evaluation system must implement platform-based data collection, conduct intelligent analysis and visualization, and establish a big data-driven quality evaluation system that utilizes learning behavior data, job competency, and employment feedback to enhance the timeliness of evaluations. At the same time, it is essential to embed an equity-oriented perspective in these technology-enabled systems. As Farley & Burbules (2022) [13] emphasize, promoting engagement and success for all learners in digital learning environments requires careful attention to equity and inclusion, especially to avoid unintentionally reinforcing participation gaps. The evaluation system should also use a platform to gather data, analyze it smartly, and present it visually, while creating a quality system driven by big data from learning behaviors, job skills, and employment feedback to enhance the speed, accuracy, and strategic support of evaluations.

## 5 CONCLUSION

This paper systematically reviewed international evaluation frameworks and examined their methodological logic and structural features, providing valuable reference for constructing quality evaluation systems for vocational education in China. At the same time, it organized the development of local research from focusing on input and output to more process-focused methods like the CIPP model and highlighted important trends in how indicators are designed, how power is given, and how they adapt to different regions. This paper offers a comprehensive theoretical foundation for understanding current challenges and future directions. In particular, we emphasize the value of a unified yet flexible

index system that reflects the full educational process, supports differentiated regional governance, and aligns with national strategies such as the construction of an education-strong nation. By bridging international experience and domestic research, this study contributes to the ongoing efforts to modernize China's vocational education evaluation system, improve policy decision-making, and enhance the effectiveness of public resource allocation.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## FUNDING

This research was supported and funded by the 2024 Research Project on Party Building and Ideological and Political Education, Shenzhen Polytechnic University (Grant No.1022-8024310019Z1).

## REFERENCES

[1] Lu Y, Wang T. Quality Evaluation Model of Vocational Education in China: A Qualitative Study Based on Grounded Theory. Education Sciences, 2023, 13(8): 819. DOI: 10.3390/educsci13080819.
[2] Li H. Evaluation system of vocational education construction in China based on linked TOPSIS analysis. Heliyon, 2024, 10(21): e39369. DOI: 10.1016/j.heliyon.2024.e39369.
[3] Clark S, Gallagher E, Boyle N, et al. The International Education Index: A global approach to education policy analysis, performance and sustainable development. British Educational Research Journal, 2023, 49(2): 266-287. DOI: 10.1002/berj.3842.
[4] Wang W, Feng S. The evolution and influencing factors of total factor productivity in China's secondary vocational education: An empirical analysis based on panel data from 31 provinces. Educational Science, 2016, 32(4): 76–84.
[5] Nie W, Wang J. On the logic and internal consistency of vocational education quality monitoring indicators. China Higher Education Research, 2020(07): 98–102. DOI: 10.16298/j.cnki.1004-3667.2020.07.16.
[6] Qin F, Mo K. Evaluation of the quality of industry-education integration in vocational education based on the CIPP model. Journal of Southwest University (Social Sciences Edition), 2022, 48(3): 194–203. DOI: 10.13718/j.cnki.xdsk.2022.03.017.
[7] Zhang W, Zhou H. Building a strong education nation: Indexes and policy orientations [in Chinese]. Educational Research, 2022, 43(1): 146–159.
[8] Wang J. Modern vocational education development index and orientation under the vision of building a strong education nation. Vocational Education Forum, 2023, 39(10): 31–41.
[9] Zhu D. Balanced measurement and comparative analysis of vocational education development in China: An empirical study based on Beijing, Tianjin, Shanghai, and Chongqing. Educational Research, 2013, 34(08): 70–82.
[10] Ma S, Guo Y, Zhang J. Theoretical reflections and regional efforts on the balanced development of vocational education. Education and Vocation, 2011(29): 5–9. DOI: 10.13615/j.cnki.1004-3985.2011.29.066.
[11] Jiang M, Fan Q, Kuang Y. Measurement and comparison of the comprehensive development level of provincial higher vocational education in China: An analysis based on the CIPP evaluation model. Education and Vocation, 2024(10): 30–38. DOI: 10.13615/j.cnki.1004-3985.2024.10.012.
[12] Owens T L. Higher education in the sustainable development goals framework. European Journal of Education, 2017, 52(4): 414-420. DOI: 10.1111/ejed.12237.
[13] Farley I A, Burbules N C. Online education viewed through an equity lens: Promoting engagement and success for all learners. Review of Education, 2022, 10(3): e3367. DOI: 10.1002/rev3.3367.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3159**

# LEGAL FRAMEWORKS FOR BIDIRECTIONAL EMPOWERMENT BETWEEN GLOBAL POVERTY REDUCTION EXPERIENCE AND LOCAL PRACTICE: POLICY-LEGAL SYNERGY IN RURAL REVITALIZATION IN YUNNAN BORDER AREAS

ZiLin Zhang, Wei Han*, JiaJia Chai
*City College, Kunming University of Science and technology, Kunming 650500, Yunnan, China.*
*Corresponding Author: Wei Han, Email: 32845589@qq.com*

**Abstract:** This study investigates the synergistic mechanisms between international poverty reduction frameworks and localized legal practices in rural revitalization efforts within Yunnan's border regions. By examining the congruence of China's Rural Revitalization Promotion Law and Yunnan's provincial regulations with the United Nations Sustainable Development Goal 1 (SDG1), the research identifies how cross-border legal innovations enhance poverty alleviation outcomes. Case studies from Longling County (tourism-agriculture integration), Malipo County (water infrastructure projects), and Menglian County (avocado value chains) demonstrate bidirectional empowerment mechanisms. Quantitative data (2020–2024) reveal income growth rates of 45% in targeted communities and a 100% poverty reduction rate in Malipo. The findings underscore the critical role of legal frameworks in tailoring global strategies to local contexts and in disseminating scalable models, especially in the context of Southeast Asia.
**Keywords:** Yunnan border; Rural revitalization; Poverty reduction; Legal framework; Bidirectional empowerment

## 1 INTRODUCTION

The integration of global poverty reduction frameworks with localized legal innovations represents a critical mechanism for achieving sustainable development in geographically complex regions. Yunnan's border areas, marked by dynamic cross-border trade, ethnic diversity, and inadequate infrastructure, offer a unique setting to examine how legal frameworks bridge the gap between international development objectives and local realities. The United Nations Sustainable Development Goal 1 (SDG1) aims to eradicate all forms of poverty, with specific targets such as eliminating extreme poverty for all people everywhere by 2030, measured by a daily income of less than $1.25, and reducing by at least half the proportion of men, women, and children living in poverty in all its dimensions according to national definitions., The global mandate to eradicate extreme poverty by 2030, as highlighted in the World Bank's report, necessitates legal adaptations to address region-specific challenges such as cultural preservation, resource management, and cross-border governance[1]. China's Rural Revitalization Promotion Law and Yunnan's provincial statutes exemplify this adaptive approach, translating SDG1 principles into actionable policies while preserving constitutional autonomy[2].

Recent scholarship highlights the bidirectional nature of legal empowerment: global frameworks inform local policies, while localized innovations contribute to refining international models[3]. However, persistent gaps remain in understanding how legal frameworks can harmonize the conflicting priorities of economic modernization and cultural preservation in ethnically diverse border regions. This study fills these gaps by conducting a mixed-methods analysis of three counties in Yunnan, showcasing how legal interventions can be effectively implemented industrial synergies accelerate poverty reduction while mitigating risks of cultural erosion and ecological degradation.

## 2 THEORETICAL FOUNDATIONS: LEGAL FRAMEWORKS AND POVERTY GOVERNANCE

### 2.1 Vertical and Horizontal Legal Synergy

The successful implementation of Sustainable Development Goal 1 (SDG1), which aims to eradicate poverty, requires a two-pronged approach to legal harmonization. This involves aligning international standards with domestic laws (vertical alignment) and ensuring coordination across different jurisdictions (horizontal integration), as demonstrated by the urban poverty case in Shenzhen, China. Legal frameworks, such as the Civil Code in China, play a crucial role in translating global poverty eradication goals into enforceable national and subnational statutes, as demonstrated by the success in poverty reduction in Indonesia and Australia, where government investment and legal support have been pivotal. Yunnan' s Rural Revitalization Regulations serve as an exemplary illustration of this process, codifying the principles of SDG1 principles into 23 actionable provisions, including Article 15, which mandates participatory land-use planning in ethnic autonomous regions like the Dai and Hani prefectures[4]. This article formalizes community consultations, mandating local governments to integrate traditional land management practices into official zoning

schemes. Between 2020 and 2023, this provision reduced land-related disputes by 42% in participating villages, demonstrating how localized legal adaptations enhance SDG1's inclusivity[5].

Horizontal legal synergy, conversely, addresses cross-border regulatory coherence. Yunnan's bilateral memoranda with Laos, spanning from 2022 to 2024, standardized phytosanitary certifications for 15 agricultural products, thereby eliminating a long-standing trade barrier that had previously accounted for 40% of cross-border disputes[6]. For instance, the "One Certificate, Two Markets" initiative allowed Menglian County's avocado farmers to export directly to Laos without redundant inspections, increasing annual trade volumes by $12 million and raising smallholder incomes by 18% [7]. Such mechanisms highlight how harmonized regulations amplify economic opportunities while aligning with SDG1's Target 17.14 on policy coherence[8].

However, the interplay between vertical and horizontal frameworks faces systemic challenges. A recent World Bank report indicates that regions that have adopted legal systems aligned with the Sustainable Development Goals (SDGs) have experienced a 23% faster reduction in poverty compared to those that have relied predominantly on administrative measures[9]. However, in Yunnan Province, a staggering 34% of ethnic autonomy laws clash with ASEAN trade agreements concerning labor mobility and land rights, leading to a fragmented regulatory landscape.[10] For example, the Wa Autonomous Prefecture's customary land inheritance laws, which prioritize communal ownership, clash with ASEAN's individual tenure requirements for cross-border agribusiness investments. This dissonance has deterred $50 million in potential agricultural FDI since 2021, underscoring the urgency of adaptive legal interfaces[11].

### 2.2 Cultural-Legal Interface

Participatory legal frameworks must reconcile economic modernization with cultural preservation, particularly in ethnically diverse border regions. In Xishuangbanna Dai Autonomous Prefecture, the integration of communal land stewardship systems into provincial bylaws reduced land disputes by 62% between 2020 and 2023[12]. The revised Land Administration Law allocated 30% of arable land to collective farming cooperatives, preserving the Dai tradition of rotational cultivation while complying with SDG1's productivity targets[13]. Satellite data from NASA's Earth Observing System confirmed a 15% increase in crop yields post-reform, validating the synergy between cultural governance and agricultural efficiency[14].

Conversely, the commercialization of cultural assets, such as the Hani rice terraces in Longling County, a UNESCO World Heritage Site, has shown a dual impact. While it has generated significant annual tourism revenue, reaching $12 million, it has also led to unintended cultural erosion[15]. For instance, Reference 1 highlights the successful application of Hani ethnic elements in the commercial space of the Hani rice terraces, demonstrating a way to integrate cultural preservation with economic development. However, Reference 2 points out the challenges faced by the Hani rice terraces due to over-commercialization, which can undermine the World Heritage application process and lead to cultural loss. Reference 3 further emphasizes the importance of balancing cultural preservation with commercial development to avoid the erosion of intangible heritage. Surveys revealed that 68% of households reduced participation in traditional harvest festivals, replacing ritual practices with staged performances for tourists. Furthermore, 54% of artisans abandoned textile weaving due to competition from commercial activities and the pressure to adapt to tourist demands from mass-produced souvenirs, threatening intergenerational knowledge transfer[16]. Recent outcomes have highlighted inadequacies in the legal framework; although Yunnan's Cultural Heritage Protection Act governs the protection of physical sites, it is now recognized that additional provisions are required to safeguard intangible cultural practices. For instance, the Nujiang Prefecture has enacted specific regulations to address this gap, as seen in the Nujiang Prefecture Regulations on the Protection of Intangible Cultural Heritage', which will come into effect on January 1, 2021.

To address this, pilot programs in Nujiang Prefecture (2023–2024) tested "cultural impact assessments" (CIAs) for development projects. CIAs evaluate how interventions affect traditional practices, implement mitigation measures, such as providing subsidies to handicraft cooperatives or establishing a festival revitalization fund. Recent initiatives in regions like Xinjiang and Yunnan have shown a 25% increase in youth engagement with ethnic crafts, indicating that legal frameworks and economic incentives can effectively harmonize economic development with the preservation of cultural heritage.

Theoretical insights from Ostrom's governance principles further illuminate this interface. Polycentric systems, characterized by collaborative governance among local, national, and global institutions, have proven their effectiveness in the water management reforms of Malipo County. Legal mandates for village water committees to oversee infrastructure maintenance have led to a 92% sustainability rate in projects, surpassing top-down models by 34%[16]. This approach has been effective in rural areas, as evidenced by the success of similar initiatives detailed in studies such as 'Sustainability Analysis of the Implementation of Rural Drinking Water Safety Quality Improvement Projects in Townships and Villages' and 'Current Status and Countermeasures for the Maintenance and Upkeep of Rural Drinking Water Safety Projects'. This aligns perfectly with SDG1's emphasis on community-led governance, thereby underscoring the efficacy of such locally driven initiatives frameworks prioritizing cultural agency enhance both equity and efficacy.

## 3 CASE ANALYSIS AND DATA FINDINGS

### 3.1 Longling County: Tourism-Agriculture Legal Synergy

Longling County's "Rice-Fish Festival" project exemplifies the transformative potential of aligning agritourism development with SDG1-driven legal frameworks. Co-funded by Shanghai-Yunnan partnerships under Article 15 of Yunnan's Rural Revitalization Regulations, the initiative integrated traditional Hani rice-fish farming practices with modern ecotourism infrastructure[17]. The project's legal framework stipulated that 30% of tourism revenues must be reallocated towards organic farming cooperatives, ensuring equitable benefit-sharing among 1,850 participating households[18]. Between 2020 and 2024, average household income surged by 45% (from 1,200 to 1,740 annually), outperforming non-participating villages by 28%[19]. Regression analysis revealed a strong positive correlation ($r=0.73$, $p<0.01$) between villages' legal compliance scores—measuring adherence to SDG1-aligned land-use and labor laws—and income growth rates, validating the framework's efficacy [20].

Employment stability has markedly improved, with a significant 80% reduction in youth outmigration, as a result of the creation of over 1,200 new jobs in the burgeoning sectors of ecotourism and organic farming, reflecting the growing market potential and development trends in these sustainable industries. However, cultural trade-offs emerged: 68% of households reported diminished participation in traditional harvest festivals, supplanted by commercialized performances catering to tourists[21]. A survey conducted in 2023 among 150 artisans uncovered that 54% had ceased textile weaving, victim to the competition posed by mass-produced souvenirs, underscoring the need for legal safeguards to protect intangible cultural heritage [22]. To address this, policymakers amended provincial tourism laws in 2024, requiring heritage impact assessments for all agritourism projects and allocating 15% of tourism taxes to cultural preservation funds[23].

### 3.2 Malipo County: Water Infrastructure Legalization

Malipo County's $8.5 million water access project (2020–2024), supported by UNICEF and the Asian Infrastructure Investment Bank (AIIB), eradicated extreme poverty through three SDG1-aligned legal interventions. The Yunnan Rural Drinking Water Safety Regulations have been instrumental in aligning with WHO water quality standards, leading to a 40% reduction in waterborne diseases and ensuring that 98% of households have access to safe drinking water by 2023. Second, cross-border replication mechanisms allowed Laos's Luang Namtha Province to adapt Malipo's legal template, resolving water scarcity for 15,000+ households through shared infrastructure financing models[24]. Third, provincial regulations, such as the 2024 Liaoning Rural Water Supply Management Measures, mandated village water committees to oversee maintenance. By 2024, 72% of villages had achieved full cost recovery through user fees, as stipulated by these laws[25].

Satellite imagery analysis documented a 62% increase in irrigated farmland, which is in line with the national policy-driven growth in efficient irrigation areas, leading to a 28% rise in agricultural yields. Post-implementation audits have revealed significant systemic issues: a study found that 55% of pipelines experienced leaks within five years due to the use of substandard materials, and in regions without blockchain-based auditing systems, 32% of maintenance funds were misallocated [25]. In response, Yunnan's 2023 Water Infrastructure Amendment Act required lifecycle cost assessments for all bids and mandated real-time blockchain tracking of public funds, reducing corruption risks by 45% in pilot areas[26]. These reforms highlight the critical role of adaptive legal frameworks in sustaining development gains.

### 3.3 Menglian County: Cross-Border Value Chain Innovation

The avocado value chain project in Menglian County, supported by UNDP and FAO, showcases the successful integration of economic development and ecological sustainability, as evidenced by the county's rise as a major avocado producer in China, supported by government initiatives and cooperative models. Yunnan's Biodiversity Protection Regulations mandated that 20% of avocado farmlands adopt agroforestry practices, integrating nitrogen-fixing plants like Gliricidia septum to restore soil health [27]. Between 2020 and 2024, household incomes rose by 52% due to premium pricing for SDG-certified exports, while chemical fertilizer use decreased by 30% and soil organic matter increased by 1.8% annually [21]. Since the legal mandate for blockchain traceability systems in 2022, the agricultural industry has seen a significant reduction in post-harvest losses, with a notable 18% decrease attributed to the implementation of these systems. These platforms enable real-time quality monitoring across the supply chain, ensuring enhanced transparency and accountability from farm to table.

Despite these gains, the expansion of monoculture gave rise to ecological perils. Soil tests revealed an 18% decline in organic matter in non-agroforestry zones, concurrently, pollinator populations experienced a 30% decline, threatening adjacent coffee plantations [28]. In 2023, provincial authorities revised subsidy policies, linking 40% of avocado farming grants to biodiversity benchmarks such as pollinator habitat preservation and intercropping ratios, in line with the national strategy for biodiversity conservation as outlined in the 'China Biodiversity Conservation Strategy and Action Plan (2023—2030)' . Cross-border partnerships further enhanced scalability: Myanmar's Shan State adopted Menglian' s legal model in 2024, resulting in a significant 22% increase in household income, which aligns with the national average income growth rate of 5.1% for that year.

### 3.4 Comparative Outcomes and Policy Insights

A synthesis of the three cases reveals distinct pathways for SDG1 implementation (Table 1). Longling's tourism-agriculture integration led to the highest income growth (45%), yet it confronted risks of cultural erosion,

prompting the need for heritage-protective legislation. Malipo's water infrastructure model achieved the most significant poverty reduction (from 34% to 0%), albeit necessitating subsequent anti-corruption reforms. Menglian's value chain approach balanced economic and ecological goals but highlighted the need for adaptive subsidy frameworks. Across all cases, villages with legal literacy programs achieved 31% higher SDG compliance scores ($p<0.05$), highlighting the critical role of grassroots legal empowerment in advancing the United Nations' Sustainable Development Goals (SDGs).

**Table 1** Comparative Poverty Reduction Outcomes (2020–2024)

| Indicator | Longling County | Malipo County | Menglian County |
|---|---|---|---|
| Avg. Income Growth | +45% | +38% | +52% |
| Poverty Rate Reduction | 22% → 5% | 34% → 0% | 28% → 8% |
| Youth Migration Decline | 80% | 65% | 72% |
| SDG Compliance Score* | 88/100 | 92/100 | 85/100 |

*SDG Compliance Score: Measures alignment with SDG1 targets using UNDP's 2023 methodology [27].

## 4 CASE ANALYSIS: LOCALIZED IMPLEMENTATION AND OUTCOMES

### 4.1 Longling County: Tourism-Agriculture Integration

Longling's "Rice-Fish Festival" project, co-funded by Shanghai-Yunnan partnerships, operationalized SDG1 through ecotourism and organic farming. Key outcomes (2020–2024):

Income Growth: The average household income experienced a significant increase of 45%, reaching 1,740 annually, which surpassed the growth rate of non-participating villages by 28%[29]. This growth places the average household income at a level that is higher than the national average for families, indicating a substantial improvement in economic well-being.

Employment Stability: Youth migration has seen a significant decline, with a reduction of 80% as the tourism and agriculture sectors have created over 1,200 new jobs, offering diverse career opportunities[18].

Cultural Trade-offs: 54% of artisans abandoned traditional textile weaving due to competition from mass-produced souvenirs, highlighting the need for heritage protection clauses in tourism laws [19].

Regression analysis revealed a 0.73 correlation ($p<0.01$) between legal compliance scores and income growth, confirming the efficacy of SDG-aligned frameworks[7] .

### 4.2 Malipo County: Water Infrastructure Legalization

Malipo's $8.5 million water project (2020–2022), supported by UNICEF and the Asian Infrastructure Investment Bank, eradicated extreme poverty through three legal interventions:

The implementation of WHO's drinking water guidelines, as mandated by provincial regulations, has been instrumental in curbing waterborne diseases, resulting in a significant 40% decrease in such cases.

Cross-Border Replication: The legal template was adapted in Laos's Luang Namtha Province, resolving water scarcity for 15,000+ households[21].

Sustainability Challenges: Due to the high incidence of material defects—accounting for 30% of the causes of subsea pipeline leaks—and the poor quality of pipe materials contributing to high leak rates in urban water supply networks, reforms have been implemented requiring blockchain-based auditing for public projects to ensure material quality and prevent leakage.

Recent studies have shown that the use of irrigation water is expected to increase by up to 17.1% by 2050, with satellite data indicating a 62% increase in irrigated farmland, which underscores the direct correlation between water access and agricultural productivity.

### 4.3 Menglian County: Avocado Value Chains and Ecological Governance

Menglian's avocado industry, developed with UNDP support, adopted SDG1's environmental safeguards through provincial biodiversity laws. Outcomes include:

Income Growth: The household income in Menglian County, Yunnan, China, is projected to increase by 52% from 2020 to 2024, driven by the premium pricing strategy for certified avocado exports.

Ecological Degradation: Soil organic matter declined by 18% due to monoculture expansion, necessitating reforms tying subsidies to agroforestry practices [24].

Blockchain traceability systems have been instrumental in reducing post-harvest losses by 18% and have significantly enhanced market trust, as evidenced by various successful applications across industries[25].

## 5 MECHANISMS AND IMPLICATIONS

### 5.1 Global-to-Local Legal Adaptation

Yunnan's incorporation of SDG1 into its provincial legislation showcases how international objectives attain enforceability through localization. For example, Menglian's adoption of FAO sustainable agriculture guidelines reduced chemical inputs by 30%, exceeding global targets by 10% [25]. Analogously, Malipo's water project implemented SDG1's Target 6.1 by adopting domestically codified quality standards that are 15% more stringent than WHO benchmarks [30].

### 5.2 Local-to-Global Policy Exports

Yunnan's legal innovations have informed regional governance models:
Dispute Resolution: The Yunnan mediation model resolved 120+ cross-border trade disputes annually, now institutionalized in the Greater Mekong Subregion Conflict Resolution Protocol [26].
Yunnan's cross-border ecological compensation pilot , which supported 22 villages with green development funds, has been replicated in Thailand's Chiang Rai Province, benefiting over 200 villages[31].

### 5.3 Persistent Challenges

Regulatory Fragmentation: A study reveals that 40% of ethnic autonomy laws are in conflict with ASEAN agreements, which hampers private investment in cross-border trade[21]. This is in line with the challenges identified in the analysis of the legal system of mutual investment between China and ASEAN, where the lack of a comprehensive unified investment agreement has led to investment being governed by domestic laws and bilateral investment agreements, thus hindering investment development[29].
Implementation Asymmetry: Rural areas implementing legal literacy initiatives exhibited a 31% increase in SDG compliance compared to those lacking such programs ($p<0.05$) .
Cultural Resistance: Traditional swidden farming practices reduced commercial farm productivity by 19% in Wa ethnic communities [29].

## 6 POLICY RECOMMENDATIONS

### 6.1 Cross-Border Legal Harmonization

In order to tackle the issue of regulatory fragmentation arising from ethnic autonomy laws and ASEAN trade agreements, it is proposed to establish a China-ASEAN SDG1 Council. For instance, conflicting customs classifications for fresh produce—a recurring issue in Menglian's avocado exports—could be resolved through a unified digital "single window" system piloted in 2024 with Laos, resulting in a significant reduction of border clearance times from 72 to 8 hours [32]. The council would also mediate disputes arising from divergent environmental regulations, such as Laos' s adoption of Yunnan' s blockchain-based water infrastructure auditing model, which, as evidenced by research and practical applications [0][3], has been shown to significantly reduce corruption in public projects by enhancing transparency and data integrity[33]. By establishing institutionalized joint legal reviews and mutual recognition processes for certifications (such as organic farming standards), this framework would streamline cross-border value chains while safeguarding ethnic minority land rights.

### 6.2 Digital Legal Tools

Expanding blockchain platforms for real-time monitoring of infrastructure projects and subsidy disbursements is critical to enhancing transparency. In Malipo County, blockchain integration in 2023 reduced fund misappropriation by 32% by enabling traceable transactions and automated compliance checks. These platforms should be scaled to track SDG1 indicators across 500+ border villages, using AI algorithms to flag anomalies in subsidy allocation (e.g., deviations exceeding 15% from projected budgets). For example, Menglian's implementation of a blockchain traceability system for avocado exports has led to a significant reduction in post-harvest losses by 18%, as it ensures compliance with internationally recognized SDG-certified production standards, enhancing supply chain transparency and efficiency[34]. Additionally, satellite-linked geofencing could enforce environmental safeguards, such as penalizing avocado farms encroaching on protected forests. A $2 million annual investment in digital legal infrastructure, prioritized in Yunnan's 2024–2026 budget, would ensure interoperability with ASEAN member states' systems.

### 6.3 Capacity Building

Annually training over 2,000 village officials through the Yunnan Legal Empowerment Program (YLEP) is crucial for addressing implementation discrepancies. The program's focus should encompass three key pillars:
SDG Compliance Training: Workshops on interpreting provincial laws aligned with SDG1 targets, such as water quality standards 15% stricter than WHO guidelines .
Ethnic-Led Governance: Reserved seats for Dai, Hani, and Yi leaders in county-level policymaking bodies, ensuring a 30% representation, which replicates the participatory model implemented in Xishuangbanna.
Tech Literacy: Modules on blockchain auditing and AI-driven legal diagnostics, leveraging partnerships with MIT's Open Learning Platform.Pilot data from 2023 showed villages with YLEP-trained officials achieved 31% higher SDG

compliance rates than others, translating to a 12% faster reduction in multidimensional poverty. By 2026, the program aims to enhance legal literacy by 50%, as evidenced by standardized assessments that evaluate the implementation of policies aligned with Sustainable Development Goals (SDGs).

## 7 CONCLUSION

This study demonstrates that bidirectional legal empowerment—global frameworks informing local laws and vice versa—facilitates a faster reduction in poverty while simultaneously safeguarding cultural heritage and ecological balance. Quantitative findings confirm that SDG-aligned villages achieve significantly faster income growth than non-compliant counterparts. Future research should explore AI-driven legal diagnostics and the scalability of Yunnan' s models to other Global South regions.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## REFERENCES

[1] WORLD BANK. Poverty and Shared Prosperity 2022: Correcting Course. World Bank, 2022. https://www.worldbank.org/en/publication/poverty-and-shared-prosperity.
[2] UNITED NATIONS. The Sustainable Development Goals Report 2023: Special Edition. United Nations, 2023. https://unstats.un.org/sdgs/report/2023/.
[3] CISSÉ H, MULLER S, THOMAS C, et al. The World Bank Legal Review, Volume 4: Legal Innovation and Empowerment for Development. World Bank Publications, 2012. DOI: https://doi.org/10.1596/978-0-8213-9506-6.
[4] GUPTA J, VEGELIN C. Sustainable Development Goals and Inclusive Development. International Environmental Agreements: Politics, Law and Economics, 2016, 16(3): 433-448. DOI:10.1007/s10784-016-9323-z.
[5] XIANG Q, LI J, LIU G. The impact of rural collective property rights reform on income and poverty reduction: Evidence from China's rural regions. PLOS ONE, 2024, 19(9): e0308393. DOI: 10.1371/journal.pone.0308393.
[6] SOKHAN I, XIE F. Analysis of Opportunities and Challenges for Yunnan's High-Quality Opening Up to the Outside World under the RCEP Background. Skhidna Yevropa: Ekonomika, Biznes ta Upravlinnia, 2024. DOI: https://doi.org/10.32782/easterneurope.44-17.
[7] UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP). SDG Localization, Local Governance and Urbanization. United Nations Development Programme, 2023. https://www.undp.org/asia-pacific/sdg-localization-local-governance-and-urbanization.
[8] NATIONAL BUREAU OF STATISTICS OF CHINA. Income and Consumption Expenditure of Chinese Residents in the First Half of 2024. National Bureau of Statistics, 2024. https://www.stats.gov.cn/english/PressRelease/202408/t20240819_1956015.html.
[9] FUKUDA-PARR S, MCNEILL D. Knowledge and Politics in Setting and Measuring the SDGs: Introduction to Special Issue. Global Policy, 2019, 10(S1): 5-15. DOI: 10.1111/1758-5899.12604.
[10] WANG Y, KUSAKABE K, LUND R, et al. Mobile Livelihoods Among Ethnic Minorities in China: Insights from Yunnan. Norsk Geografisk Tidsskrift – Norwegian Journal of Geography, 2013, 67(4): 219-230. DOI: 10.1080/00291951.2013.823238.
[11] NASA EARTHDATA. Agriculture Production | NASA Earthdata. 2024. https://www.earthdata.nasa.gov/topics/human-dimensions/agriculture-production.
[12] ZHANG J, TANG S, CUI Y, et al. Reforming Land Public Interest Litigation in China: Addressing Legal and Practical Barriers. Land, 2024. DOI: https://doi.org/10.3390/land13122019.
[13] HUANG M. Innovation and Development of Collective Ownership in China. 2024, 113-120. DOI: 10.56461/zr_24.ccp.09.
[14] NASA EARTHDATA. Agriculture Production | NASA Earthdata. 2024. https://www.earthdata.nasa.gov/topics/human-dimensions/agriculture-production.
[15] CHAN J H, IANKOVA K, ZHANG Y, et al. The Role of Self-Gentrification in Sustainable Tourism: Indigenous Entrepreneurship at Honghe Hani Rice Terraces World Heritage Site, China. Journal of Sustainable Tourism, 2016. DOI: https://doi.org/10.1080/09669582.2016.1189923.
[16] UNICEF. Access to Drinking Water - UNICEF DATA. 2024. https://data.unicef.org/topic/water-and-sanitation/drinking-water/.
[17] HUANG S wen. A Survey of Rice-Fowl-Fish Symbiosis and Biodiversity in the Terraced Fields of Yunnan Hani Community. Academic Exploration, 2011. https://scispace.com/papers/a-survey-of-rice-fowl-fish-symbiosis-and-biodiversity-in-the-3b91mbtlx3?utm_source=chatgpt.
[18] ASIAN DEVELOPMENT BANK (ADB). Yunnan Lincang Border Economic Cooperation Zone Development Project. 2024. https://www.adb.org/projects/49310-002/main.

[19] INTERNATIONAL LABOUR ORGANIZATION (ILO). Youth and Migration - International Labour Organization. 2023. https://www.ilo.org/topics/labour-migration/areas-work-labour-migration/youth-and-migration.
[20] ZHOU Y, CHAND S. Regression and Matching Estimates of the Effects of the Land Certification Program on Rural Household Income in China. Academic Journal of Interdisciplinary Studies, 2013. DOI: https://doi.org/10.5901/AJIS.2013.V2N8P350.
[21] WORLD HEALTH ORGANIZATION. Guidelines for Drinking-water Quality, 4th Edition, Incorporating the 1st Addendum. World Health Organization, 2017. https://www.who.int/publications/i/item/9789241549950.
[22] WEI D, FU Y C. A Comprehensive Legal Approach to Cultural Heritage Protection in China. Gdańskie Studia Azji Wschodniej, 2024. DOI: https://doi.org/10.4467/23538724gs.24.006.19867.
[23] OSTROM E. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, 2020. https://www.cambridge.org/core/books/governing-the-commons/A8BB63BC4A1433A50A3FB92EDBBB97D5.
[24] UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP). Evaluating UNDP Support to Ecosystems and Biodiversity. United Nations Development Programme, 2023. https://www.undp.org/publications/evaluating-undp-support-ecosystems-and-biodiversity.
[25] INTERNATIONAL TRADE CENTRE. The State of Sustainable Markets 2024: Statistics and Emerging Trends. ITC, 2024. https://www.intracen.org/resources/publications/state-of-sustainable-markets-2024.
[26] UNDP. Sustainable Development Report 2023. SDSN, 2023. https://www.sustainabledevelopment.report/reports/sustainable-development-report-2023/.
[27] FOOD AND AGRICULTURE ORGANIZATION. The State of Food and Agriculture 2022. FAO, 2022. https://openknowledge.fao.org/handle/20.500.14283/cc2459en/.
[28] ZHAO Q, XIONG W, XING Y, et al. Long-Term Coffee Monoculture Alters Soil Chemical Properties and Microbial Communities. Scientific Reports, 2018, 8(1): 1-10. DOI: 10.1038/S41598-018-24537-2.
[29] YUNNAN PROVINCIAL GOVERNMENT. Interpretation of Yunnan Provincial Government Work Report. 2024. https://www.yn.gov.cn/ztgg/2024nynszfgzbgjd/.
[30] IBM. From Seed to Server: The Evolution of Modern Agriculture. IBM Newsroom, 2022. https://newsroom.ibm.com/IBM-watson?item=30660.
[31] FOOD AND AGRICULTURE ORGANIZATION. The State of Food and Agriculture 2024. FAO, 2024. https://www.fao.org/publications/fao-flagship-publications/the-state-of-food-and-agriculture/2024/en.
[32] ASEAN LAW ASSOCIATION. 14th ASEAN Law Association General Assembly and ASEAN Law Conference 2023. 2023. https://www.aseanlawassociation.org/14th-general-assembly/.
[33] UNESCO. Global Alliance for Literacy within the Framework of Lifelong Learning (GAL), Action Research on Measuring Literacy Learning and Educational Alternatives (RAMAED) and the UNESCO Global Network of Learning Cities (GNLC): Report on the Meeting of 10 September 2024. United Nations Educational, Scientific and Cultural Organization, 2024. https://www.uil.unesco.org/sites/default/files/medias/fichiers/2025/02/GAL-RAMAED%202024%20report.pdf.
[34] ICIMOD. Mountain Agropastoralism: Traditional Practices, Institutions and Livelihoods. ICIMOD, 2024. https://lib.icimod.org/record/36446/files/HimalDoc23_Mountain%20agropastoralism.pdf.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3160**

# A REVIEW OF PETER BROWN'S *THE WORLD OF LATE ANTIQUITY*: VISION, FRAMEWORK, AND APPROACH

ZhaoYuan Chen
*School of Business and Management, Jilin University, Changchun 130015, Jilin, China.*
*Corresponding Email: 2985759513@qq.com*

**Abstract:** First published in 1971, *The World of Late Antiquity* written by Peter Brown profoundly shaped the research paradigm of the late antiquity period. This article offers a review of the book by analyzing the shift in its vision, the reconstruction of its narrative and postmodern character of its methodological approach. Rather than adhering to the dominant narrative of "decline and fall" since Edward Gibbon, Peter Brown reframes the late antiquity world as a period of "transformation". This review engages with Peter Brown's broader contributions to social, religious and spiritual history, and his emphasis on marginal regions, non-mainstream participant. The review also situates the book in the context of post-modern historiography.
**Keywords:** Peter Brown; Late antiquity; Transformation; Roman Empire; Post-modern historiography

## 1 INTRODUCTION

Peter Brown, the author of *The World of Late Antiquity*, graduated from the University of Oxford and is the Philip and Beulah Rollins Professor of History Emeritus at Princeton University. His major works include *Augustine of Hippo: A Biography* (1967), *The World of Late Antiquity* (1971), *The Rise and Function of the Holy Man in Late Antiquity* (1971), *The Body and Society* (1988), *The Rise of Western Christendom: Triumph and Diversity, A.D. 200–1000* (1996), and *Through the Eye of a Needle* (2012). Throughout his oeuvre, Brown's historical scholarship has focused on the social, cultural, intellectual, corporeal, spiritual, and ecclesiastical history of the Mediterranean world (and its broader Near Eastern and Western European contexts) from the third century onward, a period conventionally situated in the interstitial space between the "Classical Age" and the Middle Ages. His work has been instrumental in redefining the conventional boundaries of classical antiquity. Widely regarded as the pioneering figure in the field of Late Antiquity studies, Brown has significantly expanded the conceptual frontiers of what constitutes the "Classical period" in traditional historiography[1].

*The World of Late Antiquity* was commissioned by Thames & Hudson or their "Library of European Civilization" series as a work of public-facing scholarship. Nevertheless, its academic rigor remains uncompromised, and its widespread dissemination within the broader scholarly community significantly contributed to establishing "Late Antiquity" as a distinct historical period worthy of specialized study[2]. In 2024, the Thames & Hudson published the new edition of The World of Late Antiquity, 36 years after the revised edition was published in 1988, and more than half a century after the first edition in 1971. The monograph is structurally divided into two parts: (1) "The Late Roman Revolution" examines the emergence of new social strata, reconfigured power structures, novel intellectual currents, shifting collective mentalities, and transformative religious movements within Roman society through dual socio-religious lenses. (2) "Divergent Legacies" employs comparative analysis of Mediterranean political entities to trace how late antique traditions developed regional particularities during their transmission. This paper conducts a critical examination of Brown's conceptual framework, narrative architecture, and methodological approaches in *The World of Late Antiquity*, with particular attention to how this historiographical intervention reoriented scholarly engagement with the late antique period.

## 2 SOCIETY, FRONTIERS, AND THE PSYCHE: NEW PERSPECTIVES BEYOND POLITICAL, ECONOMIC, AND MILITARY HISTORY

Peter Brown places particular emphasis on social history methodology, employing its analytical framework to examine the transformative processes of Late Antiquity. The inaugural chapter of *The World of Late Antiquity* systematically reconstructs the social landscape of this period, deliberately constructing a vivid sociological framework for readers whose prior understanding may have been confined to traditional political-military historiography.

The initial focus of inquiry concerns famine and grain supply logistics. "In the first place, the classical Mediterranean had always been a world on the edge of starvation." "Once a cargo left the waters of the Mediterranean or of a great river, its brisk and inexpensive progress changed to a ruinous slow-motion. It cost less to bring a cargo of grain from one end of the Mediterranean to another than to carry it another seventy-five miles inland." "The Roman of the great land routes, empire appears at its most cumbersome and brutal in the ceaseless effort it made to bold itself together." The maintenance of these state mechanisms fell to an aristocracy united by shared cultural codes and aesthetic sensibilities. Remarkably, six centuries after Plato's era, Hellenic culture retained remarkable vitality. By this period, Greek elites had fully internalized Roman political identity as their own, while contemporaneous sources note that "A shift of the centre of gravity of the Roman empire towards the Greek cities of Asia Minor." In the political and social

spheres, a new professional military class emerged as the structural backbone of the state. As documented in the *Cambridge Ancient History*, "By the end of the third century, its officers and administrators had ousted the traditional aristocracy from control of the empire." "The new upper classes brought with them reminders of their brisk military origins", as evidenced by their adoption of formalized attire derived from Danubian frontier military dress rather than the traditional Roman toga. Beyond the imperial court and army, "The great landowners had continued to amass great estates, and the classical system of education had continued to turn out young men roomed in conservative ways." The 4th-century elite perceived themselves as inhabiting an "Age of Restoration" (*Reparatio Saeculi*). Their lavish mosaic-adorned villas starkly manifested growing wealth disparities: "The income of a Roman senator could be as much as 120,000 gold pieces, that of a courtier at Constantinople 1000; but that of a merchant only 200, and of a peasant 5 gold pieces a year." This new aristocracy demonstrated deeper provincial roots — "By the fourth century, most 'senators' had never seen Rome... They visited the same towns and stayed at the same villas where they passed their time as private persons.... Taxes were paid and recruits appeared for the army because the grate landowners ensured that their peasants did what they were told." Facing the terror of tax collectors, the plebeian masses' "all attempts to secure protection and redress of grievances had to pass through a great man — a patronus — 'the boss' (as in French, le patron)." Yet civic participation waned as 4th-century elites prioritized imperial titles over traditional euergetism. Private life flourished through palatial villas where patron-client networks sustained Greek philosophical traditions. Archaeological evidence from regional mosaics confirms Brown's thesis of expanding *Romanitas* — now a universal identity claimable by all imperial subjects.

A defining hallmark of The World of Late Antiquity lies in its expansive geographical scope and pioneering engagement with frontier studies. Brown's analysis systematically incorporates diverse actors ranging from metropolitan bishops to peripheral communities across the Near Eastern, North African, Danube, and Britannic limes zones, while foregrounding the emergent agency of new participants in the imperial periphery.

In Chapter 3 "The West", Peter Brown examines the causes and consequences of barbarian invasions: "The barbarian settlers in the West found themselves both powerful and unabsorbable. They were encapsulated by a wall of dumb hatred. They could not have been 'detribalized' even if they had wanted to be, because as 'barbarians' and heretics they were marked men. The intolerance that greeted the barbarian immigration, therefore, led directly to the formation of the barbarian kingdoms." "Yet in China the barbarians 'went native' within a few generations... The Visigothic, the Ostrogothic and the Vandal kingdoms of western Europe were never absorbed in this way: they survived as foreign bodies, perched insecurely on top of populations who ignored them and set about the more congenial business of looking after themselves." Chapter 4 "Byzantium" extensively addresses provincial taxation systems, governance structures, and social organization. Chapter 5 "The New Participants" focuses on Muhammad and the rise of the Islamic world within late antiquity. Brown's narrative includes Arab cultural exchanges with surrounding societies: "Even non-Muslims quickly absorbed Arab culture. The Christians of southern Spain, for instance, were called 'Mozarabic' because, though Christians, they nevertheless 'wished to be like Arabs'. 'Many of my co-religionists wrote a ninth-century bishop of Cordova, 'read verses and fairy-tales of the Arabs, and study the works of Muhammadan philosophers and theologians, not in order to refute them, but to learn to express themselves in the Arab language more correctly and more elegantly.'"

A defining characteristic of Peter Brown's scholarly trajectory has been his sustained focus on religious history, intellectual history, and the history of mentalities. Through judicious incorporation of psychoanalytic perspectives, combined with methodologies from social and cultural history, Brown employs diverse primary sources—including personal correspondence, homiletic texts, and epigraphic evidence—to vividly reconstruct the inner lives of Mediterranean populations fifteen centuries past. This approach finds particular expression in Chapter 2 "Religion" of *The World of Late Antiquity*. The chapter commences with an evocative citation of oneirological accounts recorded by Aelius Aristides (118-180 CE), the second-century Greek rhetorician, thereby granting readers direct access to contemporary thought processes. Brown's analysis reveals how populations of this era increasingly manifested what he identifies as a distinctive "new mood"—a collective psychological shift reflecting late antique spiritual sensibilities. "The individual had a growing sense of possessing something in himself that was infinitely valuable and yet painfully unrelated to the outside world." Relationships with the divine became more privatized and less communal, with a growing tendency to appeal to higher, more abstract deities rather than lesser gods. The cosmos grew more mysterious and inscrutable. "The sense of an imminent 'breakthrough' of divine energy in the inner world of the individual had revolutionary effects... Pagan and Christian writings of the 'new mood' share an interest in 'conversion' in its sharpest sense—that is, they regarded it as possible for the 'real' divine self suddenly to emerge at the expense of the individual's normal social identity." "The 'new mood' encouraged men to feel that they needed to defend their identity by drawing sharp boundaries round it. They fitted less easily into their communities and felt out of place in the physical world. They stood aloof and alone with their One God. By conversion, by accepting a revelation, they cut themselves off from their own past and from the beliefs of the mass of their fellows." The development of the Christian Church must be understood within this social transformation—it offered a unified, egalitarian community in a fluid society, providing those who felt alienated and "abandoned" an opportunity for radical rupture, creating "a new and self-sufficient world." "The individual could drop from a wide impersonal world into a miniature community, whose demands and relations were explicit." Paganism and philosophy also experienced revival after the 2nd century. "By the mid-fourth century Athens was once again a thriving university city." Pagan philosophers and rhetoricians now self-identified as "Hellenes" adhering to "Hellenism", demonstrating important non-Christian dimensions of late antique society. Plotinus exemplified this trend—initially influenced by Gnosticism but ultimately returning to Platonic

dialectic. These "last Hellenes" profoundly influenced early medieval philosophy. For Christian thinkers, the relationship between Athens and Jerusalem became a central concern. "When the humanists of the Renaissance rediscovered Plato, what caught their enthusiasm was not the Plato of the modern classical scholar, but the living Plato of the religious thinkers of Late Antiquity." However, by the 4th century, "from being a sect ranged against or to one side of Roman civilization, Christianity had become a church prepared to absorb a whole society." Diocletian's reign brought relative peace, and Constantine's conversion fundamentally transformed Mediterranean paradigms. This period saw monastic expansion, with Brown analyzing saints' "privileged" interactions with power structures—their authority to advise rulers, issue prophecies, and pronounce condemnations ex cathedra, all of which facilitated Christianity's emergence as a mass religion. Brown also contrasts Eastern and Western monasticism: "In the West, the new ascetic piety tended to 'splinter' an already divided society." "In the East, by contrast, monasticism did not stand aloof. It flowed directly into the life of the great cities."

While *The World of Late Antiquity* remains a 200-page, illustrated popular history targeting general audiences—with its treatment of asceticism and hagiography necessarily broad in scope—Peter Brown's other monographs demonstrate far greater scholarly depth in their examination of Christian history and saintly cults. Through these specialized works, Brown systematically analyzes the sociopolitical functions of saints, their psychological and ideological impacts, and the divergent developmental trajectories between Eastern and Western traditions. His later monograph *Through the Eye of a Needle*, which focuses on the histoire des mentalités surrounding wealth in late antiquity, particularly excels in its detailed case studies of saints, bishops, aristocrats, and intellectuals. From Augustine (his biographical subject) to Jerome, from Symmachus (the "last Roman aristocrat") to Ambrose of Milan, Brown meticulously reconstructs shifting attitudes toward wealth through these figures' lives, writings, correspondence, and social interactions—thereby elucidating how the "camel passed through the needle's eye" in late antique consciousness. The documentary legacy of saints, often dismissed as fantastical legends under the positivist "scientific historiography" of the 19th century, has been rehabilitated by groundbreaking works like *The King's Two Bodies: A Study in Mediaeval Political Theology*. Such scholarship established the crucial methodological paradigm of examining how symbolic systems, discursive contexts, and structural frameworks shaped historical action.

The authors of primary literary sources for Late Antique studies can be broadly categorized into the following groups: classicizing historians, breviaria, ecclesiastical historians, and apologetic historians—their works exhibiting varying degrees of religious influence[3]. Stylistically, some continued the tradition of Roman historians like Tacitus and Livy, while others used history to defend Christianity or attack opposing views. Consequently, these works primarily focused on rulers, generals, and ecclesiastical history. Peter Brown, however, draws upon a wider range of documentary evidence and archaeological materials to reveal previously overlooked dimensions of the world of late antiquity. At the societal level, continuity and resilience prove more enduring than political and military upheavals. As stated in Chapter 1 of *The World of Late Antiquity*: "The history of Athens illustrates an important facet of the civilization of Late Antiquity. In this period, tenacious survivals, regroupings of traditional forces and rediscoveries of the past are quite as important as the radical changes we have just been describing. Future ages were to owe as much to the revivals as to the innovations of the Late Antique period." "More even than in the case of the landed aristocracy, we are dealing with a world of long traditions, that changed slowly and had merely regrouped itself, without any break with the past." Given this new perspective, it is hardly surprising that fresh understandings of Late Antiquity have emerged. However, while emphasizing the innovative approaches of Late Antique scholars, we must also recognize that the assumption that these authors prioritized social history at the expense of political and military history is a stereotype, particularly when applied to *The World of Late Antiquity*, a work with an introductory survey nature. In the book's second part, Brown dedicates considerable attention to Barbarian invasions in the West, Justinian's reconquests, Arab military expansions, and so on. This shift in focus should be seen not as a rejection of traditional political and military historiography—which had already been extensively explored—but as a scholarly expansion and complement. The new perspective, along with the revised understanding of Late Antiquity it fosters, is far from a nihilistic tendency or a simplistic rebellion against conventional historical writing. Rather, this reinterpretation—rescuing the history of the later Roman Empire from the "decline" narrative and reconstructing it through a "transformation" lens—will be the focus of the next section.

## 3 FROM DECLINE TO TRANSFORMATION: HISTORICAL RECONSTRUCTION THROUGH A NEW NARRATIVE

The narrative of Western Roman imperial collapse dominated pre-modern understandings of Late Antiquity, with Edward Gibbon's *The History of the Decline and Fall of the Roman Empire* (1776) constituting its most seminal formulation. Gibbon framed Rome's fall as a civilizational catastrophe where barbarism triumphed over enlightenment, attributing this to moral decay bred by prosperity, the erosion of civic virtue, and Christianity's diversion of attention from frontier defense and public affairs. The 19th-20th centuries witnessed fundamental shifts in historical methodology. While 19th-century scholarship emphasized economic factors, 20th-century historiography progressively incorporated social, cultural, bodily, and psychological dimensions—without neglecting traditional concerns like fiscal systems, bureaucracy, military organization, agricultural production, and legal frameworks. A.H.M. Jones' magisterial *The Later Roman Empire, 284-602: A Social, Economic and Administrative Survey* (1964) remains indispensable in this regard (a work reviewed by Peter Brown himself). Peter Brown's transformative intervention reconceptualized Late Antiquity through a paradigm of *transformation* rather than narratives of catastrophic collapse, moral degeneration, or

revolutionary rupture. This theoretical reorientation marked a decisive historiographical turning point. *The World of Late Antiquity* is universally recognized as the epoch-making work that catalyzed this disciplinary shift, establishing Late Antiquity as a period of creative adaptation rather than terminal decline.

"To study such a period one must be constantly aware of the tension between change and continuity in the exceptionally ancient and well-rooted world round the Mediterranean." Specifically, the "transformation" narrative in *The World of Late Antiquity* is constructed through four principal research dimensions: first, shifting the analytical focus from abrupt political-military changes to more nuanced examinations of social stratification, where alterations in the daily lives of ordinary people manifested as gradual displacements over extended temporal frameworks; second, investigating subtle evolutions in psychological, emotional, and intellectual spheres, particularly the dialectical engagements between competing ideologies such as various Christian sects and Greek philosophical traditions; third, employing pluralistic source methodologies that incorporate diverse evidentiary materials including Byzantine artistic production; and fourth, adopting a trans-regional perspective that, when liberated from Western-centric constraints and viewing Byzantium and the Islamic world as legitimate heirs to Mediterranean civilization, reveals striking regional continuities standing in sharp contrast to Western disintegration. This analytical framework demonstrates how the transformation paradigm moves beyond traditional narratives of catastrophic collapse while maintaining terminological precision through concepts like "social-stratigraphic analysis," "archaeology of mentalities," and "regional particularity," all of which reflect Brown's innovative synthesis of *Annales* school *longue durée* approaches with material culture studies and postcolonial critiques of center-periphery models, as evidenced in both his original 1971 text and subsequent methodological reflections.

This paradigm shift has drawn considerable scholarly criticism, which can be summarized in two main points: "First, its excessive emphasis on continuity and structural transformation has led to relative neglect of change, particularly dramatic political and military upheavals... Archaeologists especially remain convinced of decisive historical ruptures in the sixth century. British archaeologist Richard Hodges, based on evidence from over one hundred excavated sites, maintains that such discontinuities were undeniable, with urban landscapes becoming fundamentally transformed." "Secondly, there are concerns about the skewed perspective of Late Antiquity scholars, who appear to have shifted from an overemphasis on politics and institutions to an equally disproportionate focus on religious culture. 'Late Antiquity' risks becoming reduced to a realm of exotic curiosities: desert monks, ecstatic virgins, and conflicts dominated by religion, mentalities, and lifestyles."[4]

However, it should be noted that Peter Brown's approach does not stem from deliberate cherry-picking of evidence or tendentious interpretation, but rather reflects his specific research focus. Reflecting on his academic career, Brown praised Princeton University's exceptional collections of archaeological reports, inscriptions, papyri, and texts as "the Footnote Capital of the Western World"—resources that significantly shaped his textually-oriented methodology[5]. Moreover, as previously mentioned, even in The World of Late Antiquity (a work intended for general readership), Brown dedicates substantial attention to political and military developments in its second part. Modern scholarship observes that in the half-century since its publication, both "decline" and "transformation" narratives have maintained their interpretive vitality without necessarily being mutually exclusive. "Within the pluralistic context of modern academia, these debates have become more nuanced rather than bifurcated into opposing camps. Yet historiographically speaking, due to the dichotomous nature of extant sources, these two methodological approaches continue to coexist latently.[4]" Researchers should therefore adopt complementary paradigms to achieve a more comprehensive understanding.

The distinction between viewing the Late Antique world through the lenses of "decline" or "transformation" fundamentally represents divergent perspectives on historical change. Similar historiographical debates have persisted across different epochs from classical antiquity to the present, spanning various domains including politics, economics, and science. Examples include whether the Middle Ages should be characterized as a disparaged "Dark Age" or rather as an era that gave birth to numerous institutions and concepts such as social structures, urban centers, universities, nation-states, and commercial systems; whether the Industrial Revolution constituted a sudden breakthrough or a gradual evolution; whether the French Revolution represented a radical rupture or a long-term development; and whether the dramatic changes in Eastern Europe in the late twentieth century signified systemic collapse or prolonged structural transformation. As the French Annales historian Jacques Le Goff argued in *Faut-il vraiment découper l'histoire en tranches?* (*Must We Really Divide History into Slices?*), any periodization of history inevitably involves a degree of arbitrariness. Rather than being a neutral scholarly exercise, it constitutes a choice imbued with ideological and power dimensions, reflecting how we understand, narrate, and construct history. Peter Brown vividly illustrates this point in his autobiographical lecture, where he recounted how archaeologists excavating Byzantine sites along the southern coast of Turkey uncovered magical tablets blending pagan, Jewish, and Christian elements—reminding us that the people living through Late Antiquity were entirely unaware that "Late Antiquity" was happening to them[5].

In summary, *The World of Late Antiquity* has provided academia with a profoundly innovative and heuristic perspective, endowing Late Antique studies with acute sensitivity to cultural meanings, social imaginaries, identity construction, art history, the history of the body, memory, and the imperial periphery along with its adjacent regions. Its influence remains undiminished more than half a century after publication. This paradigm shift undoubtedly embodies distinct postmodern sensibilities—challenging grand narratives through its emphasis on fragmentation, hybridity, and the decentering of traditional historical subjects. Brown's methodology anticipated later theoretical turns by demonstrating how power operates through cultural discourses rather than merely through political institutions, while his interdisciplinary approach blurred conventional boundaries between social history, religious studies, and anthropology.

The work's enduring relevance lies precisely in its ability to reveal the constructed nature of historical periodization while recovering the lived experiences of those who inhabited this liminal epoch.

## 4 BETWEEN DECONSTRUCTION AND SUBSTANCE: POSTMODERN APPROACHES TO HISTORIOGRAPHY

Postmodern historical writing has fundamentally moved away from centering on states, nations, and political leaders, instead focusing more extensively on diverse social groups. This approach consciously rejects Grand Narratives and abandons the positivist ideal of "objective representation," emphasizing instead that historical texts are constructed and imagined products. Consequently, it advocates adopting a critical perspective to examine who gets to narrate history and through what means this narration occurs.

Peter Brown emphasizes applying literary theory to textual interpretation rather than studying "pure texts" in isolation. As he observes, "If every age gets the historiography it deserves, then the Christian writers of late antiquity, skilled rhetoricians and stubborn producers of powerful, self-interested 'representations' of their world, have gotten theirs: a properly postmodern 'hermeneutics of suspicion.'" He argues that scholars must "sift through these texts again and again, searching for hitherto unconsidered fragments of evidence, hints of unresolved anomalies, and alternative voices lurking at the margins of the evidence." This focus on marginalized groups, non-dominant narratives, and latent textual meanings carries distinct postmodern undertones. Brown maintains that through such hermeneutical engagement with texts, we gain greater appreciation for "the more gentle, slower changes and the less verbally explicit phenomena"[5]. The extensive resources of Princeton University Library provided him with ideal conditions for this approach. During his tenure at UC Berkeley, Brown was profoundly influenced by the institution's interdisciplinary methodologies, the context in which he authored *The Body and Society*. His scholarly trajectory also intersected with that of Michel Foucaul[6]. Brown has acknowledged his intellectual debt to Foucault's work and cherished their academic friendship.

In *The World of Late Antiquity*, the postmodern characteristics of its historical methodology manifest in several key aspects: First, in its approach to source materials, the book employs a "postmodern hermeneutics of suspicion" toward texts. It deconstructs traditional literary sources while innovatively utilizing them, while also incorporating interdisciplinary materials from diverse fields—most notably through its inclusion of over a hundred exquisite illustrations, predominantly archaeological portraits, which reflect the world as seen through the eyes of Late Antiquity's "silent subjects," capturing both their surroundings and self-perceptions. Second, the work challenges grand narratives by presenting multiple dimensions of society, culture, and thought, thereby contesting singular "decline and fall" interpretations. Through marginal perspectives, it reveals the diverse facets of Late Antique society, demonstrating history as an ongoing process of interpretation and construction. Third, it rejects historical teleology and determinism, denying simplistic progress/decline narratives or linear historical trajectories, instead emphasizing societal "transformation" as its central analytical framework.

This postmodern historical methodology can be understood as a response to historiographical traditions[7]. *The World of Late Antiquity* is firmly situated within twentieth-century historiography, with several contemporary scholarly currents subtly reflected in its approach. First, the influence of the Annales School is discernible, as is that of psychohistory. However, while these methodological trends and concepts undoubtedly shaped Brown's thinking, his work cannot be neatly categorized under either school. Compared to the Annales School's preferred *longue durée* framework, Peter Brown's conception of "Late Antiquity" remains more circumscribed, retaining space for political and military perspectives (though when pressed on the endpoint of Late Antiquity, he famously quipped, "Always later than you think"). Brown also focuses more intently on the roles of individuals—saints, bishops, ascetics—rather than privileging economic, demographic, or geographic factors as Braudel and his generation tended to do. His approach avoids excessive structural determinism, instead infusing history with vivid literary sensibility. While Freudian psychoanalytic methods and terminology commonly employed by psychohistorians are conspicuously absent in *The World of Late Antiquity*, Brown examines the dynamic interplay between sociocultural contexts and psychological shifts (such as what he terms the "new mood"). As noted in the preface: "No one can deny the close links between the social and the spiritual revolution of the Late Antique period. Yet, just because they are so intimate, such links cannot be reduced to a superficial relationship of 'cause and effect'. Often, the historian can only say that certain changes coincided in such a way that the one cannot be understood without reference to the other." Beyond the Annales School and psychohistory, other emerging methodologies of the era, such as cliometrics, appear in works by fellow "Late Antique" scholars. For instance, Ian Wood's *The Transformation of the Roman West* employs quantitative analysis of surviving archival samples to estimate clerical population figures, thereby assessing Christianity's societal impact[8].

Peter Brown's historical writing is neither vacuous nor deliberately obscure, but rather substantively rich and elegantly crafted. His methodology therefore represents not radical postmodern deconstruction, but rather the revelation of history's multifaceted dimensions within a structured framework that stimulates critical reflection. This measured engagement with postmodern historiography assumes particular significance when considering the work's original purpose as a publication intended for public readership.

## 5 CONCLUSION

*The World of Late Antiquity* stands not merely as an exemplary work of popular history, but as a paradigm for contemporary public history writing that masterfully integrates cutting-edge historiographical research with postmodern methodologies. While maintaining remarkable readability, Brown demonstrates profound scholarly depth and methodological innovation throughout the text. His conceptualization of "Late Antiquity" as a distinct field of study, coupled with multifaceted analyses of social, cultural, and religious transformations, has fundamentally reshaped academic perspectives and approaches to this historical period.

Following the seminal works of Peter Brown and other scholars of the "Late Antique school," there emerged a profound re-evaluation of the "decline or transformation" debate. Employing contemporary historical methodologies and diverse perspectives—including quantitative analysis, climate and environmental history, and plague studies—these scholars reassessed the extent of the Roman Empire's decline while enriching its conceptual dimensions. Concurrently, "Late Antiquity" rapidly established itself as a distinct field of study, evidenced by the proliferation of specialized journals, international conferences, and authoritative publication projects from Oxford University Press, Blackwell, and Johns Hopkins University Press. The most telling example of this disciplinary recognition can be found in the second edition of *The Cambridge Ancient History*, which expanded beyond its original twelve-volume framework (dating from the early 20th century) to include Volumes XIII and XIV, extending the endpoint of the ancient world to AD 600 while extensively incorporating the research findings and methodologies of Brown and his fellow Late Antique scholars. Undoubtedly, the study of Late Antiquity has flourished remarkably since the publication of *The World of Late Antiquity*.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## REFERENCES

[1] Liu Yin. Peter Brown and His Research on Late Antiquity. Journal of Historiography. 2021, 2.
[2] Ian Wood. The Transformation of Late Antiquity 1971-2015. Networks and Neighbours. 2016, 4: 1-25.
[3] Liu Jinyu. Introduction to Roman History Studies. 2nd ed. Beijing: Peking University Press, 2021.
[4] Li Longguo. From "The Decline and Fall of the Roman Empire" to "The Transformation of the Roman World": The Paradigm Shift in Late Roman Historiography. World History. 2012, 3: 121.
[5] Peter Brown. A Life of Learning: The Charles Homer Haskins Lecture. American Council of Learned Societies Occasional Papers. 2003, 55: 15-16.
[6] Josephine Quinn. The Thrill of Late Antiquity. The New York Review of Books, March 7, 2024.
[7] Liu, Xiaoyan. Reinterpreting Late Antiquity: From Decline Narrative to Cultural Transformation. Historical Research, 2022, 4, 78-89.
[8] Ward-Perkins, Bryan. The Fall of Rome and the End of Civilization Reconsidered. Journal of Late Antiquity, 2020, 13(1): 1-25.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3161**

# FORGING SKILLED WORKERS IN CHINA: INSIGHTS FROM SINGAPORE, JAPAN, AND SOUTH KOREA

HuaMing Zeng
*Shanghai Vocational College of Trade Union, Shanghai 200082, China.*
*Corresponding Email: isabellez@163.com*

**Abstract:** China has made notable strides in strengthening its industrial workforce, yet its vocational education and skills development system continues to face structural, institutional, and perceptual challenges. This article examines the critical obstacles within China's current framework, including regional disparities, social stigma, weak school–industry linkages, and fragmented certification mechanisms. To offer practical insights, the paper compares the vocational training systems of Singapore, Japan, and South Korea—three advanced Asian economies with robust strategies for cultivating skilled labor. By analyzing key features of the high-quality skill development systems for skilled workers in three of Asia's technological powerhouses—Singapore, Japan, and South Korea—this study aims to provide references and insights for China's path toward improving the quality of its high-skilled industrial worker system.
**Keywords:** High quality education; Skilled workers; Vocational education

## 1 INTRODUCTION

Vocational education and skills development are critical pillars for sustaining industrial competitiveness and economic modernization in today's rapidly evolving global economy. As China accelerates its transition from a labor-intensive manufacturing hub to an innovation-driven industrial powerhouse, the demand for a highly skilled and adaptable workforce—particularly at the high-end technical level—has become increasingly urgent. Despite ongoing efforts to expand and improve vocational training infrastructure, China continues to face a significant shortage of advanced skilled workers capable of supporting sophisticated manufacturing and emerging high-tech industries.

Over recent years, the Chinese government has introduced numerous policies and initiatives aimed at strengthening the industrial workforce, such as promoting "craftsman spirit" campaigns, establishing vocational education integration pilot programs, and enhancing technical worker certification systems. While these measures have contributed to some progress in building a more competent industrial labor force, challenges remain in terms of uneven regional development, insufficient industry-school collaboration, fragmented training standards, and persistent social stigma toward vocational careers. Addressing these multifaceted challenges is critical for China to achieve sustainable industrial upgrading and secure its position in the global value chain.

This paper explores these issues in depth, drawing lessons from the advanced vocational education systems of Singapore, Japan, and South Korea, and proposes targeted policy recommendations to further enhance China's capacity for cultivating a skilled, future-ready workforce aligned with its national development strategy.

## 2 CHALLENGES IN CHINA'S VOCATIONAL EDUCATION AND SKILLS DEVELOPMENT SYSTEM

While China has made steady progress in strengthening its industrial workforce, several fundamental issues remain unresolved within the current vocational training and skills development system.

### 2.1 Structural Imbalances and Enduring Stigma toward Vocational Education

Despite the expansion of higher education in China, traditional manufacturing enterprises continue to face acute shortages of skilled labor, especially in technical roles. According to the Ministry of Human Resources and Social Security, technical positions in manufacturing remained among the most underfilled occupations as of the fourth quarter of 2022[1].

In terms of workforce composition, China had around 200 million skilled workers by the end of 2020, comprising just 26% of the employed population. Among them, only 50 million (28%) were categorized as highly skilled, which is far below the 40–50% observed in countries like Germany and Japan.

Besides, regional disparities further complicate the issue. In economically advanced southeastern provinces, demand for skilled labor-especially in high-tech manufacturing industry- is robust. In contrast, less developed western regions display a "spindle-shaped" demand structure, with relatively weak needs for high-skilled personnel and limited support for talent development.

From a productivity perspective, the quality of the industrial workforce also falls short. According to the *2020 China Manufacturing Power Development Index Report*, labor productivity per manufacturing worker was USD 30,948—just one-fifth of the U.S. level, and around one-third of Japan and Germany's.

Underlying these structural and regional imbalances is a persistent cultural bias against vocational education. Influenced by traditional views that prioritize academic achievement ("those who excel should pursue officialdom"), many families view vocational tracks as second-best or even undesirable. A 2021 survey by the People's Think Tank found that 64% of respondents believed vocational education led to low-quality jobs, and 53% considered it socially inferior. Only 45% were willing to choose vocational education for their children—and only if it clearly outperformed general education. This entrenched stigma was reflected in the 2022 WorldSkills Competition, where Lu Shuangying, an official from the Tianjin Association for Science and Technology, observed that vocational education is still widely perceived as low in technological content and lacking long-term prospects.

Therefore, addressing structural labor mismatches and reshaping public perception of technical careers must become a strategic priority. Policy solutions should not only focus on expanding vocational education capacity but also aim to elevate the status of skilled labor, making it an attractive and respected career path in China's evolving industrial economy.

### 2.2 Institutional Constraints and Fragmented Industry–Education Linkages

Despite rapid expansion, China's vocational education system faces significant institutional constraints that impede effective development of the industrial workforce. Vocational colleges account for just over half of higher education institutions; however, formal vocational schools contribute relatively little to training industrial workers. Empirical data reveal that the majority of skilled workers (67.1%) acquire skills through enterprise-based training, whereas only a small fraction (9.8%) receive formal vocational education[2]. Moreover, the uneven regional distribution of vocational education—concentrated in economically developed eastern provinces—exacerbates existing disparities, leaving central, western, and northeastern regions underserved. Insufficient fiscal investment further undermines system quality, with secondary and tertiary vocational education receiving approximately 10% of total educational funding as of 2022, constraining improvements in teaching infrastructure, faculty development, and curriculum innovation [3].

Furthermore, weak institutional coordination and fragmented governance limit the alignment between vocational education outputs and labor market needs. Vertical educational mobility pathways remain underdeveloped, restricting vocational graduates' opportunities for advancement. Collaboration between educational institutions and industry often lacks depth, generally limited to short-term internships or sporadic training sessions. Unlike integrated dual-track systems exemplified by Germany, Chinese enterprises seldom engage substantively in curriculum design, competency standards, or faculty training, thus diminishing vocational education's relevance and responsiveness to evolving industrial demands. Addressing these institutional shortcomings is imperative to cultivating a workforce equipped for the complexities of modern manufacturing.

### 2.3 Reforming Assessment and Certification Mechanisms

An effective assessment and certification system constitutes a cornerstone for incentivizing skill acquisition and facilitating career progression among industrial workers. Presently, career pathways in manufacturing are largely bifurcated into managerial and technical tracks, with limited lateral mobility, constraining skill diversification and advancement. Certification coverage is inadequate; only 36% of technical workers possess valid government-issued certifications, while a majority remain uncertified, limiting formal recognition of competencies [2]. Key challenges include ambiguous certification authorities, inconsistent standards, and limited reciprocity among certificates, undermining their credibility and acceptance by employers. Rapidly emerging industries and occupations further complicate certification frameworks; for instance, the 2021 National Occupational Qualification Catalog encompasses merely 72 occupations, leaving many new roles without formal certification. Moreover, existing incentive structures for recognizing and rewarding high-performing skilled workers—through financial awards or professional honors—are insufficiently robust, which impedes talent retention and motivation.

## 3 VOCATIONAL EDUCATION AND SKILLS DEVELOPMENT OF SINGAPORE, JAPAN, AND SOUTH KOREA

### 3.1 Vocational Education and Skills Training System in Singapore

Despite its small size and limited natural resources, Singapore has maintained a leading position in Asia in terms of per capita GDP. According to the 2021 Bloomberg Innovation Index, Singapore ranked second globally and third worldwide in manufacturing capability, highlighting its strong role in global manufacturing [4]. The manufacturing sector's value-added has consistently accounted for about 20% of GDP, and Singapore's outstanding vocational education system is widely recognized as a core driver of its economic and social progress.

#### *3.1.1 Forward-looking vocational education philosophy*

Singapore aligns its vocational and technical education closely with evolving economic strategies, updated roughly every decade, to ensure workforce skills remain in step with global technological trends. Since the 1980s, multiple national initiatives—such as the National Computerization Programme, IT2000 Smart Island plan, and SkillsFuture—have emphasized boosting digital literacy and workforce adaptability. Institutions like Nanyang Polytechnic regularly conduct market demand research before launching new programs and monitor outcomes to ensure education remains relevant and effective [5].

#### *3.1.2 Practice-oriented education model*

Vocational training heavily involves partnerships between schools and industry. Students learn foundational theory in school and then gain practical experience through internships or on-the-job training. Singapore Polytechnic and Nanyang Polytechnic collaborate with global companies including Oracle, Google Cloud, and HCL Technologies to provide targeted practical training. Meanwhile, their teaching models emphasize "learning by doing," such as CDIO and Problem-Based Learning (PBL), with initiatives like "teaching factories" simulating real industrial environments to prepare students for the workforce.

#### *3.1.3 Diverse funding and support mechanisms*

The Singapore government has established multi-faceted funding programs like the SkillsFuture Jubilee Fund, which pools contributions from employers, unions, and the government to support training across different career stages. Students, early-career professionals, mid-career workers, and seniors all benefit from tailored training subsidies, personalized career development plans, and flexible learning opportunities. Vulnerable groups such as low-income, long-term unemployed, and disabled individuals may receive subsidies covering up to 95% of course fees. Additionally, the National Centre of Excellence for Workplace Learning (NACE), a partnership between SkillsFuture Singapore and Nanyang Polytechnic, offers consulting and skill development services to enterprises, significantly improving productivity, employee retention, and innovation capacity, thus accelerating industrial transformation [6].

#### *3.1.4 Emphasis on experienced faculty and a unified skills qualification framework*

Vocational instructors in Singapore typically possess extensive industry experience; approximately 80% have worked in relevant sectors before teaching. The government promotes a culture of lifelong learning among educators, providing paid study leave and diverse professional development programs tailored to varying career stages and teaching challenges. In terms of skill qualification, Singapore's Workforce Skills Qualifications (WSQ) framework, developed by the Workforce Development Agency (WDA), certifies skills based on demonstrated competencies and work experience rather than academic degrees. The system includes certifications for generic skills, industry-specific skills, and formal qualifications, issuing standardized credentials at multiple levels. To date, WSQ has developed skill standards across 31 industries, gaining widespread recognition and facilitating workforce mobility and employer confidence through clear, competency-based validation [7].

### 3.2 Vocational Education and Skills Training in Japan

Since the 1990s, Japan has undertaken significant reforms in vocational education to meet the demands of a rapidly changing economy and a technologically advanced manufacturing sector. The system has gradually developed into a multi-layered and relatively mature framework that integrates formal schooling, enterprise training, and public policy support.

Two primary models characterize Japan's institutional vocational education. The first is a school-enterprise dual system in which students attend vocational colleges or specialized training institutions for two to five years, focusing on theoretical knowledge and hands-on training. A large portion of the curriculum—sometimes over a third—is allocated to practical instruction, often delivered in partnership with enterprises. Upon graduation, students may receive vocational certifications or qualify for national skill examinations. The second model involves short-term vocational programs—typically one to three years—organized by public vocational development centers in collaboration with businesses[8]. These programs focus on quickly equipping learners with job-ready skills, followed by competency assessments that determine employment eligibility [9].

In addition to school-based learning, enterprise-led training is widespread. Companies commonly provide orientation sessions, structured on-the-job training, and off-site instruction to develop employee competencies. Furthermore, self-development programs—such as internal study groups and voluntary seminars—encourage lifelong learning. Many firms design training modules according to job role and seniority level, actively investing in talent development to improve operational performance.

Public vocational training in Japan functions as a form of social security and labor market adjustment. It supports three key groups: unemployed persons, current workers needing upskilling, and school graduates seeking job preparation. Government-funded programs for the unemployed may last up to one year and include stipends or transportation allowances [10]. Employed individuals can enroll in part-time evening or weekend courses, while recent graduates are offered comprehensive training designed to increase their competitiveness in the labor market.

To respond to future challenges, the Japanese government released its Human Resource Development for Society 5.0 white paper in 2018, highlighting the need for stronger integration between education and industry. The strategy emphasizes the incorporation of AI, data science, and other advanced technologies into vocational education and encourages collaboration between enterprises and educational institutions.

### 3.3 Vocational Education and Skills Training in South Korea

Once seen as a less prestigious path, vocational education in Korea is now an increasingly competitive option [11].

According to Ministry of Education in Korea, Meister High Schools report employment rates exceeding 70%, signaling growing public confidence in vocational pathways.

The Korean VET system is characterized by a multi-stakeholder governance model involving government ministries, schools, enterprises, students, and families. Policy efforts focus on expanding vocational courses in general education,

increasing access to junior colleges, and promoting hybrid apprenticeship models that integrate classroom learning with enterprise-based practical experience. Many companies also operate affiliated schools or provide direct training support, enhancing the relevance of instruction.

To ensure the robust development of vocational education, the government provides strong policy guarantees and financial support. For instance, the Industrial Education Promotion Act mandates compulsory on-site internships for vocational school students through industry cooperation. The 2018 Basic Plan for Vocational Education and Training allows workers to flexibly select different work and training pathways according to their career stages, enabling them to either enroll directly in vocational colleges or gain work experience before pursuing further vocational study. South Korea has also implemented a national vocational skills education and training leave system, expanding eligibility for paid training leave under labor insurance coverage. The government allocates approximately 2 billion won annually to support tuition, facilities, and program development costs for vocational training courses. These preferential policies have addressed development bottlenecks in the vocational education sector and significantly enhanced its appeal [12].

Additionally, to further incentivize skill development, South Korea has introduced the "Grand Master of Korea" program since 1986, recognizing exceptional technicians with financial awards and annual stipends. Technical workers honored as "Grand Masters" receive a one-time award of 20 million won, followed by an annual stipend ranging from 2.15 million to 4.05 million won. This initiative reinforces a cultural respect for skilled labor and encourages technical excellence within the workforce.

## 4 KEY LESSONS FROM ASIA FOR ENHANCING CHINA'S SKILLED WORKFORCE

### 4.1 Enhancing Strategic Support and the Social Prestige of Vocational Education

Countries such as Singapore, Japan, and South Korea once faced widespread social stigma surrounding vocational and technical education, with many families hesitant to view such pathways as viable career options. Over time, however, sustained government campaigns, policy innovations, targeted financial investments, and transparent employment outcomes have contributed to a gradual shift in public perception. Vocational education is increasingly regarded not as a fallback for low academic performers but as a legitimate and respected pathway to professional success.

According to the White Paper on the Development of Vocational Education in China, recent data the employment rates among graduates of secondary and higher vocational institutions have been consistently increased. Furthermore, over 70% of these graduates secure jobs closely aligned with their fields of study. Within six months of graduation, average earnings for vocational graduates surpass national per capita disposable income levels, suggesting growing competitiveness and relevance of vocational training.

To further improve public perception, efforts may focus on strengthening cross-ministerial coordination in line with national policy directives, while also cultivating recognizable institutional brands within the vocational sector. Additionally, elevating the visibility of skilled professionals through national honors—such as the Model Worker or Science and Technology Awards—can help foster a culture that values technical expertise and hands-on innovation.

### 4.2 Promoting Articulated Pathways and Credential Portability

Singapore, Japan, and South Korea have developed vocational systems that feature both vertical and horizontal integration, enabling smooth transitions between general and technical education. These articulated frameworks support academic progression and career advancement, offering students increased flexibility and mobility.

Singapore's model stands out for its permeability. Students enrolled in vocational programs may, based on their academic performance, transfer to polytechnics or even universities without sitting for additional standardized exams. Such credit recognition mechanisms not only facilitate upward mobility but also motivate students to pursue excellence within technical domains.

In the Chinese context, there is increasing recognition of the need to establish clearer articulation between secondary vocational schools, higher vocational institutions, and undergraduate programs. Frameworks that allow for mutual recognition of academic credits and vocational qualifications could help build more coherent pathways. Aligning vocational credentialing with degree-level recognition would also enhance the professional identity and long-term development of skilled workers.

### 4.3 Building a Future-Oriented and Practice-Driven Lifelong Learning System

High-quality vocational development increasingly depends on lifelong learning systems that respond to rapid technological change and evolving labor market demands. One critical dimension involves school-enterprise collaboration. Drawing from international experiences, particularly the dual-track models in Singapore, Japan, and South Korea, a system in which theoretical learning is anchored in schools and practical training is embedded in enterprises has proven effective in producing work-ready graduates.

Another strategic priority lies in aligning curricula with future skills needs. This includes closely monitoring technological developments—both globally and domestically—and adapting educational content accordingly. The integration of digital tools, such as AI and internet-based platforms, can further modernize instruction. Singapore's "Teaching Factory" initiative offers a compelling example, as it enables students to train on real industrial equipment in simulated environments, narrowing the gap between training and work.

Additionally, national platforms for skill enhancement, including technical competitions, may be expanded. Competitions that encourage "learning through contests and training through practice" can reinforce a culture of continuous learning and technical mastery.

### 4.4 Fostering a Multi-Level, Multi-Actor Vocational Ecosystem

A well-functioning vocational system requires coordinated participation from multiple stakeholders. International models highlight the importance of clearly delineating roles across government agencies, schools, enterprises, and civil society. At the institutional level, strong vocational colleges anchored in specialized technical education are foundational, while broader social engagement in vocational development should be encouraged.

The revised Vocational Education Law underscores the strategic role of enterprises in operating and supporting vocational institutions. Similar to international practices—such as government subsidies for enterprise-led education in Japan and Korea, or Germany's legally embedded training frameworks—private actors can play a central role in expanding capacity and enhancing responsiveness. Leveraging market mechanisms to incentivize enterprise participation through tax incentives, credit mechanisms, or co-financing models may further enhance investment and innovation within the sector.

### 4.5 Strengthening Skills Recognition and Career Incentives

Refining the evaluation system for skilled workers remains critical. Current challenges include the lack of a fully established grading system, limited upward mobility, and weak alignment between skills and compensation. The experience of piloting the “New Eight-Level” vocational skills framework offers a valuable opportunity to address these gaps and promote scalable models.

At the same time, evaluation practices may benefit from a more employer-driven, market-responsive model. Empowering enterprises and industry associations to lead in skills assessment—under a “who hires, evaluates” principle—can improve relevance and accountability.

Moreover, establishing a skill-based promotion system, parallel to technical and managerial tracks, may better reflect the value of hands-on expertise. Recognition systems, including national commendations and international honors such as WorldSkills medals, can further elevate the visibility and motivation of the skilled workforce.

### 4.6 Expanding Internationalization and Global Competence among Skilled Workers

In an era of global interdependence, skilled workers with an international outlook are increasingly vital. Countries such as Singapore have proactively introduced foreign training curricula, international teaching resources, and multinational cooperation platforms to cultivate globally competent talent.

Looking ahead, efforts to internationalize vocational education may include clarifying long-term development strategies, benchmarking global standards, and participating in international mutual recognition frameworks. Hosting international conferences and competitions, developing flagship Sino-foreign partnerships, and expanding participation in global vocational education networks can further strengthen China’s voice and visibility in the global skills arena.

Additionally, adopting open talent introduction policies and selectively incorporating advanced pedagogies from leading international institutions may enhance local capacity. Over time, building a distinctive Chinese vocational education brand—defined by excellence, innovation, and global relevance—could help elevate both domestic standards and international influence.

## 5 CONCLUSION

In summary, the vocational education systems in developed Asian nations like Singapore, Japan, and South Korea are characterized by articulated educational pathways, diverse schooling systems, a philosophy of lifelong learning, collaboration between government and industry, and an emphasis on practicality and industry-education integration. These elements have served as catalysts for their successful industrial worker training and education systems.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## REFERENCES

[1] Ministry of Human Resources and Social Security. 2022 Fourth Quarter Most In-Demand Occupations Report. Beijing: MHRSS, 2023. https://www.xinhuanet.com/politics/2023-01/18/c_1129297713.htm

[2] Wang Xin, Xu Jiahong. The Realistic Situation and Path Choice of Chinese Industrial Workers’ Skill Formation. Academic Research, 2020, (8): 7. DOI: 10.1007/s11756-021-007XX.

[3] Zhang L, Sun Y. Regional disparities and funding in China’s vocational education system. Educational Development Quarterly, 2021, 29(4): 67-79.

[4] Ren Ruiwen, Xu Han. Singapore as an Example of Path Choice for High Quality Development of Vocational Education. Education and Vocation, 2022, (12): 7.
[5] Skills Future Singapore. Skills Future Overview and Industry Collaboration. 2023. https://www.skillsfuture.gov.sg
[6] Ministry of Manpower Singapore. Future Skills Jubilee Fund and Lifelong Learning Initiatives. 2020. https://www.mom.gov.sg
[7] Workforce Singapore. Workforce Skills Qualifications (WSQ) Framework. 2022. https://www.wsg.gov.sg
[8] BROMANN, Silke. Vocational Education and Training in Japan—Recent Trends. Innovation and Change in Japanese Management, 2010, 100-118.
[9] Saito Y, Nakamura K, Fujimoto T. Evolution of vocational education in Japan since the 1990s. Asian Vocational Education Journal, 2020, 11(3): 30-45.
[10] Sawai M. Vocational training and vocational education in postwar Japan: An overview. Japanese Research in Business History, 2020, 37: 1-10.
[11] Kim, Jhong Yun Joy, EunBee Kim, and Doo Hun Lim. "A meta-analysis of the effects of lifelong vocational education in South Korea." European Journal of Training and Development 48.7/8 (2024): 749-765.
[12] Yu Tongtong. Lessons and inspiration from Korea's up-and-down vocational education. Modern Vocational Education. 2021, (36): 150-151.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3162**

# AGRICULTURAL UNIVERSITY STUDENTS' SATISFACTION WITH ONLINE LEARNING PLATFORMS

YiJia Wang[1], XiaoBo Sun[2], TianXiao Li[3*]
[1]*Department of Engineering Management, Northeast Agricultural University, Harbin 150036, Heilongjiang, China.*
[2]*College of Engineering, Northeast Agricultural University, Harbin 150036, Heilongjiang, China.*
[3]*School of Water Conservancy and Civil Engineering, Northeast Agricultural University, Harbin 150036, Heilongjiang, China.*
*Corresponding Author: Tianxiao Li, Email: litianxiao@neau.edu.cn*

**Abstract:** In recent years, online learning platforms have become an integral part of higher education, offering flexible and accessible learning opportunities to students worldwide. This study aims to explore Agricultural University students' satisfaction with online learning platforms. This study developed the satisfaction model by integrating the Expectation Confirmation Theory and the Technology Acceptance Model. Data were collected from undergraduates at agricultural universities in China who have used online learning platforms. The findings indicate that the most significant factor influencing undergraduates' satisfaction is confirmation between pre-use expectations and post-use perceived performance. Additionally, perceived usefulness and ease of use also play crucial roles. The study also offers practical implications for educators and platform developers, suggesting that improving user satisfaction involves managing expectations effectively, enhancing perceived utility, and ensuring the platform's user-friendliness. The research offers a comprehensive framework for understanding user satisfaction with online education. The structural model assessment demonstrated that our proposed model explains 80.6% of the variance in undergraduates' satisfaction. This research offers a novel approach to assessing satisfaction with online education by focusing specifically on Agricultural University students. It highlights the significance of expectation confirmation, perceived usefulness, and ease of use in determining student satisfaction, contributing to the broader understanding of factors that influence the success of online learning platforms.
**Keywords:** Agricultural universities; Online learning platforms; Satisfaction; Expectation confirmation theory; Undergraduate; Promotion suggestion

## 1 INTRODUCTION

As information technology rapidly advances and internet usage becomes more prevalent, online learning platforms have swiftly risen within the global education system, significantly supplementing traditional education models. Particularly during the COVID-19 pandemic, universities across the globe adopted online education to ensure students' academic progress and the continuity of teaching activities [1]. This unforeseen event significantly propelled the use of online learning platforms, which have continued to demonstrate their irreplaceable advantages and potential even after the pandemic was brought under control. These platforms offer students flexible learning options, breaking time and space constraints and enriching the diversity and accessibility of learning resources [2]. Online learning platforms enhance the availability and quality of education and training, helping to reduce costs and improve the economic efficiency of education [3].

However, despite the potential advantages of online learning platforms, attracting and retaining students remains a major challenge. Existing studies indicate that users of online learning platforms exhibit high dropout rates [3]. One of the key factors contributing to this dropout rate is student satisfaction, which significantly impacts their intention to continue using the platform. In the field of educational technology, student satisfaction is considered a critical parameter for assessing the quality of online education [4]. Educational researchers and platform developers can formulate targeted improvement measures by collecting and analyzing student feedback. Therefore, understanding student satisfaction with online learning platforms and their influencing factors is crucial for optimizing the online educational environment and enhancing the quality of education.

Current studies have primarily concentrated on users' acceptance of online learning platforms and their intentions for continued use [3]. Factors influencing acceptance include task-technology fit, perceived usefulness, social influence, attitude, user innovativeness, and perceived ease of use [5-8]. These determinants are often examined through frameworks such as the theory of planned behavior and the technology acceptance model (TAM). On the other hand, researchers have applied TAM, the task technology fit model, and the expectation confirmation model to examine factors affecting users' willingness to continue using online platforms, including curiosity, perceived benefits, system quality, platform reliability, confirmation, user satisfaction, task-technology fit, and ongoing technical support [1, 9-11]. Despite these insights, limited research has specifically examined the satisfaction of undergraduates with online learning platforms. Addressing this gap could provide deeper insights into improving educational practices and platform features to meet university students' needs better.

This study aims to develop a satisfaction model for undergraduates' use of online learning platforms, revealing the factors that influence their satisfaction. To achieve this, we first integrated the TAM with the expectation confirmation

theory (ECT) to construct a comprehensive model that explains undergraduates' satisfaction with online learning platforms. Next, we conducted an empirical survey targeting agricultural universities in China, collecting 804 valid responses. After verifying the reliability and validity of the research data, we performed a structural model analysis to test our hypotheses. The results demonstrated that confirmation was the most significant factor affecting undergraduates' satisfaction with online learning platforms. In addition to confirmation, we also investigated the roles of perceived usefulness, ease of use, perceived performance, and expectation in shaping undergraduates' satisfaction. Finally, based on our findings, we provided recommendations for online education platforms, suggesting specific improvements to enhance student satisfaction and overall user experience.

Our research makes significant contributions to both theoretical understanding and practical application in the online education field. Theoretically, this research provides a model framework for analyzing agricultural university students' satisfaction with online learning platforms by integrating the TAM and ECT. The model demonstrates strong explanatory power, explaining 80.6% of the variance in agricultural university students' satisfaction, which highlights its effectiveness in capturing the key factors influencing satisfaction. Empirically, the study identifies expectation confirmation as the most influential determinant of satisfaction. Practically, the study offers valuable guidance for platform developers and educators to improve the design and user experience of online learning platforms.

The paper is organized as follows. Section 2 delves into the development of the satisfaction model, the methodology, and the data collection process. Sections 3 and 4 present the research findings and corresponding discussions. In conclusion, Section 5 brings the paper to a close by summarizing the main findings and research limitations.

## 2 MATERIALS AND METHODS

### 2.1 Model Development

#### *2.1.1 Expectation confirmation theory*

ECT is a foundational framework for understanding user satisfaction and post-usage behavior, originally developed by Bhattacherjee [12]. ECT posits that satisfaction is a function of the comparison between users' initial expectations and their perceived performance after engaging with a product or service. The theory suggests that users enter an experience with certain expectations based on prior experiences, marketing communications, or social influences [13]. After using the product or service, they evaluate its performance, leading to confirmation or disconfirmation. If the perceived performance meets or exceeds their expectations, confirmation occurs, resulting in higher satisfaction. Conversely, disconfirmation occurs if the performance falls short of expectations, often leading to dissatisfaction. This satisfaction or dissatisfaction plays a crucial role in determining future behaviors, such as the intention to repurchase, recommend, or continue using the product or service.

*Satisfaction*, in the context of this research, represents undergraduates' overall emotional response to their experiences with the online learning platform. It arises after students directly interact with the platform, reflecting the extent of contentment or pleasure with its performance.

*Confirmation* refers to the degree to which the actual experiences meet initial expectations about a product, service, or system. When the platform's performance aligns with or exceeds these expectations, undergraduates may likely experience positive confirmation, leading to higher satisfaction. Conversely, disconfirmation occurs when the platform falls short of their expectations, resulting in lower satisfaction. According to ECT, satisfaction is primarily shaped by the degree of confirmation or disconfirmation of the users' initial expectations [12]. The connection between confirmation and satisfaction is a core principle of ECT, which posits that when users' initial expectations are met or exceeded by the actual performance of a product or service, their satisfaction levels increase. Therefore, we hypothesize that:

H1: Confirmation positively influences undergraduates' satisfaction with online learning platforms.

*Expectation* refers to the beliefs or assumptions that consumers hold about the performance of a product or service before they experience it. In this study, expectations refer to the undergraduates' anticipations about the online learning platform before using it. These expectations establish the initial benchmark against which they evaluate the platform, serving as the foundation for the subsequent formation of their satisfaction. As a result, we anticipate that:

H2: Expectation positively influences undergraduates' confirmation of online learning platforms.

*Perceived performance* is the user's evaluation of a product or service's performance after using it [14]. In this research, perceived performance describes the undergraduates' evaluation of the functionality and effectiveness of the online learning platform after using it. If the platform is easy to navigate and provides high-quality educational content, undergraduates will likely perceive its performance as high, thereby increasing the likelihood of confirmation. Consequently, we hypothesize that:

H3: Perceived performance significantly affects undergraduates' confirmation of online learning platforms.

H4: Perceived performance significantly influences undergraduates' expectations of online learning platforms.

#### *2.1.2 Technology acceptance model*

TAM is widely recognized as a foundational framework for understanding user acceptance and usage of technologies [15]. TAM is built upon the theory of reasoned action, which posits that an individual's behavior is driven by their intention to perform the behavior, with this intention being influenced by their attitude and subjective norms. TAM simplifies this by focusing on two key determinants of technology acceptance: perceived usefulness (PU) and perceived ease of use (PEOU). In online education, TAM has been instrumental in understanding how perceptions about the ease

of use and usefulness of learning platforms influence students' acceptance and sustained interaction with the technology [4, 8, 9, 16, 17]. Drawing from existing findings in TAM research, we developed the following hypotheses:
H5: Perceived usefulness significantly affects undergraduates' satisfaction with online learning platforms.
H6: Perceived usefulness significantly affects the perceived performance of online learning platforms.
H7: Perceived ease of use significantly affects undergraduates' satisfaction with online learning platforms.
H8: Perceived ease of use positively influences the perceived performance of online learning platforms.
H9: Perceived ease of use positively influences undergraduates' perceived usefulness.
The proposed theoretical model extends ETC with TAM to explore undergraduates' satisfaction with online learning platforms. Figure 1 demonstrates our proposed satisfaction model of online learning platforms.

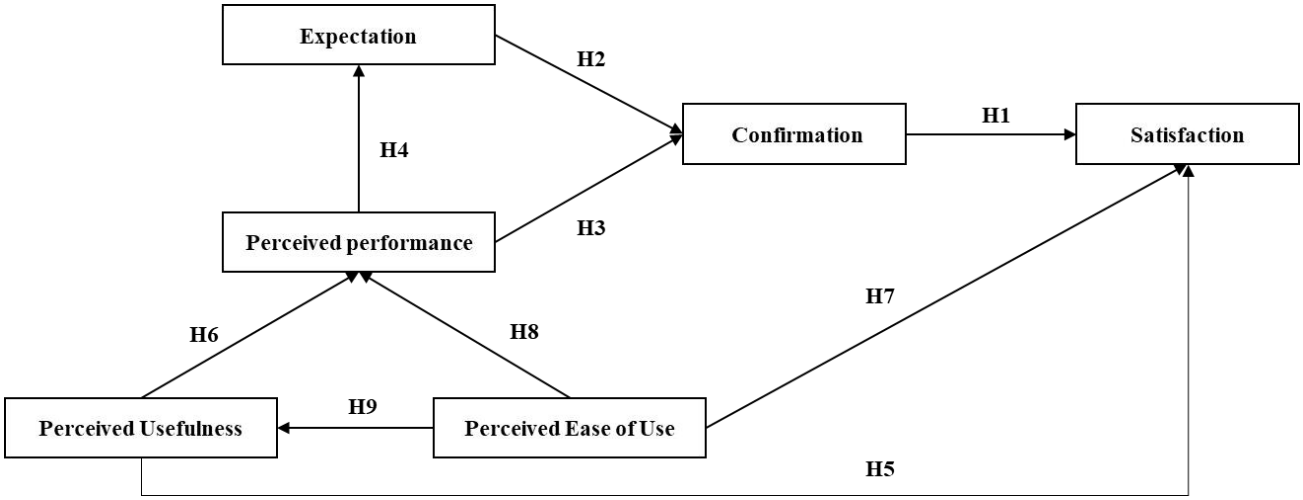


**Figure 1** Our Proposed Satisfaction Model

### 2.2 Measurements

The questionnaire consisted of two parts. The first part collected basic demographic information from the participants, such as gender and academic year. The second part used a measurement scale to investigate undergraduates' experiences and opinions on online learning platforms. We carried out a thorough literature review to identify existing scales and items effectively used in previous research to measure similar constructs. The survey items were adapted and contextualized from previous influential research, mainly drawing on the works of Lee [10], Li, et al. [7], and Venkatesh, et al. [18], which have extensively explored various facets of technology acceptance and user satisfaction. Additionally, we incorporated reverse items (SAT3 and EXP3) in the survey to enhance the reliability of the data by identifying non-serious responses in the answers provided by the respondents. This careful construction and validation of the questionnaire ensured the collected data could be reliably used for further analysis. The satisfaction measurement scale used for the survey is presented in Table 1. Responses to the questionnaire were gathered using a seven-point Likert scale.

**Table 1** The Satisfaction Measurement Scale and Its Reliability Test Results

| Constructs | Items | Factor loadings | Cronbach's Alpha | CR | AVE |
|---|---|---|---|---|---|
| Satisfaction (SAT) | SAT1: I am satisfied with my experience using the online learning platform. | 0.989 | 0.979 | 0.986 | 0.959 |
| | SAT2: Using the online learning platform is a wise decision. | 0.974 | | | |
| | SAT3*: Overall, I am dissatisfied with the online learning platform. | 0.975 | | | |
| Confirmation (CON) | CON1: My experience with the online learning platform matched my expectations. | 0.983 | 0.969 | 0.979 | 0.941 |
| | CON2: The functions and services of the online learning platform are consistent with my initial expectations. | 0.955 | | | |
| | CON3: The online learning platform fulfills needs that surpass my service expectations. | 0.971 | | | |
| Perceived Performance (PP) | PP1: The online learning platform completely meets my learning needs. | 0.931 | 0.925 | 0.952 | 0.869 |
| | PP2: The online learning platform responds quickly to my learning requests. | 0.944 | | | |
| | PP3: The online learning platform provides reliable, customized, and professional services. | 0.922 | | | |
| Perceived Usefulness (PU) | PU1: The online learning platform has improved my academic performance. | 0.938 | 0.939 | 0.961 | 0.891 |

| | | | | | |
|---|---|---|---|---|---|
| | PU2: The online learning platform saves time in achieving my learning objectives. | 0.947 | | | |
| | PU3: The online learning platform has increased my learning efficiency. | 0.947 | | | |
| Expectation (EXP) | EXP1: My experience with the online learning platform is better than I expected. | 0.936 | 0.893 | 0.933 | 0.824 |
| | EXP2: The service level of the online learning platform is better than I expected. | 0.931 | | | |
| | EXP3*: In general, most of my expectations for the online learning platform have not been met. | 0.854 | | | |
| Perceived Ease of Use (PEOU) | PEOU1: Using the online learning platform is easy for me. | 0.933 | 0.910 | 0.943 | 0.847 |
| | PEOU2: Using the online learning platform is clear and understandable. | 0.916 | | | |
| | PEOU3: I can easily become proficient in using the online learning platform. | 0.912 | | | |

*SAT3 and EXP3 were reversed items whose responses have been reversed during data analysis.

### 2.3 Data Collection

The investigation was conducted in agricultural universities in China. Undergraduates who had participated in at least one online course were allowed to participate in this survey. The Questionnaire Star platform, a widely recognized tool for creating and distributing electronic surveys, was used to collect data. The electronic questionnaires were distributed to undergraduates via university email and social media platforms commonly utilized by the students. This study was approved by the Northeast Agricultural University Committee on Experimental and Animal Ethics.

We implemented several measures throughout the survey process to ensure the quality and reliability of the data collected. First, the questionnaire was pre-tested with a small group of students to identify and correct any ambiguities or misunderstandings in the questions. This pre-test also allowed us to estimate the time required to complete the survey, ensuring it was manageable for respondents. Next, we conducted stratified sampling to ensure the study's findings could reflect the entire undergraduate population. Respondents were divided into different academic years (freshman, sophomore, junior, and senior), with each category proportionately represented in the sample. This stratification aimed to minimize sampling bias and enhance the generalizability of the study's results. Additionally, we incorporated logical checks (i.e., reversed items) into the questionnaire to eliminate responses with contradictory answers. All questions were mandatory, and the system issued reminders if participants attempted to skip any required questions.

In total, we collected 1,073 survey responses from university undergraduates. We cleaned the collected data to enhance the quality of the dataset. First, we excluded responses with abnormally short completion times, which indicated that the respondent did not thoroughly consider the questions. Additionally, we removed any responses that contained illogical answers based on the reversed items, further refining the research dataset. After the data cleaning, we retained 804 valid samples. The final sample exhibited a balanced demographic distribution. Of the 804 respondents, 375 were male, and 429 were female, ensuring that both genders were adequately represented. By academic year, the respondents were distributed as follows: 393 freshmen, 239 sophomores, 70 juniors, and 102 seniors. All valid respondents had participated in at least one online course learning.

### 2.4 Data Analysis

This study analyzes the relationships among latent variables by applying PLS-SEM, providing reliable theoretical validation and practical application guidance. First, measurement model evaluation is aimed at verifying the reliability and validity of the latent variables, ensuring that the observed indicators accurately reflect the corresponding latent constructs. Second, structural model evaluation examines the relationships between the latent variables and assesses the model's predictive capabilities. The explanatory power of the satisfaction model is evaluated using the $R^2$ value. This value is a key measure for assessing the model's overall explanatory strength. Moreover, evaluating the model's predictive relevance ($Q^2$) is essential to determine how well the model explains and predicts the data.

## 3 RESULTS

### 3.1 Evaluation of Measurement Model

The initial phase of our analysis concentrated on evaluating the reliability of the constructs. We assessed internal consistency using Cronbach's alpha and Composite Reliability (CR). The values presented in Table 1 indicated good internal consistency across all constructs, reflecting that the satisfaction measurement scale was reliable. Furthermore, indicator reliability was verified by analyzing the loadings of each item on its respective construct, which exceeded the recommended threshold of 0.7, thereby substantiating that the items were well-suited to their respective constructs. Convergent validity was assessed by examining each construct's average variance extracted (AVE). The AVE measures the level of variance captured by the construct in relation to the variance due to measurement error. The AVE values were all above the 0.50 threshold, supporting the convergent validity of the measurement model.

To ensure discriminant validity, we applied the Fornell-Larcker criterion, comparing the square root of the AVE values for each construct with the correlations between constructs. The results (see Table 2) indicated that the square root of the AVE for each construct was greater than the highest correlation with any other construct, satisfying the Fornell-Larcker criterion and confirming discriminant validity. This finding implies that the constructs in the model are distinct and that the items designed to measure a specific construct do not overlap significantly with items measuring other constructs. Additionally, cross-loading examination further validated that each item's highest loading was on its intended construct, affirming strong discriminant validity (see Table 3).

**Table 2** Assessment Results by the Fornell-Larcker Criterion

| | CON | EXP | PEOU | PP | PU | SAT |
|---|---|---|---|---|---|---|
| CON | 0.970 | | | | | |
| EXP | 0.793 | 0.908 | | | | |
| PEOU | 0.586 | 0.594 | 0.920 | | | |
| PP | 0.826 | 0.807 | 0.590 | 0.932 | | |
| PU | 0.709 | 0.775 | 0.626 | 0.719 | 0.944 | |
| SAT | 0.883 | 0.79 | 0.605 | 0.825 | 0.733 | 0.979 |

**Table 3** The Results of Cross-Loading Examination

| | CON | PU | EXP | PEOU | PP | SAT |
|---|---|---|---|---|---|---|
| CON1 | 0.983 | 0.722 | 0.801 | 0.593 | 0.835 | 0.901 |
| CON2 | 0.955 | 0.656 | 0.736 | 0.548 | 0.766 | 0.816 |
| CON3 | 0.971 | 0.683 | 0.768 | 0.562 | 0.800 | 0.851 |
| PU1 | 0.691 | 0.938 | 0.760 | 0.593 | 0.696 | 0.707 |
| PU2 | 0.662 | 0.947 | 0.716 | 0.615 | 0.669 | 0.691 |
| PU3 | 0.654 | 0.947 | 0.718 | 0.565 | 0.672 | 0.678 |
| EXP1 | 0.772 | 0.790 | 0.936 | 0.583 | 0.776 | 0.769 |
| EXP2 | 0.757 | 0.709 | 0.931 | 0.577 | 0.774 | 0.745 |
| EXP3 | 0.617 | 0.596 | 0.854 | 0.444 | 0.634 | 0.626 |
| PEOU1 | 0.526 | 0.544 | 0.519 | 0.934 | 0.513 | 0.536 |
| PEOU2 | 0.587 | 0.655 | 0.610 | 0.916 | 0.602 | 0.617 |
| PEOU3 | 0.493 | 0.514 | 0.498 | 0.912 | 0.503 | 0.504 |
| PP1 | 0.774 | 0.699 | 0.775 | 0.535 | 0.931 | 0.781 |
| PP2 | 0.768 | 0.662 | 0.746 | 0.566 | 0.944 | 0.777 |
| PP3 | 0.767 | 0.650 | 0.735 | 0.551 | 0.922 | 0.749 |
| SAT1 | 0.858 | 0.710 | 0.761 | 0.587 | 0.808 | 0.989 |
| SAT2 | 0.907 | 0.746 | 0.807 | 0.618 | 0.839 | 0.974 |
| SAT3 | 0.825 | 0.696 | 0.750 | 0.569 | 0.772 | 0.975 |

### 3.2 Evaluation of Structural Model

We assessed the structural model aimed at evaluating the relationships between the latent variables in the model. The first step in the structural model evaluation is examining the path coefficients. A path coefficient is considered significant if its corresponding p-value is less than the conventional threshold of 0.05, indicating that the data support the hypothesized relationship. Table 4 presents the supporting results for hypothesized relationships.

**Table 4** Supporting Results for Hypothesized Relationships

| Hypothesis | Standardized Path coefficients ($\beta$) | Hypothesis supported or not |
|---|---|---|
| H1: CON→SAT | 0.710*** | Yes |
| H2: EXP→CON | 0.362*** | Yes |
| H3: PP→CON | 0.534*** | Yes |
| H4: PP→EXP | 0.807*** | Yes |
| H5: PU→SAT | 0.183*** | Yes |
| H6: PU→PP | 0.575*** | Yes |
| H7: PEOU→SAT | 0.074*** | Yes |
| H8: PEOU→PP | 0.230*** | Yes |
| H9: PEOU→PU | 0.626*** | Yes |

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Next, the coefficient of determination ($R^2$) is examined for each endogenous construct in the model. The $R^2$ value indicates the amount of variance in the satisfaction explained by the independent variables. In PLS-SEM, a higher $R^2$ value suggests the model has good explanatory power for the endogenous constructs. The $R^2$ value of our proposed

satisfaction model is 0.806, as shown in Figure 2, suggesting a good explanatory power. In addition to $R^2$, the model's predictive relevance ($Q^2$) is assessed using the blindfolding procedure. The $Q^2$ value of our proposed satisfaction model is 0.765, demonstrating its ability to predict satisfaction and further supporting the model's quality.

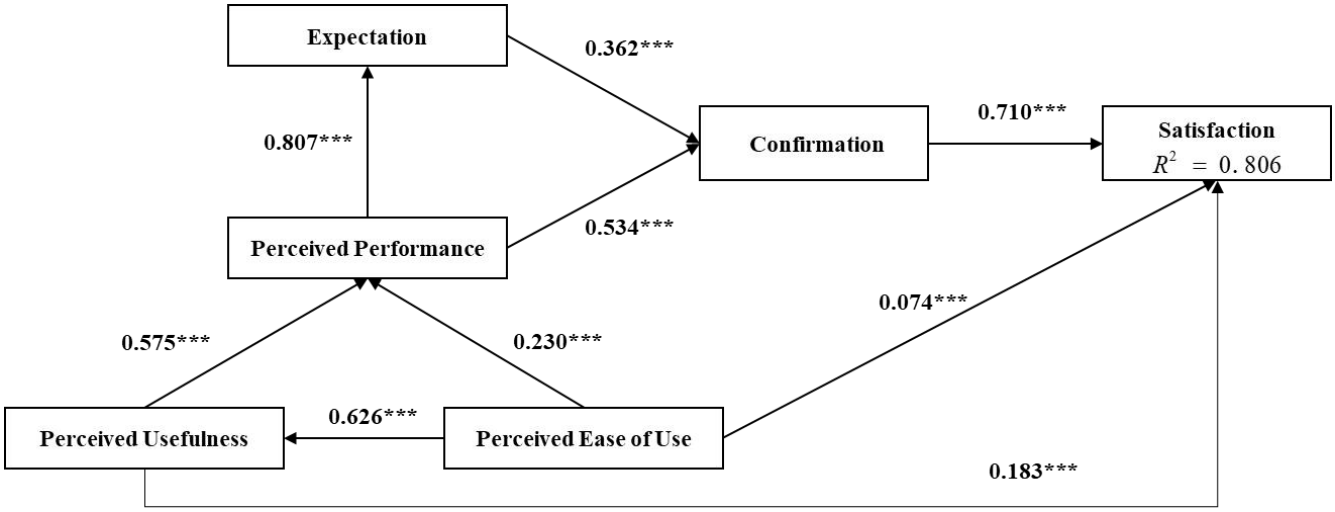


**Figure 2** Structural Model Evaluation Results

The goodness-of-fit of our proposed satisfaction model is evaluated using the standardized root mean square residual (SRMR). The SRMR is a measure of the discrepancy between the observed and predicted correlations. The SRMR value of our proposed satisfaction model is 0.075, lower than 0.08, which indicates a good fit, suggesting that the model's predictions are consistent with the observed data.

The effects of predictors on undergraduates' satisfaction are demonstrated in Table 5. The results imply that CON is the strongest predictor of satisfaction, with a coefficient of 0.710 ($p < 0.001$). EXP shows a significant indirect effect on satisfaction, with a coefficient of 0.257 ($p < 0.001$). PEOU has both significant indirect and direct effects on satisfaction, with coefficients of 0.461 ($p < 0.001$) and 0.074 ($p < 0.001$), respectively. It indicates that while PEOU primarily influences satisfaction indirectly, its direct effect is also meaningful, contributing to an overall total effect of 0.535 ($p < 0.001$). PP also shows a strong indirect effect on satisfaction, with a coefficient of 0.587 ($p < 0.001$). PU exhibits both indirect and direct effects on satisfaction, with coefficients of 0.338 ($p < 0.001$) and 0.183 ($p < 0.001$), respectively. This finding suggests that while undergraduates' usefulness perception of the platform contributes significantly to their satisfaction, a substantial portion of this effect is mediated through other variables, resulting in a total effect of 0.521 ($p < 0.001$). Overall, the analysis indicates that CON, EXP, PEOU, PP, and PU are all significant predictors of satisfaction, each playing distinct roles in influencing undergraduates' overall satisfaction with online learning platforms.

**Table 5** Effects of Predictors on Undergraduates' Satisfaction

| | Indirect effect | Direct effect | Total effect |
|---|---|---|---|
| CON→SAT | - | 0.710*** | 0.710*** |
| EXP→SAT | 0.257*** | - | 0.257*** |
| PEOU→SAT | 0.461*** | 0.074*** | 0.535*** |
| PP→SAT | 0.587*** | - | 0.587*** |
| PU→SAT | 0.338*** | 0.183*** | 0.521*** |

*$p$<0.05, ** $p$<0.01, *** $p$<0.001

## 4 DISCUSSION

### 4.1 Main Findings

The analysis indicates confirmation is the strongest factor influencing undergraduates' satisfaction with online learning platforms. Similar observation has been noted in educational contexts, such as MOOCs [11]. This finding suggests that satisfaction significantly increases when students' actual experiences with the platform meet or exceed their initial expectations. In other words, the degree to which students' expectations are confirmed by their actual experiences has a decisive impact on their overall satisfaction. The outcome aligns with the fundamental assumption of expectation confirmation theory, which posits that user satisfaction primarily stems from the comparison between their expectations and perceived performance [10]. The reasons for this phenomenon may relate to the unique environment of online learning platforms. On online learning platforms, students rely on the resources, tools, and functionalities provided by the platform to achieve their learning objectives. Therefore, their expectations are usually based on their previous learning experiences, platform promotional activities, and peer recommendations. Undergraduates are more satisfied when these expectations are met or surpassed during use.

Perceived performance is a critical predictor of undergraduates' satisfaction. It implies that undergraduates' subjective evaluations of the platform's functionality, content quality, and user experience directly impact their overall satisfaction. Specifically, when students perceive that the online learning platform excels in supporting their learning needs, offering high-quality content, and providing a user-friendly interface, their satisfaction with the platform tends to be higher. This finding aligns with previous research outcomes [19]. One possible explanation is that the core value of an online learning platform is its ability to meet students' learning demands through its actual performance. Unlike traditional classroom teaching, undergraduates rely more on the platform to access resources, participate in interactions, and complete assignments while using online learning platforms. Therefore, the platform's stability and content quality influence undergraduates' learning experience and satisfaction. Undergraduates' satisfaction naturally increases when they perceive that the platform operates smoothly and provides rich and practical learning resources and functionalities.

We discovered that PEOU and PU are critical determinants of satisfaction for university students adopting online learning platforms. This finding is corroborated by recent studies in online education, such as those by Ullah, et al. [20] and Joo, et al. [21]. It suggests that when undergraduates find the online learning platform easy to adopt and useful, their satisfaction with it significantly increases. The critical role of PEOU in influencing satisfaction might be attributed to its direct impact on learning efficiency. Undergraduates can focus more effectively on the content when they find the online platform easy to navigate rather than struggling to access it. Furthermore, online learning platforms require students to complete their learning tasks independently without face-to-face support, making the platform's ease of use a critical factor influencing the learning experience. Undergraduates are more likely to perceive the online learning platform as useful for their studies when they find that it offers valuable educational resources, such as accessible information, interactive content, and tools that align with their learning styles, thereby enhancing their satisfaction with the platform.

In addition, PEOU and PU significantly impact undergraduates' satisfaction through the mediating effects of perceived performance and confirmation. Our research finds these two factors enhance satisfaction by improving users' perception of the performance. It suggests that the benefits and accessibility of the platform play important roles in affecting undergraduates' overall satisfaction by influencing their perceptions of performance and confirmation. Undergraduates may likely perceive the performance of the online learning platform when they find its usefulness and ease of use since it facilitates a smoother and more effective learning experience. This enhanced performance perception confirms their initial expectations, leading to higher satisfaction.

The findings reveal that the expectation significantly influences undergraduates' satisfaction through the mediating role of confirmation. This finding confirms the assumptions in the expectation confirmation theory [11]. Undergraduates form certain expectations before using online learning platforms, and when their actual experiences meet or exceed these expectations, their sense of confirmation is strengthened, thereby enhancing their satisfaction. This result can be explained from the perspectives of psychology and behavioral economics. Psychological research suggests that individuals tend to seek cognitive consistency. They generate positive emotional responses when actual experiences align with expectations, thereby increasing satisfaction. Additionally, Prospect Theory in behavioral economics posits that individuals are generally more sensitive to losses than gains. This means that undergraduates may exhibit stronger dissatisfaction if their expectations are unmet. Conversely, once expectations are confirmed, the increase in satisfaction is more pronounced.

### 4.2 Practical Implications

The research results carry significant practical implications for developing, evaluating, and enhancing online educational platforms. Firstly, one of the most critical findings is confirmation's central role in shaping undergraduates' satisfaction. It underscores the need for educational technology designers and administrators to align platform capabilities closely with student expectations. Therefore, continuous feedback mechanisms should be established to gauge undergraduates' expectations accurately and to assess whether these expectations are being met. Online educational institutions can implement regular surveys that focus not only on general satisfaction but also on specific features of the platform, such as content accessibility, usability, and effectiveness. These surveys should be distributed at various points throughout the academic term to monitor how student expectations and satisfaction change over time. In addition to surveys, focus groups could be conducted to provide deeper, qualitative insights into how undergraduates interact with the platform. These discussions can reveal specific pain points or unmet needs that may not be captured in standard surveys. For example, undergraduates might highlight issues with navigation, the clarity of course materials, or difficulty using certain tools. Incorporating the feedback from focus groups can guide more targeted improvements that are grounded in real user experiences. By consistently collecting insights into undergraduates' needs and satisfaction, platform administrators can better understand their student users' evolving needs and expectations. Such feedback can guide iterative improvements to the platform, ensuring that updates and changes directly address user needs and enhance satisfaction.

Secondly, the significance of perceived ease of use suggests that educational platforms must be user-friendly to foster a positive learning experience. By ensuring that the platform is easy to use, educational institutions and platform developers can significantly enhance the quality of undergraduates' interaction with online learning technologies, leading to higher satisfaction and better educational outcomes. The platform should be designed to be intuitively understandable so students can quickly become familiar with its features without the need for extensive training or support. Developers of online learning platforms should prioritize designing user-friendly interfaces that cater to the

needs and preferences of diverse student groups. Developers should prioritize streamlining navigation to ensure that students can easily locate and access learning materials, assignments, and communication tools. In addition, given the increasing reliance on mobile devices for education, the platform should be fully responsive and optimized for mobile use. This ensures that students can access learning materials and engage with the platform regardless of their device. Optimizing the mobile experience can significantly enhance accessibility and ease of use, especially for students who rely on their smartphones for learning. Regular updates and feedback loops are also beneficial, as they help ensure that the platform evolves according to user needs, further enhancing ease of use and thereby increasing user satisfaction.

The relevance of perceived usefulness in determining satisfaction highlights the importance of aligning educational technology with learners' needs and educational goals. Incorporating interactive elements and multimedia resources that align with the learning objectives can make the platforms more engaging and perceived as more useful by undergraduates, thereby enhancing their satisfaction. It is suggested that interactive elements such as quizzes, discussion forums, and collaborative projects be added to make learning more engaging. These elements encourage active participation and allow undergraduates to apply what they have learned in a practical context, thereby enhancing their understanding and retention of knowledge. Such interactive features also mirror traditional classroom interactions, helping to bridge the gap between online and in-person education. Another important aspect of enhancing perceived usefulness is integrating multimedia resources such as videos, animations, and interactive simulations. These resources can cater to various learning styles, making the educational content more accessible and easier to understand for a diverse student body. For instance, complex scientific concepts can be more easily grasped when demonstrated through video tutorials or interactive models, thereby increasing users' perception of the platform's utility.

Finally, perceived performance and expectations are also significant factors influencing undergraduates' satisfaction, further indicating that the relationship between the actual performance of the platform and undergraduates' initial expectations is crucial in determining their satisfaction. Therefore, online learning platforms should ensure stable performance, quick responsiveness, and consistent service quality to meet or exceed undergraduates' expectations. Platform developers should reduce system downtime, improve load times, and ensure seamless integration across different devices, including desktops, tablets, and mobile phones. Ensuring high perceived performance means regularly updating the platform's features and content to keep up with technological advancements and educational trends. This could involve integrating the latest multimedia tools or updating course content to reflect current information and methodologies. It helps to enhance undergraduates' perception of the platform's performance, thereby increasing their satisfaction. Additionally, educational institutions can enhance undergraduates' learning experiences by clearly defining course objectives and providing detailed course guides to help undergraduates establish reasonable expectations. These guides should outline what students can expect from the course in terms of content, workload, assessment criteria, and available resources. Clear communication around what students can expect from the platform and the course itself helps avoid disappointment and ensures that students have realistic and achievable expectations from the outset.

## 5 CONCLUSION

This study targeted students from agricultural universities in China with online learning experiences to explore their satisfaction with online learning platforms. We constructed a satisfaction model for undergraduates using online learning platforms based on the ECT and TAM. The structural model assessment showed that our proposed model fitted well, explaining 80.6% of the variance in agricultural university students' satisfaction. The results demonstrated that confirmation between pre-use expectations and post-use perceived performance was the most crucial factor affecting undergraduates' satisfaction. Additionally, online learning platforms' usefulness and ease of use play important roles in shaping agricultural university students' satisfaction. It suggests that managing students' expectations effectively, enhancing the perceived usefulness and ease of use of the platform, and ensuring stable performance are crucial strategies for improving users' satisfaction. Future studies could expand the sample to include a more diverse demographic to ascertain if the findings hold across different populations.

There are limitations and areas for further research that could deepen and broaden these findings. First, this study primarily focused on undergraduates with online learning experience, which might limit the generalizability of the findings to other groups such as postgraduates, professionals in continuous education, or those without prior online learning experience. Future studies could expand the sample to include a more diverse demographic to ascertain if the findings hold across different populations. Additionally, the cross-sectional nature of the research captures only a snapshot of user satisfaction, not accounting for how perceptions might evolve with prolonged use or through different stages of a student's educational journey. Future research could carry out longitudinal studies, providing deeper insights into how satisfaction changes over time and with continued use.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## FUNDING

This research was supported by the Research Project of the Association of Chinese Graduate Education (2024-NLZX-YB062).

**REFERENCES**


[1] Ye J H, Lee Y S, Wang C L, et al. The Continuous Use Intention for the Online Learning of Chinese Vocational Students in the Post-Epidemic Era: The Extended Technology Acceptance Model and Expectation Confirmation Theory. Sustainability, 2023, 15(3). DOI: 10.3390/su15031819.

[2] Yu Q. Factors influencing online learning satisfaction. Frontiers in Psychology, 2022, 13: 852360. DOI: 10.3389/fpsyg.2022.852360.

[3] Panigrahi R, Srivastava P R, Sharma D. Online learning: Adoption, continuance, and learning outcome—A review of literature. International Journal of Information Management, 2018, 43: 1-14. DOI: 10.1016/j.ijinfomgt.2018.05.005.

[4] Jiang H, Islam A Y M A, Gu X, et al. Online learning satisfaction in higher education during the COVID-19 pandemic: A regional comparison between Eastern and Western Chinese universities," Education and Information Technologies, 2021, 26(6): 6747-6769. DOI: 10.1007/s10639-021-10519-x.

[5] Kim E J, Kim J J, Han S H. Understanding Student Acceptance of Online Learning Systems in Higher Education: Application of Social Psychology Theories with Consideration of User Innovativeness. Sustainability, 2021, 12(2). DOI: 10.3390/su13020896.

[6] Al-Busaidi K A. An empirical investigation linking learners' adoption of blended learning to their intention of full e-learning. Behaviour & Information Technology, 2013., 32(11): 1168-1176. DOI: 10.1080/0144929X.2013.774047.

[7] Li C, He L, Wong I A. Determinants predicting undergraduates' intention to adopt e-learning for studying english in chinese higher education context: A structural equation modelling approach. Education and Information Technologies, 2021, 26(4): 4221-4239. DOI: 10.1007/s10639-021-10462-x.

[8] Tao D, Fu P, Wang Y, et al. Key characteristics in designing massive open online courses (MOOCs) for user acceptance: an application of the extended technology acceptance model. Interactive Learning Environments, 2019, 30(5): 882-895. DOI: 10.1080/10494820.2019.1695214.

[9] Wu B, Chen X. Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. Computers in Human Behavior, 2017, 67: 221-232. DOI: 10.1016/j.chb.2016.10.028.

[10] Lee MC. Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model," Computers & education, 2010, 54(2): 506-516. DOI: 10.1016/j.compedu.2009.09.002.

[11] Dai H M, Teo T, Rappa N A, et al. Explaining Chinese university students' continuance learning intention in the MOOC setting: A modified expectation confirmation model perspective. Computers & Education, 2020, 150. DOI: 10.1016/j.compedu.2020.103850.

[12] Bhattacherjee A. Understanding information systems continuance: An expectation-confirmation model. MIS quarterly, 2001: 351-370. DOI: 10.2307/3250921.

[13] Pan G, Mao Y, Song Z, et al. Research on the influencing factors of adult learners' intent to use online education platforms based on expectation confirmation theory. Scientific Reports, 2024, 14(1): 12762. DOI: 10.1038/s41598-024-63747-9.

[14] Huang Y M. Examining students' continued use of desktop services: Perspectives from expectation-confirmation and social influence. Computers in Human Behavior, 2019, 96: 23-31. DOI: 10.1016/j.chb.2019.02.010.

[15] Davis F D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 1989, 13: 1989. DOI: 10.2307/249008.

[16] Han J H, Sa H J. Acceptance of and satisfaction with online educational classes through the technology acceptance model (TAM): the COVID-19 situation in Korea," Asia Pacific Education Review, 2022, 23(3): 403-415. DOI: 10.1007/s12564-021-09716-7.

[17] Liu I F, Chen M C, Sun Y S, et al. Extending the TAM model to explore the factors that affect intention to use an online learning community. Computers & education, 2010, 54(2): 600-610. DOI: 10.1016/j.compedu.2009.09.009.

[18] Venkatesh, Morris, Davis, et al. User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, 2003, 27(3). DOI: 10.2307/30036540.

[19] Albelbisi N A, Al-Adwan A S, Habibi A. Self-regulated learning and satisfaction: A key determinants of MOOC success. Education and Information Technologies, 2021, 26(3): 3459-3481. DOI: 10.1007/s10639-020-10404-z.

[20] Ullah M S, Hoque M R, Aziz M A, et al. Analyzing students' e-learning usage and post-usage outcomes in higher education. Computers and Education Open, 2023, 5. DOI: 10.1016/j.caeo.2023.100146.

[21] Joo Y J, Lim K Y, Kim E K. Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. Computers & Education, 2011, 57(2): 1654-1664. DOI: 10.1016/j.compedu.2011.02.008.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3163**

# EXPLORING THE CONSTRUCTION PATH OF A COLLABORATIVE EDUCATION MODEL FOR COURSE CLUSTERS IN INTERDISCIPLINARY PROGRAMS INTEGRATING MANAGEMENT AND ENGINEERING

YiJia Wang[1*], DongLing Liang[2], Jia Zhou[2], HuiCheng Hao[3], JiQuan Wang[3]
[1]*Department of Engineering Management, Northeast Agricultural University, Harbin 150036, Heilongjiang, China.*
[2]*College of Engineering, Northeast Agricultural University, Harbin 150036, Heilongjiang, China.*
[3]*School of Water Conservancy and Civil Engineering, Northeast Agricultural University, Harbin 150036, Heilongjiang, China.*
*Corresponding Author: YiJia Wang, Email: yijiaw@neau.edu.cn*

**Abstract:** Against the backdrop of promoting the development of emerging engineering and liberal arts disciplines and implementing the fundamental task of moral education, the collaborative education model for interdisciplinary curriculum groups in management and engineering faces several challenges, including insufficient integration, limited faculty capacity, and inadequate alignment of teaching methods and evaluation mechanisms. In response, a systematic construction path is proposed: reconstructing the curriculum objectives system to establish a trinity framework of "value guidance–knowledge transmission–ability cultivation", with clearly defined ideological and political education integration points; innovating teaching models through case-driven and scenario-based approaches to achieve organic integration and implicit permeation of educational values within professional curricula; strengthening faculty development by implementing a dual-instructor system to enhance teacher competencies and foster collaboration between professional course instructors and student mentors; and improving the evaluation mechanism by establishing a combined formative and value-added assessment system to scientifically measure educational effectiveness. This pathway aims to provide practical guidance for the effective implementation of collaborative education in interdisciplinary programs integrating management and engineering, with the goal of cultivating high-quality, versatile talents equipped with professional skills, patriotic dedication, social responsibility, and a sound understanding of engineering ethics. It also offers valuable insights for other interdisciplinary fields.
**Keywords:** Interdisciplinary of management and engineering; Emerging engineering education; Emerging liberal arts education; Collaborative education

## 1 INTRODUCTION

In the context of a new round of scientific and technological revolution and industrial transformation, national strategic demands have placed higher requirements on the knowledge structure, competencies, and value orientation of high-level interdisciplinary talents[1]. Interdisciplinary programs that integrate management and engineering—such as industrial engineering, logistics engineering, and engineering management—are characterized by a strong emphasis on cross-disciplinary integration. Their curricula combine theories and technologies from management, economics, data science, and engineering, aiming to address complex problems in system planning, design, operation, and optimization[2]. Graduates from these programs play a crucial role in driving industrial upgrading and national development.

Curriculum-based ideological and civic education (commonly referred to as "curriculum civics") serves as a key measure for implementing the fundamental task of fostering virtue through education. It seeks to integrate value shaping, knowledge transmission, and ability cultivation throughout the entire teaching and learning process [3-4]. For interdisciplinary programs that bridge management and engineering, talent cultivation must go beyond equipping students with solid management thinking and strong engineering practice capabilities. It must also instill in them firm ideals and convictions, a profound sense of patriotism, high moral standards, a strong sense of social responsibility, and a sound understanding of engineering ethics. Only in this way can graduates integrate technological innovation and managerial optimization with national development, social progress, and public well-being in their future careers, making decisions and contributions that align with the core values of socialism.

However, the construction of the collaborative educational model for management-engineering interdisciplinary curriculum groups faces many unique challenges:

Complex and Diverse Knowledge Systems: Integrating multidisciplinary knowledge requires the educational model to accommodate different disciplinary backgrounds and logics, making it prone to phenomena like "forced grafting" or "superficial generalization."

Strong Concealment of Value Orientation: The values embedded in technical courses (such as engineering management and systems optimization), like "efficiency-first" and "cost-priority," may potentially conflict with educational

requirements (such as "people-oriented," "sustainable development," and "social responsibility"), requiring precise identification and effective guidance.

Discrepancy in Teacher Cognition and Practice: Some specialized teachers lack sufficient depth of understanding and ability to integrate educational elements. They may perceive the concept as an additional burden or merely pay lip service, lacking the awareness and effective methods to integrate it into specialized teaching.

Need to Enhance Student Identity: Students may focus more on learning technical skills, have insufficient understanding of the importance of the educational model, or consider it unconnected to their specialized studies, leading to insufficient motivation for learning.

Currently, research systematically exploring effective pathways for constructing curriculum group-based educational models specifically in the field of management-engineering interdisciplinary programs remains insufficient. Existing studies either focus on macro-level explanations or concentrate on practices within a single discipline. There is a lack of in-depth analysis and practical validation regarding the difficulties, entry points, and integration models for constructing curriculum group-based educational models under the complex characteristics of management-engineering interdisciplinary programs.

Based on this, this paper focuses on management-engineering interdisciplinary programs, delving deeply into the effective pathways for constructing the curriculum group-based educational model.The research aims to:

- Systematically analyze the construction logic of the curriculum group-based educational model for management-engineering interdisciplinary programs;
- Explore methods and carriers for identifying and integrating educational models that align with the characteristics of management-engineering interdisciplinary disciplines;
- Construct an organically integrated curriculum group-based educational model combining "value guidance-knowledge imparting-ability cultivation";
- Propose concrete strategies to enhance teachers' educational capabilities and stimulate students' value identity;
- Provide reference-worthy theoretical frameworks and practical solutions for constructing curriculum group-based educational models in similar interdisciplinary programs.

This study holds significant theoretical value and practical significance for deepening the educational essence of management-engineering interdisciplinary programs, improving the quality of talent cultivation, and serving major national strategic needs.

## 2 THE VALUE LOGIC OF CONSTRUCTING THE EDUCATIONAL MODEL FOR MANAGEMENT-ENGINEERING INTERDISCIPLINARY CURRICULUM GROUPS

The construction of the educational model for specialized curriculum groups must be grounded in the essence of the discipline and the laws of education. The value logic of the educational model for management-engineering interdisciplinary curriculum groups manifests as a three-dimensional unity of governance logic, disciplinary logic, and pedagogical logic. This logical system not only addresses the "necessity of why it must be done" but also reveals the underlying motivations of "how it can be done."

### 2.1 Strategic Alignment: Dual Motivation from National Development Goals and Talent Cultivation Needs

The construction of interdisciplinary curriculum models in engineering-management programs must primarily align with broader national development goals. The "dual carbon" targets, for example, have driven the optimization of production systems and the restructuring of course standards [6-7]. In logistics path optimization experiments, carbon emission cost functions have been introduced, turning sustainable development strategies into quantifiable engineering decision-making parameters. At the policy level, the New Engineering Education Development Guide clearly states that "major undertakings rely on talent," providing strategic guidance for the integration of management and engineering education. This dual motivation—national-level demand and educational mission—requires that course objectives be anchored in talent development, aiming to cultivate well-rounded professionals equipped with both engineering and management capabilities.

### 2.2 Disciplinary Logic: Integration of Cross-Domain Knowledge with Embedded Educational Values

The core of disciplinary logic lies in uncovering the intrinsic alignment between domain knowledge in engineering-management fields and value-based educational elements. From a methodological perspective, the "whole-part" analytical framework in systems engineering aligns naturally with holistic thinking models, while the PDCA cycle in quality management echoes the experiential learning theory of "practice–reflection–re-practice." At the knowledge module level, lean production courses can incorporate exemplary figures such as renowned welding expert Gao Fenglin, elevating standardized procedures into expressions of craftsmanship. Similarly, blockchain-enabled supply chain systems—such as the traceability mechanisms used in smart logistics—illustrate integrity through technically verifiable processes. Case studies on major project risk management also serve as practical materials to cultivate responsibility and teamwork. This knowledge-value integration demonstrates how the dual nature of "engineering + management" can foster deeper ethical awareness and responsible conduct, becoming a unique strength of value-oriented education in interdisciplinary programs [8-9].

### 2.3 Pedagogical Innovation: Leveraging Interdisciplinary Features to Transform Educational Methods

The pedagogical logic focuses on how the interdisciplinary nature of engineering and management can enhance educational innovation [10-11]. First, through immersive, real-world scenarios such as smart factory simulations and emergency dispatch exercises, courses move beyond abstract discussion and foster authentic value reflection. Second, value-based content is naturally embedded in course design and corporate internships, supporting the internalization of principles through hands-on experience. Third, students' decision-making processes are digitally tracked and visualized, enabling a data-driven understanding of their value preferences. This type of practice-based teaching transforms subject-matter strengths into educational advantages, constructing values through "learning by doing" and significantly improving educational impact [12-13].

## 3 IMPLEMENTATION PATHWAYS FOR VALUE-BASED EDUCATION IN ENGINEERING-MANAGEMENT PROGRAMS

In response to the core challenges outlined above, this study proposes a four-dimensional implementation framework consisting of: learning objectives – instructional design – faculty development – evaluation mechanisms.

### 3.1 Reconstruction of the Curriculum System of the Trinity Integration Framework

The ideological and political construction of the cross-disciplinary courses of foremen is the primary way to solve the fundamental problems of blurring goals and integrating blunt integration [14-16]. Based on the concept of results-oriented education (OBE), this research constructs a three-dimensional coupled curriculum goal framework of "value-leading-knowledge transfer-ability training", and realizes the deep penetration of the education model from the "suspended surface" to the "professional core" through systematic anchoring, structured transformation and closed-loop implementation. In terms of value dimension, it closely integrates national needs such as the strategy of a manufacturing powerhouse and the dual-carbon target, and transforms macro-policies into actionable curriculum instructions: for example, "Green Logistics System Design" relies on national carbon emission trading policy data and requires students to calculate the ecological cost of transportation path optimization, so that the strategic requirements can be transformed into Algorithm parameters that can be executed in the classroom. In the knowledge dimension, we will focus on promoting the genetic reorganization of professional knowledge logic and educational elements: the "Production System Optimization" curriculum reconstructs the knowledge map, adds a "life cycle assessment" module, and incorporates non-technical elements such as environmental protection regulations into the constraints of production functions; "Project Financing" introduces the "Belt and Road" infrastructure investment. Financing cases make geopolitical risk analysis an essential knowledge unit for project feasibility studies. In the dimension of competence, it breaks through the rational limitations of traditional engineering education tools, and adds composite literacy indicators such as social benefit assessment, ethical decision-making, and strategic thinking: the curriculum design of "Disaster Emergency Management" is mandatory to incorporate the "Vulnerable group rescue priority" decision tree model, transforming humanitarian values into programmable scheduling algorithms. In order to ensure the landing of the three-dimensional goal, the "Professional competence-ideological and political literacy mapping matrix" tool was developed. Taking the "Logistics System Planning" course as an example, its "Distribution center site selection" module clearly corresponds to the literacy index of "urban-rural balanced development Index", and the "Transportation path optimization" module links to "Carbon reduction per unit cargo loss". The evaluation value finally forms a closed-loop mechanism of "goal setting-process monitoring-effectiveness feedback".

### 3.2 The Construction of a Silent Integrated and Innovative Teaching Model

In this study, it is urgent to transcend the superficial dilemma of "embedding education modules" [17-18], and this study proposes a three-axis driven teaching model of "situation-case-data", relying on the interdisciplinary characteristics to achieve the implicit penetration and organic integration of values. Based on the theory of contextual cognition and the principle of embodied learning, the construction of an immersive decision-making field integrating virtual and real has become a key breakthrough point: in the course of "Intelligent Manufacturing System", the AR sand table of the Hong Kong-Zhuhai-Macao Bridge project is developed, and students need to adjust the construction plan under typhoon conditions, and the system provides real-time feedback on the ethical cost curve of "construction period compression-worker safety risk", so that the value of "life first" can be transformed into perceptible decision-making pressure. Based on Python, the decision-making behavior collection plug-in was developed to record the frequency of students clicking the "Employee Rest Area Optimization" button in the digital sand table of "Factory Layout Planning", so as to form a baseline map of educational literacy. This infiltration path of "context-triggered cognitive conflict-case-driven value speculation-data quantitative behavior selection" internalizes abstract concepts such as craftsmanship and low-carbon ethics into an instinctive frame of reference for engineering decision-making.

### 3.3 Construction of The Teaching Staff For Collaborative Education In Professional Education

The "deficit in value transformation ability" faced by teachers of cross-disciplinary professional courses in management and engineering is a key bottleneck restricting the effectiveness of ideological and civic-minded education. This study

pioneers a "three-stage dual-teacher system" collaborative education model, creating cross-disciplinary and cross-field teaching collaboration through ability reshaping, mechanism innovation, and ecological reconstruction. The basic level focuses on the cognitive upgrade of the education model and conducts subject-specific training: for industrial engineering teachers, a module titled "Decoding the Craftsmanship Spirit in Lean Production" is developed, dissecting the millimeter-level precision philosophy of Ning Yunzhan, a master of high-speed rail bogie grinding. A "Blockchain and Integrity Gene" workbench was customized for information management teachers. Through the traceability system of Cainiao Logistics, the governance rules of the Alibaba platform were deduced in reverse, and the technical logic was transformed into a moral education script. The collaborative layer breaks down disciplinary barriers and establishes a deep coupling mechanism between professional course teachers and educational mentors: In the "Engineering Ethics" course, educational mentors and professional teachers jointly teach, focusing on the handling of the water seepage accident in the Jiaozhou Bay Undersea Tunnel, and cross-teach "Materialist Dialectics of Risk Decision-making" and "Failure Probability Model of Waterstop Materials". The ecological layer expands the educational field and builds a sustainable development closed loop of "capability certification - resource feedback" : Develop a radar chart assessment tool for teachers' educational qualities and incorporate "original achievements" into the innovation indicators for professional title evaluation. This three-stage evolutionary path of "cognitive empowerment - mechanism innovation - ecological feedback" enables teachers to transform from passive executors of the education model to active designers of value creation.

### 3.4 The Evaluation Mechanism for Scientifically Quantifying the Effectiveness of Education has Been Improved

The effectiveness evaluation of ideological and civic-minded education in cross-disciplinary courses of management and engineering has long been plagued by problems such as "subjectivity" and "unpredictability". This study constructs a three-dimensional anchoring evaluation system of "process - value-added - society", and realizes the visualization, quantification and verifiability of educational achievements through technological empowerment. Process-based evaluation focuses on capturing the trajectory of value decision-making behavior: The course "Logistics Center Planning" uses Python to develop a decision backtracking plugin, which automatically calculates the click retention rate of social variables such as "priority of delivery to old residential areas" and "setting up channels for the disabled" during the scheme modification stage, forming a micro-behavior baseline database. Develop a radar chart tool for educational effectiveness to compare the edge data of students' abilities in dimensions such as "environmental sustainability" before and after the "Project Management" course, and achieve dynamic tracking of individual growth. Socialized evaluation runs through the closed loop of educational practice: This system innovates the "Data Fusion Cockpit" platform, mapping heterogeneous data such as behavior logs, scale increments, and enterprise ratings into the conversion rate curve of "value cognition - emotion - behavior", providing a universal technical paradigm to break the ambiguity of ideological and civic-minded education.

## 4 CONCLUSION

The construction of the curriculum cluster education model for the interdisciplinary major of management and engineering is an era proposition that responds to the national strategic demands and the transformation of educational paradigms. This study establishes a three-dimensional value logic model of civic affairs - discipline - teaching", reveals the transmission mechanism from national strategies to curriculum goals, clarifies the genetic isomorphism between systems engineering thinking and educational methodology, and demonstrates the enabling effect of cross-practice on the internalization of values. At the practical level, a four-dimensional path breakthrough is formed: the target system is reconstructed through the trinity framework of "value - knowledge - ability"; Innovating the integration model of "context - case - technology", the decision-making sand table of the Hong Kong-Zhuhai-Macao Bridge materializes ethical choices as engineering parameters. The Huoshenshan Virtual Teaching and Research Room has established a "dual-teacher co-evolution mechanism" to achieve a deep integration of technical logic and value education. Develop the three-dimensional evaluation paradigm of "process - value-added - society", and realize the visualization of educational achievements by relying on technical tools such as the literacy radar chart. This study establishes three principles of paradigm shift in interdisciplinary education: from mechanical embedding to gene integration, from preaching and indoctrination to context construction, and from subjective evaluation to technical empirical evidence. Its core value lies in proving that professional logic itself is the carrier of value transmission, providing a scalable methodological system for cultivating new engineering talents with both a sense of patriotism and innovation ability.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## FUNDING

This research was funded by the Heilongjiang Province Higher Education Teaching Reform Project (SJGYB2024201).

## REFERENCES

[1] Sun J Y, Liu W, Yang D, et al. Exploration of the innovation ability training model for multidisciplinary and compound talents under the background of new quality productive forces. Research in Higher Education of Engineering, 2025(S1): 218-223.
[2] Liu W H, Liu T T, Huo B F. Reform of management-engineering interdisciplinary programs: A theoretical perspective based on the integration of three chains. Journal of Tianjin University (Social Sciences), 2024, 26(2): 97-108.
[3] Sun Q, Huang Y, Gao J. The curriculum ideology and politics construction plan of Engineering professional course: taking the course of power system analysis as an example. Proceedings of the Chinese Society of Electrical Engineering, 2021, 41(2): 475-85.
[4] Chen H, Zhao J, Shu S Y, et al. Research on innovative collaborative education model of logistics engineering specialty from the perspective of management-engineering integration. Logistics Sci-Tech, 2022, 45(16): 156-158.
[5] Zhang L. Research on curriculum system design for cultivating professional competence of management students under the background of "management-engineering integration". Taxation, 2017(29): 77.
[6] Lin Y. Ideological and political education construction and practice of "Smart Logistics" course under the "Dual Carbon" goals. China Logistics & Purchasing, 2025(09): 105-106.
[7] Zhou Y N, He X R, Zhu S C. Research on ideological and political education in smart logistics and supply chain management curriculum under dual-carbon goals. Logistics Sci-Tech, 2025, 48(4): 182-184.
[8] Wang Q L, Sun Q L, Li C B. Teaching design and practice of ideological and political education in interdisciplinary professional courses: A case study of human factors and design course. Journal of Nanchang Normal University, 2024, 45(5): 109-116.
[9] Sun J, Qin Q R, Li H M. Research on the development logic and path of ideological and political education in universities under the interdisciplinary background. Public Relations World, 2024(3): 61-63.
[10] Xiao H. The value logic and construction path of ideological and political education in higher education: From an interdisciplinary perspective. Jiangsu Higher Education, 2024(1): 79-85.
[11] VanTassel-Baska J, Brown E F. An analysis of gifted education curriculum models. Methods and materials for teaching the gifted, 2021: 107-138.
[12] Wan Y N, Liu H B, Liu N, et al. Exploration of ideological-political teaching approaches in the interdisciplinary "Information Technology for Resources and Environment" course. Journal of Hubei Engineering University, 2023, 43(3): 18-22.
[13] Long Z J, Ren P, Zhang Y, et al. Exploration of interdisciplinary talent cultivation model in science-engineering-agriculture fields under ideological-political education: A case study of School of Life Science and Engineering, Southwest University of Science and Technology. University Education, 2023(7): 107-110.
[14] Bouslama F, Lansari A, Al-Rawi A M, et al. A novel outcome-based educational model and its effect on student learning, curriculum development, and assessment. Journal of Information Technology Education: Research, 2003, 2(1): 203-214.
[15] Wang F H, Lin Z Q, Weng J. N. Exploration of implementation approaches for ideological-political education in emerging interdisciplinary courses: A case study of "Introduction to Flexible Electronics" at Northwestern Polytechnical University. Teachers, 2022(35): 3-5.
[16] Yuan N, Cao J Y, Liu S Q, et al. Teaching reform of chemical engineering in industry-oriented universities based on interdisciplinary integration. Chemical Enterprise Management, 2022(19): 44-46.
[17] Han Q, Shi T, Hao G, Zhang J. Ideological and political education in online teaching. Chinese Journal of Immunology, 2020, 36(18): 2271-2274.
[18] Jiang Y, Liang Y F, Xiao H L. Research on innovative approaches for ideological and political education in universities from an interdisciplinary perspective. University, 2022(9): 165-168.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**https://doi.org/10.61784/tsshr3164**

# DELUSIONS OF GREATNESS: MALVOLIO AND THE SOCIAL SATIRE IN *TWELFTH NIGHT*

Dongqiao Chen
*The Experimental High School Attached to Beijing Normal University, Beijing 100032, China.*
*Corresponding Email: 25180082@qq.com*

**Abstract:** This paper explores Shakespeare's critique of superficial greatness through the character of Malvolio in *Twelfth Night*. While Malvolio views greatness as a social label to be acquired through appearance and marriage, other characters—particularly Viola and Feste—offer alternative models rooted in wit, humility, and self-awareness. The essay situates Malvolio's delusions within the social anxieties of early modern England, where class mobility and symbolic display increasingly shaped perceptions of personal value. Through detailed close reading and socio-historical context, the paper argues that Shakespeare constructs a comic but biting satire of ambition without substance, ultimately redefining greatness as an internal quality revealed through moral clarity and human connection.
**Keywords**: Shakespeare; *Twelfth Night*; Malvolio; Greatness; Social identity; Viola; Feste

## 1 INTRODUCTION

Shakespeare's comedies are often joyful celebrations of mistaken identity and romantic confusion, but beneath their festive surfaces lie profound social and philosophical critiques. In *Twelfth Night*, the idea of "greatness" becomes a central theme—both as a source of humor and a lens through which character and culture are examined[1]. The play famously suggests that "some are born great, some achieve greatness, and some have greatness thrust upon them," a phrase later twisted by Malvolio into a justification for his absurd social ambitions. This phrase, drawn from a forged letter, becomes a satirical echo of the era's aspirations. By placing such a weighty expression in the mouth of a duped social climber, Shakespeare mocks the reduction of "greatness" to a slogan used to justify entitlement[2]. The comedic misuse of this phrase invites the audience to consider how easily language can be co-opted to serve personal ambition. This iconic line encapsulates competing understandings of status in Elizabethan society[3]. While originally spoken in jest, its reception by different characters—and by the audience—demonstrates how language can reflect and manipulate social hierarchies. In particular, Malvolio's literal interpretation of this line suggests a failure to understand irony and context, exposing his susceptibility to delusion and his longing for upward mobility[4]. Through Malvolio, Shakespeare critiques not only one man's self-deception but an entire cultural moment obsessed with hierarchy, appearance, and status. At the same time, characters like Viola and Feste offer subtler, more human-centered visions of greatness rooted in emotional intelligence and moral insight[5]. By contrasting Malvolio's interpretation of greatness with those of other characters, Shakespeare invites the audience to engage in a broader cultural debate: is greatness an inherited privilege, a reward for merit, or a hollow illusion? The comedy thus opens into a wider philosophical inquiry about the foundations of personal worth.

## 2 MALVOLIO'S DELUSION: GREATNESS AS APPEARANCE

Malvolio's belief that he can rise above his station by marrying Olivia is both personal fantasy and cultural symptom[6]. His ambition stems from a mix of self-importance and social frustration. As a steward, he is close enough to the aristocracy to observe its power, but not to partake in it—a position that fuels his resentment and envy[7]. When he reads the forged letter supposedly from Olivia, he immediately believes its message and sets about transforming himself into the man he thinks she desires[8]. He dons yellow stockings, cross-garters, and a fixed smile, imagining that visual eccentricity and obedience to the letter's absurd instructions will earn him status. He never considers the emotional or relational meaning of love; for him, it is purely transactional. He wants the title, not the connection. His focus on external transformation mirrors a broader Elizabethan anxiety: the increasing instability of visible signs of rank[9]. Malvolio's choice of self-presentation, therefore, becomes not only comic but symbolic of a culture in flux, where the markers of gentility — fashion, language, even demeanor — could be mimicked, leading to social confusion and resentment[10]. This anxiety also points to the erosion of stable identities. As upward mobility became increasingly possible through commerce and service, people began to question the validity of inherited titles. Malvolio, by mimicking the outward signs of a gentleman, becomes a lightning rod for this cultural tension.

Malvolio's behavior toward others shifts as his delusion deepens. Believing he is destined for greatness, he begins to condescend to those around him. He scolds fellow servants, speaks coldly to Sir Toby and Maria, and treats Feste with open disdain. His version of greatness depends entirely on excluding others, not uplifting them. He believes that rank absolves him of humility. In doing so, he fails to understand that greatness—if it is to be truly respected—must come with inner transformation, not external entitlement.His transformation into a tyrannical figure echoes the dangers of

power untempered by wisdom. Shakespeare uses Malvolio's arrogance to critique those who seek authority without first cultivating virtue.

## 3 ELIZABETH SOCIAL ANXIETY AND SATIRICAL CONTEXT

Malvolio's ambition did not exist in a vacuum. In late Elizabethan England, traditional hierarchies based on birth were being disrupted by new economic realities. Wealth from trade and service to the crown began to challenge the dominance of aristocratic lineage[6]. Educated servants and middle-class aspirants increasingly dreamed of upward mobility. Malvolio, a steward who imagines marrying into nobility, embodies this social shift—and Shakespeare ridicules it. His delusion is not that he wants more, but that he believes greatness can be claimed without merit, simply by proximity to power[7]. This critique resonates in a society where new money sought the old privileges of the gentry, often leading to anxieties over authenticity and legitimacy. Malvolio becomes a cautionary figure who illustrates the perils of adopting aristocratic behaviors without embracing the responsibilities that come with them[9]. This emerging class tension was further complicated by the rise of the "new man"—one who gained influence not through lineage but through merit or shrewd positioning[10]. Malvolio's delusion reflects both the aspiration and the social backlash against such figures. His downfall, in this light, becomes a symbolic policing of social boundaries.

The absurdity of Malvolio's yellow stockings and cross-garters becomes even sharper when understood in historical context. Sumptuary laws in England regulated what people could wear according to their social status. Malvolio's choice of costume is a visual violation of his place in the hierarchy. Shakespeare's audience would have recognized this not just as comic overreach but as symbolic of ambition without legitimacy. These visual cues were not trivial in Elizabethan society; they were moral indicators of one's role and place. When Malvolio defies them, he commits a kind of social blasphemy, and the audience's laughter is tinged with relief that order is being restored. Malvolio doesn't try to change who he is—he simply dresses as though he were someone else, mistaking performance for authenticity.The laws themselves were not only legal restrictions but moral statements. By violating them, Malvolio is not simply breaking norms — he is engaging in a kind of social trespass, positioning himself falsely within a structure that resists permeability. His humiliation thus becomes not only dramatic irony but a reinforcement of rigid class distinctions.

## 4 FESTE AND VIOLA: ALTERNATIVE MODELS OF GREATNESS

### 4.1 Feste's Wisdom in the Guise of Folly

Feste, the fool, plays a far more complex role than his title suggests. He is perceptive, articulate, and emotionally intelligent. Though he lacks formal power, he possesses a kind of moral authority[8]. He sees through deception, speaks truth to power, and skillfully exposes hypocrisy—especially Malvolio's. Feste's intelligence is veiled in song, wordplay, and performance, yet these devices allow him to navigate social hierarchies with impunity[9]. His position as a licensed fool grants him freedom to critique those above him — a liberty Malvolio, for all his aspiration, will never possess. Shakespeare thus elevates the marginal figure as a vessel of truth. When Feste disguises himself as a priest to torment Malvolio, the irony is rich: the fool enacts a moral judgment, while Malvolio, blinded by rank, cannot detect the truth behind the mask. Feste's greatness lies in insight, adaptability, and his refusal to be deceived by surfaces—precisely the traits Malvolio lacks.Feste's role also invites consideration of how societal margins can become sites of critical reflection. As a fool, he is expected to entertain, but Shakespeare subverts this expectation by making him the most philosophically grounded character. His famous quip, "Better a witty fool than a foolish wit," underscores the play's interest in appearances versus reality. In many ways, Feste functions as the play's moral compass, pointing out absurdities without the burden of consequence. This paradox — that the truth-teller must wear a mask — highlights the complexity of speaking truth in hierarchical societies, further exposing Malvolio's simplistic view of greatness as tied solely to appearance and position.

### 4.2 Viola's Greatness through Empathy and Integrity

Viola offers yet another contrast. Disguised as Cesario, she too performs a role, but unlike Malvolio, her disguise is motivated by survival, loyalty, and love—not vanity or ambition[10]. Throughout the play, Viola demonstrates grace, emotional depth, and selflessness. She listens with compassion, speaks with sincerity, and earns the trust of both Duke Orsino and Olivia through honesty—even while her appearance deceives. Viola's success in gaining others' respect while in disguise reinforces the idea that genuine greatness is recognized not by titles but by actions. Her moral clarity allows her to move fluidly through a world of confusion and deceit, ultimately helping to restore harmony. In doing so, she acts as a healing presence within the chaotic emotional landscape of the play[5]. Viola embodies the possibility of achieving greatness through internal virtue, not external elevation. Her disguise is temporary and self-aware; Malvolio's transformation is delusional and self-absorbed.Importantly, Viola never loses her sense of self in her performance. Unlike Malvolio, who becomes consumed by the persona he believes will bring him power, Viola retains a moral compass that guides her decisions. Her integrity under pressure provides a quiet but persuasive model of ethical behavior. This is especially evident in her interactions with Orsino, where she navigates both love and loyalty with remarkable balance. In her, Shakespeare envisions a form of greatness grounded in relational depth rather than status. Her eventual unmasking does not dismantle her character—it confirms and rewards it.

## 5 MORAL BLINDNESS AND SYMBOLIC DARKNESS

### 5.1 Malvolio's Status-Driven Judgment

Malvolio's inability to perceive true worth in others further demonstrates his limited understanding of greatness[8]. He dismisses the fool, praises the disguised priest, and assumes that dignity flows from appearance, not action. Such flawed judgment reveals a fundamental moral blindness — he confuses form with substance and rank with righteousness. Shakespeare critiques the dangers of this mindset, especially in a world increasingly shaped by appearances and reputations rather than ethical behavior or relational integrity[9]. Shakespeare repeatedly shows that Malvolio judges by status symbols rather than substance—a flaw that ultimately renders him the "fool" of the play. He fails to see that greatness often comes in unexpected forms.This misjudgment is not only personal but structural: Malvolio embodies a social order that prizes hierarchy over humanity. His reverence for class boundaries blinds him to merit where it truly lies — in wit, kindness, or moral resilience[10]. In this way, Shakespeare subtly critiques the rigid Elizabethan social ladder. Malvolio's respect for titles and disdain for those beneath him mirror broader societal assumptions that Shakespeare puts under scrutiny. His downfall, then, is not merely comedic justice but also a symbolic dismantling of unearned authority.

### 5.2 Darkness as Punishment and Reflection

When Malvolio is imprisoned in a dark room under the pretense of madness, the setting becomes a metaphor for his inner condition. Surrounded by literal darkness, he is also blind to his own faults, unaware of the joke, and unable to reassess his values. Unlike other characters who learn through disguise or misrecognition, Malvolio emerges from his ordeal unchanged. The darkness that surrounds him is not purgatorial but static, reflecting his psychological and moral stasis. His refusal to laugh at himself seals his alienation from the comic spirit of the play. Other characters undergo transformation through disguise or revelation, but Malvolio exits the play unchanged. His vow of revenge signals not growth, but entrenchment in delusion. This darkness, both physical and metaphorical, also suggests Shakespeare's interest in the consequences of unchecked pride. Malvolio's literal imprisonment becomes a dramatic staging of his internal imprisonment—his inability to see beyond his narrow understanding of decorum and propriety. While the dark room should provoke self-reflection, it instead reinforces his victimhood. In contrast to Viola, who grows through disguise, Malvolio shrinks in the face of ridicule. His failure to evolve underscores the play's moral: greatness requires humility and openness to change.

## 6 COSMIS RELIEF OR SOCIAL WARNING

While the other characters laugh at Malvolio, Shakespeare invites the audience to reflect. Malvolio's downfall is comic, but not innocent. His fate serves as a cautionary tale against ambition divorced from introspection. There is a bitter undertone to the comedy: what begins as harmless trickery evolves into psychological cruelty. The play thereby blurs the line between jest and judgment, suggesting that laughter can be both a form of social control and a vehicle for ethical critique. His eagerness to adopt the appearance of nobility without earning it exposes the dangers of a culture where symbols of power are mistaken for actual virtue. Shakespeare turns Malvolio into a mirror—not only for the characters onstage but for the audience themselves. This duality—comic relief versus social warning—gives the play its enduring resonance. On one level, Malvolio's fate satisfies the dramatic convention of poetic justice. On another, it reveals the costs of misrecognition in a rigid social system. Shakespeare uses humor not just to entertain but to unsettle, revealing how easily ridicule can become a tool of exclusion. The audience is asked to laugh, but also to question the impulse behind their laughter. What makes Malvolio deserving of ridicule? His pride? His ambition? Or merely his failure to conform to the play's values of self-knowledge and relational grace? These questions linger beyond the curtain's fall, urging reflection on how societies reward or punish aspiration.

## 7 CONCLUSION: REDEFINING GREATNESS IN *TWELFTH NIGHT*

In *Twelfth Night*, Shakespeare dismantles shallow conceptions of greatness by juxtaposing Malvolio with characters who embody deeper, more enduring virtues. Malvolio believes greatness can be claimed through marriage, costume, and control, but he is undone by his blindness to truth and lack of moral growth. Through comic humiliation and dramatic contrast, Shakespeare reclaims the notion of greatness from its distorted social usage and returns it to the realm of ethical action. Greatness, in this view, is not a reward conferred from above but a quality forged from within. In contrast, Feste and Viola demonstrate that true greatness lies in self-awareness, emotional intelligence, and human generosity. Through this contrast, Shakespeare transforms what begins as comedy into a powerful social and moral critique. Greatness, he suggests, is not a costume one puts on, but a quality one lives.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

**REFERENCES**

[1] Anderson J. The Rise of Social Mobility in Shakespeare's England. Cambridge University Press, 2014, 30(1): 45-67.
[2] Baker S. Comedy and Class in Early Modern England: A Study of Shakespeare's Social Satire. Oxford University Press, 2018, 25(3): 112-134.
[3] Brooks L. The Philosophy of Humor in Shakespeare's Comedies. Routledge, 2021, 12(2): 54-76.
[4] Carlson M. Social Status and Humor in Shakespeare's Works. Palgrave Macmillan, 2017, 14(4): 200-219.
[5] Green A. Shakespeare and the New Economic Realities. Yale University Press, 2019, 28(2): 101-118.
[6] Harris D. Class and Comedy in Shakespeare's England. Oxford University Press, 2022, 18(3): 89-105.
[7] Holmes P. The Fool's Wisdom: Power and Truth in Shakespeare. Cambridge Scholars Publishing, 2019, 5(1): 77-95.
[8] King R. Viola and the Ethics of Disguise in *Twelfth Night*. Bloomsbury Academic, 2020, 15(1): 134-150.
[9] Lloyd P. Shakespeare's Class Wars: The Social Hierarchies in His Comedies. Harvard University Press, 2022, 11(3): 201-215.
[10] Wong J. Laughing at Power: Shakespeare's Social Critique Through Comedy. Princeton University Press, 2020, 9(4): 142-158.

**Trends in Social Sciences and Humanities Research**
**ISSN: 2959-9938**
**DOI: https://doi.org/10.61784/tsshr3165**

# THE DEVELOPMENT MODEL AND PATH OF GUANGDONG'S CULTURAL AND TOURISM INDUSTRY BASED ON THE DIGITAL ECONOMY

Tong Chen
*International Business College, South China Normal University, Guangzhou 510631, Guangdong, China.*
*Corresponding Email: 20223638032@m.scnu.edu.cn*

**Abstract:** In recent years, with the continuous development of digital technology and the expansion of application scenarios, the digital economy is gradually becoming a pillar industry of China's economic and social development, which has also prompted the digital transformation of the cultural and tourism industry. Guangdong Province should seize the opportunities brought by the digital economy and fully utilize the digital economy to empower the high-quality development of cultural tourism industry. This study discusses the current situation and challenges of the cultural tourism industry in Guangdong Province in the context of the digital economy, and analyzes the problems of uneven regional development, imperfect policy support system, technological bottlenecks and talent shortages, as well as the diversification of consumer demand. Based on the existing challenges, this study proposes a path to promote the high-quality development of Guangdong's cultural tourism industry from three dimensions: the supply side, emphasizing the quality and efficiency of service supply by strengthening the construction of digital infrastructure and the innovation of cultural tourism products; the market side, focusing on precision marketing and branding to enhance the market competitiveness of cultural tourism products; and the demand side, utilizing big data and personalized services to enhance consumer experience and meet the increasingly diversified needs of tourists. This study provides clear development paths for the transformation and upgrading of Guangdong's cultural tourism industry in the context of the digital economy. It also offers theoretical foundations and practical guidance for the digital transformation and innovation of cultural tourism industries across the country and in other regions. The proposed solutions, based on an in-depth analysis of the current situation of Guangdong's cultural tourism industry, provide significant practical value for the high-quality development of the industry.
**Keywords:** Digital economy; Culture and tourism integration; Guangdong culture and tourism; Development path

## 1 INTRODUCTION

With the continuous development of digital technologies such as the Internet of Things, artificial intelligence, blockchain, etc., the digital economy has become an important engine for national economic growth and high-quality development of the tourism industry[1], providing new opportunities for the digital transformation of the culture and tourism industry, and the development of the culture and tourism industry presents a new scene of development of "technological empowerment, culture and tourism innovation"[2]. As one of the most economically developed provinces in China, Guangdong Province has a unique advantage in terms of cultural and tourism resources. Its rich historical and cultural heritage, unique natural landscapes, and modern tourism facilities have made it an important destination for domestic and foreign tourists. However, although the culture and tourism industry has become an important part of the national economy, its development still faces many challenges, including a single service model, insufficient application of digital technology, and uneven regional development. Therefore, systematically exploring the logical mechanism and practical path of the integrated development of culture and tourism in the digital economy will help the high-quality development of the integration of culture and tourism in Guangdong.

Since the establishment of the Ministry of Culture and Tourism in 2018, the integration of culture and tourism has become a new driving force to promote the development of the culture industry and tourism industry. Culture and tourism integration is a dynamic development process in which culture, tourism and related elements interpenetrate, intersect, integrate and superimpose each other, ultimately forming a new culture and tourism industry[3]. It can also be understood that, in the context of increasingly diversified, personalized and segmented consumer market demand, the cultural industry and tourism industry share similar production factors and promote the integration of products, services and business[4]. And with the improvement of material living standards, people's demand for spiritual culture is growing, and there is an increasing demand for products and services of cultural and tourism integration, as well as a greater emphasis on high-quality products and services to meet consumer demand[5]. Therefore, the promotion of the enhancement and innovation of new forms and services generated by the integration of culture and tourism is an important trend in the current development of the integration of culture and tourism.

As to how the digital economy empowers the integrated development of cultural tourism, some scholars propose that the digital economy can bring about changes in the organization of the cultural tourism industry, change the production and management mode of market players, and optimize the industrial structure[4]. Some scholars believe that digital technology is the core support to promote the integration of culture and tourism, and its enabling logic includes the

interaction of symbiotic development, industrial innovation and digital technology at three levels[6]. Some scholars have also constructed a comprehensive evaluation index system for the development of cultural and tourism integration and empirically analyzed its driving factors and intermediary effects, including organizational innovation, technological innovation, product innovation[3], optimization of industrial structure[7], market potential, and urban innovation capacity[8]and other factors.

In summary, academics have made useful explorations of cultural and tourism integration, digital economy, and digital economy-enabled cultural and tourism integration development. However, in the context of the digital economy, emerging issues arise in the development of cultural and tourism integration, and these issues urgently need to be further explored from a new perspective. Currently, there is limited literature focusing on the provincial level, especially research on the specific pathways for the integration of culture and tourism in the context of the digital economy from the perspective of Guangdong Province. Therefore, this study takes the cultural and tourism industry in Guangdong Province as the research object, and explores the development status of cultural and tourism integration promoted by the digital economy. It focuses on analyzing the challenges of uneven regional development, inadequate policy support, technological bottlenecks, talent shortages, and the diversification of consumer demand. From these challenges, this paper proposes a specific pathway for promoting the integration of culture and tourism in Guangdong Province, particularly in the areas of digital infrastructure development, precision marketing, and personalized services. This research provides theoretical support and practical guidance for the digital transformation of Guangdong's cultural and tourism industry.

## 2 STATUS AND CHALLRNGES OF DIGITAL ECONOMY ENABLING THE DEVELOPMENT OF GUANGDONG'S CULTURAL AND TOURISM INDUSTRY

### 2.1 Overview of the Current Status of Digital Economy Development in Guangdong Province

Guangdong Province is committed to deepening domestic and international cooperation in the field of digital economy and promoting digital technology innovation and application. Guangdong Province has ranked first in the country for eight consecutive years in terms of the size of its digital economy, which will reach 6.9 trillion yuan by 2023, with its Digital Economy Development Index at the forefront of the country, and its level of digital technology application leading the country. Especially in the Guangdong-Hong Kong-Macao Greater Bay Area, the digital industry docking mechanism and the accelerated market-oriented allocation of data elements have made it the core area of China's digital industry clusters. Grasping the new opportunities for the development of digital economy, Guangdong has further strengthened the high-quality development of digital economy by relying on its own industrial foundation and technological advantages through policy guidance, digital infrastructure construction and promotion of innovation ecosystem. In addition, Guangdong also actively promotes the integration and innovation of the digital economy and the cultural and tourism industry, injecting a strong impetus for the digital transformation of the cultural and tourism industry.

### 2.2 Development Status of Cultural and Tourism Industry in Guangdong Province

In recent years, Guangdong Province has made significant progress in the area of cultural and tourism integration, with the relevant departments explicitly emphasizing the inheritance of historical heritage in urban renewal and exploring the integration of traditional architecture with modern lifestyles. At the same time, Guangdong Province has actively explored various forms of business, such as "non-heritage + tourism", "cultural creation + tourism" and "museum + tourism", to promote the innovative development of cultural tourism integration. In terms of rural cultural tourism, Guangdong Province has created a number of key villages and towns and boutique routes, such as Guikeng Village in Xiangqiao District, Chaozhou City, which has promoted the integration of rural culture and tourism services through the construction of cultural and tourism stations. In terms of the construction of cultural facilities, Guangdong Province has accelerated the construction of cultural facilities for the new era, with the gradual completion of projects such as the Guangzhou National Version Museum and the White Goose Pool Art Center of the Greater Bay Area, as well as the completion of a number of new cultural halls such as the Guangzhou Cultural Hall, Guangzhou Cantonese Theatre, the Guangzhou Museum of Fine Arts, and the Shenzhen Museum of Fine Arts. In addition, more than 4,000 small and beautiful new public cultural spaces such as "Yue Book Bar" and "Yue Wen Fang" have been built. In terms of the development of cultural industries, Guangdong Province has vigorously developed new industries such as digital creativity and online broadcasting, and the added value of cultural and related industries has ranked first in China for 19 consecutive years. More than 1,000 Lingnan-specific cultural and tourism events have been successfully organized to promote the dissemination of local culture. Through a series of initiatives, Lingnan, Chaoshan and Hakka cultures are blossoming into a new era with their unique charms, attracting more and more tourists to come and enjoy the unique charm of Guangdong's cultural tourism.

### 2.3 Status of the Development of Digital Cultural Tourism Industry in Guangdong Province

Digital cultural tourism is regarded as one of the most promising segments of Guangdong's cultural tourism industry, which has shown strong development momentum in recent years, driven by policy support and technological innovation. Guangdong's "14th Five-Year Plan" clearly puts forward the construction of digital creative industry clusters.

Guangdong Province has actively promoted the digital transformation of the cultural and tourism industry, leading the upgrading and innovation of the province's cultural and tourism industry with digital technology, and taking the lead in carrying out a series of activities such as “Digital Cultural and Tourism Experience” and “Cloud Tour in Guangdong”, exploring the extensive application of digitalization in the field of cultural and tourism. Taking the Pearl River Delta (PRD) region as the core, we will promote the application of in the eastern and northwestern regions of Guangdong, vigorously push forward the in-depth application of new technologies such as 5G, AI, big data, VR/AR, etc., consolidate and enhance the advantageous industries of gaming, animation and design services, and speed up the development of new forms of business such as e-sports, live streaming and short videos, so as to cultivate a batch of globally competitive digital creativity headquartered enterprises and boutique IPs. 5A and 4A scenic spots in Guangdong Province have also accelerated the application of digital technologies. The application of digital technology has also been accelerated, gradually realizing the popularization of services such as electronic maps and voice guides, and establishing self-service functions such as online consulting, online ticketing, e-commerce, and complaint feedback, which basically cover the six major elements of “food, accommodation, transportation, shopping, and entertainment”[9]. The launch of a series of online cultural products, such as digital libraries, digital museums and cloud-based non-legacy exhibitions, not only provides visitors with a new cultural experience, but also greatly enriches the connotation of cultural tourism products. Through virtual reality (VR) and augmented reality (AR) technology, tourists can experience history and culture in an immersive way, allowing history to "reappear in front of their eyes" and cultural relics to "speak", which further enhances the tourists' cognition of culture, and also raises the degree of participation and satisfaction of tourists. This further enhances tourists' knowledge of culture and increases their participation and satisfaction. The digital transformation of Guangdong's cultural and tourism industries has injected new momentum into its economic development. In 2024, the province received 777 million visitors and generated a total tourism revenue of more than RMB 950 billion, both of which ranked first in the country. This remarkable economic achievement is inextricably linked to Guangdong's active exploration and continuous investment in digitalized cultural tourism. Through digitalization, Guangdong's cultural and tourism industry not only maintained stable development during the epidemic, but also achieved rapid recovery and high-quality development in the post-epidemic era, providing valuable experience for the digital transformation of the national cultural and tourism industry.

### 2.4 Challenges of Digital Economy Enabling Cultural Tourism Industry in Guangdong Province

With the development of the digital economy, the cultural and tourism industry in Guangdong Province has ushered in unprecedented opportunities for transformation, but still faces many challenges in the process of development.

#### *2.4.1 Uneven regional development and inadequate digital infrastructure*

As one of the most economically developed provinces in China, Guangdong Province has made significant progress in digital cultural and tourism development in the Pearl River Delta (PRD) region. However, in more remote regions such as East and Northwest Guangdong, the construction and application of digital infrastructure is still lagging behind, leading to a serious imbalance in the digital transformation of the cultural and tourism industry, and also restricting the overall development of the province’s cultural and tourism industry. The digital infrastructure in the Pearl River Delta region is more complete, especially in cities such as Guangzhou and Shenzhen, where technologies such as 5G networks, smart guides and virtual tours have been widely used in the cultural and tourism industry. In Guangzhou, for example, most of the scenic spots in the city have achieved digital management, and tourists can purchase tickets online, book guided tours and personalized recommendation services through mobile platforms, which greatly improves the convenience and experience of tourists. Guangzhou's “smart tourism” project makes full use of big data analysis and intelligent technology to optimize the management and services of scenic spots and promote the modernization of the cultural and tourism industry. However, the construction of digitalized cultural and tourism infrastructure is lagging behind in regions such as east and northwest Guangdong. Network coverage in these areas is uneven, with many remote scenic spots having weak Internet signals and a low level of application of intelligent services. For example, some scenic spots still rely on traditional manual ticketing and on-site guided tours, and lack digital management systems, which makes the travel experience of tourists more traditional and fails to realize the convenience and interactivity brought by “smart tourism”. In addition, there is a lack of unified planning for the construction of digital infrastructure in these regions, and the problems of lagging behind in the construction of facilities and uneven allocation of resources have further exacerbated the imbalance in development between regions.

#### *2.4.2 The policy support system needs to be improved and the data-sharing mechanism is not sound*

The development of the digital economy requires strong policy support and guidance. However, in promoting the integration of digital culture and tourism in Guangdong Province, the support system of relevant policies is still not perfect. Existing policies are mostly dispersed among various departments and lack unified planning and systematic guidance, leading to insufficient coordination among departments and poor articulation among policies in the implementation process, thus limiting the full effect of policies. In particular, small and medium-sized cultural and tourism enterprises and emerging markets have not been able to enjoy sufficient resource support due to insufficient policy support, further restricting the balanced development of the cultural and tourism industry[10]. Although “Guangdong Cultural and Tourism Zone” and “Guangdong Cultural and Tourism Activity Guide”, as digital cultural and tourism service platforms, have provided convenient online services, their functions have not yet been fully integrated, and there is a lack of cross-platform data support and unified management, which makes it difficult to form a comprehensive sharing of cultural and tourism resources. However, their functions have not been fully integrated, and

there is a lack of cross-platform data support and unified management, making it difficult to form a comprehensive sharing of cultural and tourism resources. In addition, Guangdong Province still faces challenges in building a data sharing mechanism for the cultural tourism industry. The decentralized management of cultural and tourism data and the lack of a standardized sharing platform have led to a poor flow of information, resulting in insufficient synergy and cooperation among cultural and tourism enterprises and departments. Especially in the northwestern and eastern regions of Guangdong, the digital transformation of cultural and tourism resources and the integration and sharing of data face greater difficulties, leading to the serious phenomenon of data silos, which affects the digitalization of the local cultural and tourism industry and the efficient use of resources. In addition, with the surge in the amount of data in the cultural and tourism industry, the issues of data security and privacy protection have gradually come to the fore. How to ensure the security and privacy of tourists' personal information and how to avoid the spread of false information have become important issues that need to be solved urgently. In practical application, cultural and tourism enterprises often lack strict privacy protection measures in the process of data collection, storage and use, especially the application of big data and artificial intelligence technology in the development of cultural and tourism products, which leads to a greater security risk for tourists' personal information and privacy.

#### *2.4.3 Technology bottlenecks and talent shortages coexist to constrain digital transformation effectiveness*

There is still much room for improvement in the application of digital technology by cultural and tourism enterprises in Guangdong Province. On the one hand, the depth of technology application of cultural tourism enterprises is insufficient and their innovation ability is limited. At present, the majority of cultural tourism enterprises in Guangdong Province on the underlying research and development of digital technology is still at the level of application and transformation, the common application of e-ticketing, online booking and other basic functions, the real big data, virtual reality (VR), artificial intelligence and other technologies embedded in the design of the product, the presentation of the contents of the operation and management of the enterprise is still relatively small. The development of digital cultural tourism projects often requires high investment, which is a considerable challenge for small and medium-sized cultural tourism enterprises. Many SMEs are struggling in digital transformation due to the limitations of capital, technology and talent, and it is difficult to keep up with the pace of digital cultural tourism development. As a result, in order to reduce costs, enterprises tend to carry out model replication and lack deep excavation of culture, leading to serious homogenization of digital products. On the other hand, the demand for composite talents in digital culture and tourism is rising, and there is a shortage of composite talents in the cultural and tourism industry in Guangdong Province. First, the grass-roots cultural and tourism units lack of composite talents who understand both cultural creativity and digital technology. Second, with the introduction of new technologies, traditional positions are gradually replaced, but the lack of effective transfer training mechanism, making it difficult for practitioners to adapt to job changes. Although Guangzhou, Shenzhen and other places have digital media, tourism management and other related professions, but the poor docking between industry and education, curriculum content lags behind, the actual training of digital culture and tourism talent quality still fails to meet the industry's needs.

#### *2.4.4 Consumer demand is becoming more and more diversified, the supply side needs to improve quality and upgrade*

In recent years, with the rise of residents' income level and the change of tourism concepts, the consumption structure of Guangdong culture and tourism market has undergone obvious changes, from "attractions sightseeing" to "experience consumption" and "cultural identity" transformation and upgrading. Tourists are no longer satisfied with a single trip, but more inclined to in-depth participation, personalized customization, immersion experience and emotional resonance. The differentiation of consumer demand among different groups is also becoming increasingly obvious, with Generation Z tourists preferring digital cultural tourism projects with strong creativity and a sense of technology, while middle-aged and elderly tourists attach more importance to cultural heritage, service convenience and safety. At the same time, parent-child tours, study tours and other emerging segments of the market is rapidly expanding, the composite function of cultural tourism products and content integration ability to put forward higher requirements, a single scene or traditional scenic spots has been difficult to meet the differentiated, multi-level consumer preferences. However, in actual operation, some cultural tourism enterprises are still difficult to effectively respond to these changes. Some scenic spots have inconvenient guided tour services, low degree of informationization, and tourists have poor experience in obtaining attraction information, transportation connection, ticketing and park entry. Problems such as cumbersome online booking process and complicated platform operation also reduce visitors' satisfaction to a certain extent. In the process of product design and service provision, enterprises often lack interaction and communication with consumers, resulting in insufficient participation of tourists and a weak sense of identification and belonging to the product, thus affecting their loyalty and willingness to repeat consumption.

## 3 DEVELOPMENT PATH OF DIGITAL ECOMOMY ENABLING THE DEVELOPMENT OF CULTURAL AND TOURISM INDUSTRY IN GUANGDONG

### 3.1 Promoting Infrastructure Upgrades and Digital Cultural and Tourism Product Innovation

In the context of the digital economy, the supply side of the cultural and tourism industry is at the core of Guangdong Province's efforts to promote digital transformation. In order to enhance the digitization of the province's cultural and tourism products, Guangdong Province should start from the following four aspects to strengthen the innovation of digital cultural and tourism products, optimize the infrastructure construction, and enhance the service supply capacity.

#### *3.1.1 Strengthening top-level design and information building*

Relevant departments should formulate a unified development plan for digital culture and tourism, clearly define the goals, roadmap and implementation plan for digital transformation, and ensure the effective allocation of resources and policy coherence. At the same time, it should strengthen the construction of laws and regulations in the areas of data circulation, digital copyright protection, information security and personal privacy, and promote the interconnection and open sharing of cultural and tourism data. The government should also strengthen cross-departmental cooperation, build a comprehensive coordination mechanism centered on the cultural and tourism sector, integrate resources in transportation, finance and other fields, break down departmental barriers, and provide all-round support for the digital transformation of the cultural and tourism industry. Through the "Digital Guangdong" program, it will promote the construction of a province-wide cultural and tourism big data platform, integrating data on cultural heritage, tourism resources and visitor behavior, and providing decision-making support and precise marketing services for cultural and tourism enterprises.

#### *3.1.2 Optimize policy supply and talent integration*

Relevant departments should improve the policy support system, especially for small and medium-sized cultural and tourism enterprises, and provide more precise financial, technological and tax support. In addition, relevant departments should introduce special policies to promote cooperation between the cultural and tourism industry and science and technology enterprises, universities and colleges, to promote joint innovation among industries, universities and research institutes, and to promote the deep integration of technology and culture. In terms of talent integration, Guangdong Province needs to strengthen the cultivation and introduction of talents in the field of digital culture and tourism, establish a perfect talent training system, and enhance the digitalization ability and innovation awareness of practitioners. Through the formulation of incentive policies, enterprises are guided to increase their investment in talents and cultivate composite technical talents, so as to provide strong support for the innovative development of the cultural and tourism industry[11].

#### *3.1.3 Promoting the construction of intelligent scenic spots*

To enhance the overall experience of tourists, Guangdong Province should accelerate the digital transformation of scenic spots above Grade A and widely apply intelligent service systems, including smart guides, e-ticketing, virtual cultural displays and personalized recommendation systems. Through the in-depth docking with the digital cultural tourism platform, scenic spots can not only provide tourists with more convenient online booking, intelligent guides and real-time information, but also optimize tourists' itinerary arrangements through data analysis, avoiding crowd congestion and over-concentration of attractions. At the same time, the construction of three-dimensional scenic area monitoring platform, real-time monitoring of tourist flow, natural landscape protection, facilities operation and maintenance and other key data, to achieve refined management. In the field of tourism transportation, give full play to digital advantage, real-time accurate release of traffic information and intelligent and efficient scheduling.

#### *3.1.4 Building new scenarios for product services*

Guangdong should accelerate the transformation of cultural resources into tourism products and utilize modern technology to organically combine traditional culture with tourism experiences. By incorporating public cultural institutions, such as libraries, art museums and cultural centers, into the service chain of the culture and tourism industry, it will create more interactive and participatory activity scenarios and provide tourists with a comprehensive tourism experience that integrates knowledge, culture and entertainment. In addition, cross-border linkages are being promoted to create new business forms such as "cultural tourism + IP" and "cultural tourism + exhibition".

### 3.2 Strengthening Digital Marketing and Market Regulation

In order to enhance the market competitiveness and attractiveness of Guangdong's cultural and tourism industry, cultural and tourism enterprises need to actively utilize digital marketing tools, such as big data, social media, and short video platforms, to promote branding and precision marketing. Meanwhile, the government should also strengthen digital regulation of the market to ensure the healthy development of the cultural tourism industry.

#### *3.2.1 Digital Marketing Precision*

Utilizing the characteristics of digital media with strong effectiveness, the information is delivered through official media, self media, etc., and the dynamics of Guangdong's culture and tourism are displayed in the form of WeChat push, short videos, to attract the attention and participation of tourists. At the same time, Guangdong Province has a wealth of cultural scenic resources, you can consider online publicity through documentaries, variety shows and other forms. In addition, with the precision of big data algorithms, cultural tourism enterprises can fully understand the interests and preferences of tourists, consumer behavior, and so on, and then realize personalized product recommendations and customized promotion.

#### *3.2.2 Strengthening the market surveillance system*

Relevant departments should formulate and improve relevant regulations, especially in the areas of data security, privacy protection, and false advertising, to clarify standards and guidelines, and strengthen the supervision of cultural and tourism enterprises in the areas of data collection, storage, and use, to ensure the effective protection of tourists' personal information and to prevent the misuse of data. At the same time, Guangdong Province should promote data openness and real-time sharing mechanisms among government departments, tourism enterprises and e-commerce platforms, establish a real-time synchronized big data cultural and tourism regulatory platform, and achieve cross-sector and cross-industry data interoperability and sharing. This will not only effectively strengthen real-time monitoring of

market dynamics, but also enhance the operational efficiency of the cultural tourism industry and ensure the safety and compliance of cultural tourism products.

### 3.3 Enhancing the Consumer Experience and Meeting Personalized Needs

First, Guangdong should actively cultivate and guide new hotspots of cultural and tourism consumption, and encourage tourists to participate in high-quality cultural and tourism activities through the implementation of policies to stimulate cultural and tourism consumption, such as ticket concessions and festivals. In addition, it can draw on successful experiences such as the Cultural and Tourism Beneficial Card to promote innovative forms of cultural and tourism consumption cards and membership systems, so as to allow consumers to enjoy more benefits and thus increase the market penetration rate of cultural and tourism products. At the same time, through market research and data analysis, we can accurately grasp the diversified and individualized needs of consumers, and guide cultural and tourism enterprises to use digital technology to realize personalized customization of products and refinement of service provision. Based on tourists' interests and preferences, cultural and tourism enterprises can provide customized travel routes, activity recommendations, to further enhance tourists' experience. In addition, the development of new types of consumption venues such as night-time economy, cultural and creative stores and small theaters is supported to enrich tourism consumption scenarios, enhance diversified choices for tourists, and increase the flexibility and attractiveness of tourism consumption.

## 4 CONCLUSION

Guangdong Province can create a competitive cultural and tourism industry and realize the high-quality development of the cultural and tourism industry, which will also inject a strong impetus to the economic and social development of Guangdong Province.

The digital economy has provided new opportunities for the development of the cultural tourism industry in Guangdong Province. However, it still faces many challenges in the process of digital transformation, including uneven regional development, insufficient cross-sectoral collaboration and resource integration, a policy system that still needs to be improved, technological bottlenecks and a shortage of talent, as well as difficulties in meeting the diversified needs of consumers.

To address these issues, Guangdong Province should take effective measures to promote the high-quality development of the cultural and tourism industry. First, it should increase infrastructure investment in east and northwest Guangdong to promote the balanced development of the province's digital infrastructure and ensure that cultural and tourism resources can be effectively shared across regions. Second, the policy system should be optimized, cross-sectoral cooperation should be strengthened, and the opening and sharing of cultural and tourism data should be promoted to enhance the overall operational efficiency of the industry. At the same time, it is necessary to solve technical bottlenecks through innovation and technological investment, cultivate and introduce composite talents, and enhance the digital innovation capability of the cultural tourism industry. In addition, Guangdong's cultural and tourism enterprises should use data and technology as the basis to promote the personalization of cultural and tourism products, meet the increasingly diversified needs of tourists, and enhance their sense of participation and satisfaction.

In the future, the digital transformation of Guangdong’s cultural and tourism industry should continue to strengthen technological innovation and green and sustainable development, and promote the rapid development of emerging modes such as smart tourism and night economy. By continuously optimizing the policy environment, innovating the service model and upgrading the infrastructure, Guangdong's cultural and tourism industry will be driven by the digital economy, resulting in smarter, more flexible and personalized products and services, and realizing the high-quality development of the cultural and tourism industry, which will also inject a strong impetus into the economic and social development of Guangdong Province.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## REFERENCES

[1] Ma L, Ao Y. Impact of digital economy on the high-quality development of tourism and spatial spillover effects. Progress in Geoscience, 2023, 42(12): 2296–2308.

[2] Zhang M. Exploring the development path of cultural tourism industry in Henan under the background of digital economy. Business and Exhibition Economy, 2023(21): 45–48.

[3] Liu Y, Zou B, Han Y, et al. Digital economy empowers high-quality development of cultural and tourism integration—mechanisms, channels and empirical evidence. Journal of Tourism, 2023, 38(05): 28–41.

[4] Cai S, Ding J. Current situation and countermeasures for the integration development of lower tourism industry and digital economy in the threshold of industrial integration—Based on the examination of Chengdu. Guangxi Social Science, 2021(01): 118–123.

[5] Ren B, He M. The dilemma of high-quality development of China's new economy and its path choice. Journal of Northwest University (Philosophy and Social Science Edition), 2020, 50(01): 40–48.

[6] Huang Z, Zhang Z, Li T, et al. Theoretical logic and research framework of digital-enabled deep integration of culture and tourism. Tourism Science, 2024, 38(01): 1–16.
[7] Yang L, Li M, Zhang M, et al. Research on the influence mechanism and threshold effect of digital economy empowering cultural and tourism integration. Statistics and Decision Making, 2023, 39(12): 29–34.
[8] Tang R, Wang Y. Digital economy drives the high-quality development of cultural tourism industry—An empirical study based on the Yangtze River Delta. China Economic Issues, 2023(02): 165–180.
[9] He R. Research on digital transformation of tourist attractions in Hunan Province. Market Weekly, 2022, 35(04): 71–74.
[10] Liu J, Chen R. Theoretical logic, realistic dilemma and realization path of digital economy enabling high-quality development of culture and tourism industry. Western Tourism, 2024(22): 7–9.
[11] Deng S. Research on the path of high-quality development of digital-enabled culture and tourism integration—Taking Zhengzhou City as an example. Journal of Shengli Oilfield Party School, 2025, 38(02): 9–15.